ABSTRACTS

Plenary Speech 1 (Room G)

January 23 (Wednesday), 11:10-12:00

Chair: Fumitoshi Matsuno (Kyoto University, Japan)

Historical and Futuristic Perspectives of Robotics

Shuzhi Sam Ge

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Professor, Department of Electrical and Computer Engineering
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Robotics and Artificial Intelligence (AI) are the buzzwords of today in research, industry and funding agencies as they are revolutionizing our works and daily lives. In this lecture, I will first give a brief introduction of industrial robots which has reduced the need for manual labour, then go through the works of mobile robots which have much wider outreach and larger operating space in comparison with industrial robots, and welcome the era of social robots which are becoming parts of the daily lives in education, healthcare, finance, entertainment, etc. I would like to conclude my lecture by the discussion on the fusion of AI and Robotics. For each of the sub topics, I will begin with an overview for a broader perspective, before delving into certain fundamental technical details and actual development examples. After a brief history of industrial and mobile robotics, I will focus more on the recent research works of social robotics which call for much higher demands in robot designs with artistic appeal, intelligent control with safety, scene understanding for better interaction and companionship, and among others. At this point of the time, the fusion of AI and robotics is apparent, and open for us to work together to make social robots as an integral part of our social fabric.

Biography:

Shuzhi Sam Ge is the founding Director of Social Robotics Lab, Smart Systems Institute, and Professor of Department of Electrical and Computer Engineering, the National University of Singapore, the founding Director of Centre for Robotics, University of Electronic Science and Technology of China, Chengdu (on leave with). He received his BSc degree from Beijing University of Aeronautics & Astronautics in 1986, and PhD degree and DIC from the Imperial College, London in 1993. He has (co)-authored 7 books and over 400 international journal and conference papers. He has been playing a leading role in fundamental research in robotics, intelligent control and translational research.

He serves as the founding Editor-in-Chief of the International Journal of Social Robotics, Springer, and served/serves as an Associate Editor for a number of flagship journals including IEEE Transactions on SMC: Systems, IEEE Transactions on Automatic Control, IEEE Transactions on Control Systems Technology, IEEE Transactions on Neural Networks, and Automatica, Book Editor for Taylor & Francis Automation and Control Engineering Series. He serves/served as Vice President for Membership Activities, 2011-2012, Vice President of Technical Activities, 2009-2010, Member of Board of Governors, 2007-2009, and Chairman of the Technical Committee of Intelligent Control, 2005-2008, IEEE Control Systems Society (CSS). He is a Fellow of IEEE, IFAC, and IET, and Singapore Academy of Engineering.

Plenary Speech 2 (Room G)

January 24 (Thursday), 11:00-11:50

Chair: Fumitoshi Matsuno (Kyoto University, Japan)

Mobility AI and Marine AI: AI applications to real regional problems

Hitoshi Matsubara

Future University Hakodate, Japan

Currently it is the third boom of artificial intelligence. For example, computers have won over the world champion at Go and they can recognize human faces more accurately than humans. Artificial intelligence has become practical in the real world at last. The recent boom is based on the premise of the existence of a lot of data. Since coal cities like Hakodate (in Hokkaido, Japan) are rich repositories of data, it is suitable for research and development of artificial intelligence (and machine learning). We are trying to solve real regional problems using artificial intelligence. We talk examples of applying artificial intelligence to problems of public transportation and problems of fishery.

Biography:

Prof. H. Matsubara graduated from graduate school of Tokyo Univ.(Dr.Eng) in 1986. He entered ElectroTechnical Laboratoy, Japan (ETL, National Institute of Advanced Industrial Science and Technology at present) in 1986. He was a professor of Future University Hakodate Japan from 2000. He is now the vice president of Future University Hakodate. And he established a start-up company “Mirai Share” in Hakodate Japan and became the president. He has been and is now active in the research fields of artificial intelligence, game programming, tourism informatics and AI applications to local areas. He is one of founders of RoboCup, the international robot soccer initiative. He was the president of Japanese Society for Artificial Intelligence from 2014 to 2016.

Plenary Speech 3 (Room G)

January 24 (Thursday), 14:30-15:20

Chair: Hee-Hyol Lee (Waseda University, Japan)

Development of a walking assistance device for paralytic by collaborating medical-engineering and academic-industry

Eiichiro Tanaka

Waseda University, Japan

There are so many over 1 million paralytic patients in Japan. Most of them have some features of walking; extending the toe of the foot and circumductive foot, etc. and it is dangerous because it is easy to stumble with a slight step. They have to train to improve and recover their gait, however, most of conventional assistance devices were attached some motors and very bulky. On the other hand, we developed a wearable and compact walking assistance device RE-Gait® for paralytic by collaborating medical-engineering and academic-industry as a practical product. We discussed so many times and we could find innovative idea. By utilizing the muscle structure and physiological phenomenon of the human, RE-Gait® can induce raising the foot only assisting the ankle joint motion. This device is very compact, enable to be hidden in the pants, and the weight is only 1kg. Furthermore, we also developed the tablet software which can tune RE-Gait® easily by medical doctors or physical therapists in a hospital and a care home. RE-Gait® is already used in many hospitals and care home, and so many patients improve their walking gait.

Biography:

Eiichiro Tanaka graduated from Tokyo Institute of Technology, and received the Doctor of Engineering. He joined the Mechanical Engineering Research Laboratory in Hitachi Ltd., and after working as a researcher in Hitachi, he joined Hiroshima University, Shibaura Institute of technology, and Saitama University, and so on. He joined Waseda University as a Professor in 2016. His research field is machine elements, and human assistance devices. In 2018, he received the awards of JSME, RSJ, JSDE, and JSWE to RE-Gait®.

January 23 (Wednesday), 09:00–10:15

Room A

GS15 Manipulator

Chair: Yuichiro Taira (Sojo University, Japan)

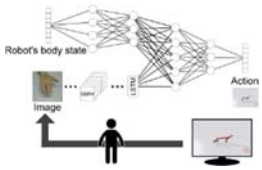
GS15-1 Flexible manipulator inspired by Octopi: Comparative study of pushing and pulling mechanisms in realizing intelligent behavior

Taichi Mukai and Kazuyuki Ito
(Hosei University, Japan)

In this study, we focus on flexible manipulators made of silicon or rubber. In conventional works, various flexible manipulators have been proposed. Usually, these manipulators are driven by air pressure. By expanding some parts of a finger, pushing force is generated to bend the finger. In fact, most real creatures use a pulling force to move their bodies. The goal of this study is to explore the advantages of a pulling mechanism by comparing it to the conventional pushing mechanism. We develop two manipulators of the same size: One uses a pushing mechanism, and the other uses a pulling mechanism. Experiments are conducted to compare their adaptive behaviors.

GS15-2 Mutual learning between human and machine to develop a human-machine interface to operate multi-DOF robots

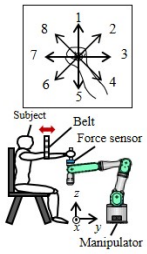
Kei Takada[1], Hiroyuki Iizuka[1], Subhransu Maji[2], and Masahito Yamamoto[1]
([1]Hokkaido University, Japan)
([2]University of Massachusetts Amherst, United States)



We propose a model-free mutual learning algorithm to create a human-machine interface (HMI) to manipulate multi-degrees-of-freedom (DOF) robots. The proposed HMI receives the robot's states and the image of the user's behavior captured by the camera as the input, and it outputs the servomotor's torques of the controlled robot, thus allowing the user to operate the robot from the intuitive hand behavior. To demonstrate that our proposed learning algorithm could create such an HMI, evaluation experiments, including three participants, were conducted. The experimental results show that the HMI learns the generality from the user's behaviors, allowing the user to operate the robot from the intuitive behavioral input.

GS15-3 Human Arm Compliance Evaluation Based on Muscle Activation Analysis

Naomichi Higashiyama, Toru Tsumugiwa, and Ryuichi Yokogawa
(Doshisha University, Japan)



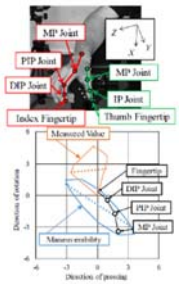
The purpose of this paper is to evaluate the human arm compliance by examining the correlation between the size of the arm compliance ellipses and the activation state of the muscle among the subjects. In this study, in addition to the evaluation of the conventional arm compliance ellipse, we measured the six myopotentials of the muscles which are considered to be related to the adjustment of the arm compliance, and the comparison was made among the subjects. Surface electrodes positioned on the exp carpi radialis longus (ECRL) of the forearm, the flex carpi radialis longus (FCRL) of the antagonistic muscle of the forearm, the biceps brachii (BB) of the upper arm, the deltoideus anterior (DA) of the shoulder, the deltoideus middle (DM), and the deltoideus posterior (DP). The experimental results show that the ECRL is mainly correlated with the adjustment of the arm compliance, and BB is also correlated with the adjustment of the arm compliance in this study.

January 23 (Wednesday), 09:00–10:15

GS15-4 Force and posture analysis of the index finger and thumb in turning the cylindrical device

Itsuki Hirata, Toru Tsumugiwa, and Ryuichi Yokogawa
(Doshisha University, Japan)

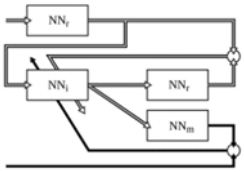
Finger operated cylindrical devices have been used as a tuning dial, a volume controller, and so on, for in-vehicle navigations and kinds of audio equipment. It is important to elucidate the motion characteristics of fingers for evaluating and improving the equipment. We clarified the relationship between the fingertip forces and the joint angles in rotating the cylindrical device with the click mechanism. In addition, in order to compare the manipulability of the cylindrical device with the measured fingertip force values, we analyzed a link model of the index finger and a model of the muscle tendon. These models show us the manipulability as a fingertip vector, and we compared the model fingertip vector with measured values of the index finger. The index finger/thumb fingertip forces were measured by force sensors. Comparing with the model of the index finger and measured values of the fingertip force, we analyzed the manipulability of the cylindrical device and the fingertip force in turning the cylindrical device.



GS15-5 Neural network based construction of inverse kinematics model for serial redundant manipulators

Hideaki Takatani, Nozomu Araki, Takao Sato, and Yasuo Konishi
(University of Hyogo, Japan)

Solving the inverse kinematics of redundant manipulators is difficult, because knowledge of the manipulators and their evaluation functions is required. To solve this problem, we propose a novel method of enabling a neural network model to learn the inverse kinematics. The method achieves learning independent of the structure of the evaluation function, by combining multiple neural network models. The method can obtain the neural network models of the inverse kinematics via an automatic calculation process using only training data, which consist of the postures, end-points, and evaluation values. In this paper, the algorithm used by the method and its background is explained, and the effectiveness of the method is validated by a numerical simulation.



January 23 (Wednesday), 09:00–10:15

Room B

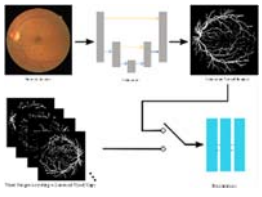
GS16 Medical Informatics

Chair: Masahiro Nishibori (International University of Health and Welfare, Japan)

GS16-1 Retinal Vessel Grading in Fundoscopic Images Using GANs

Guangxu Li[1], Mingzhe Ruan[1], Na Wan[1], Jishuo Yan[1], Zhitao Xiao[1], Hyoungseop Kim[2], and Deheng Li[3]
([1]Tianjin Polytechnic University, China)
([2]Kyushu Institute of Technology, Japan)
([3]Redasen Medical Technology (Dalian) Co., Ltd., China)

Retinal vessels grading, generally marked according to the vascular bifurcations, is an indispensable step for automatic detection of oculopathy on fundoscopic images. In this paper, we propose vessel grading method which based on the precise segmentation of vessels. Firstly, we present a map generation method of retinal vessels using Generative Adversarial Networks (GANs). For the generator, we follow the spirit of U-Net method to generate probability maps of retinal vessel in pixel level. And the discriminator makes a judgment to the input image whether it is from gold standard samples or composited by generator. After obtained the skeletonisation of vessels, the bifurcations are collected by tracking the skeleton line, consequently generate a digraph of the vascular structure. Finally, the grades of vessels could be estimated by labeled digraph. …



January 23 (Wednesday), 09:00–10:15

GS16-2 Efficient Alignment method for facial swelling analysis measured from Kinect Depth sensor

Tomoko Tateyama, Akifumi Ohno, and Shimpei Matsumoto
(Hiroshima Institute of Technology, Japan)

The post-surgical follow-up observation of facial swelling change is mainly subjective assessment by the doctor, therefore clinical field hopes to establish its numerical assessment of the facial changed. In this study, we focus to develop Computer Aided Diagnosis (CAD) system for assessment to three-dimensional facial swelling morphological change after orthognathic surgery. Kinect is one of the general-purpose devices that can acquire three-dimensional face shape information, verification that its accuracy is effective for the measurement of facial swelling is not sufficient. In this study, we verify the effectiveness of the evaluation of the morphological change from the face shape obtained using Kinect. First, we propose an alignment method at some points including the forehead part for the face shape of all samples and evaluate whether accurate analysis for facial morphological change is possible.

GS16-3 Automatic extraction of knee structure for damage analysis and assessment of knee meniscus using intensity histogram

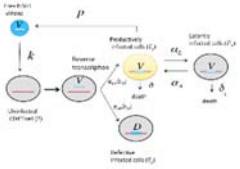
Tomoko Tateyama, Natsumi Maemoto, Yukari Uehara, Yuki Akiyama, and Shimpei Matsumoto
(Hiroshima Institute of Technology, Japan)

In general, the clinician concludes about damage of the meniscus by direct visual diagnosis and palpation. However, since its diagnostic is not quantitative, it is required to establishment of a CAD system for assessment of the meniscus damages. Using visualizing the anatomical features of the knee joint with this three dimensional shape on this CAD system, it is possible to observe the shape deformation by the damages from all directions, not the damage degree evaluation based on the subjective opinion of the doctor so far. In medical MR image, since the intensity values of the meniscus and the ligament in the region of the knee cartilage are very similar, it is necessary to investigate the intensity distribution between structures and classify them. In this paper, we investigate the intensity distribution of meniscus and ligament between knee cartilage tissues in MR image and focus to classification based on the intensity distribution.

GS16-4 A mathematical study for the development of anti-HIV-1 therapies based on the lethal mutagenesis method

Kouji Harada
(Toyohashi University of Technology, Japan)

This study tried to mathematically unveil the difficulties associated with an anti-HIV therapy based on the lethal mutagenesis method; two difficulties were identified. The first difficulty of this method was that the efficacy of a mutagen must be over a certain threshold to treat HIV-1 infection, which could explain the apparent failure of the KP-1461 trial. Furthermore, we investigated the influence of the latency of HIV-1 on the treatment period and clarified that the latency increases the treatment period in a manner almost independent of the efficacy of a mutagen. This is the second difficulty associated with the lethal mutagenesis method.



January 23 (Wednesday), 09:00–10:15

GS16-5 Applying recommendation methods in suggesting hashtags for promoting Thai local products

Manasawee Kaenampornpan[1], Kaveepoj Banluewong[1], and Tran Huong Thao[2]
([1]Mahasarakham University, Thailand)
([2]University of Science and Technology of Hanoi, Viet Nam)

In the era of big data, many social networks have opted hashtags to help users identify media on a specific topic. Firstly, it is used to identify the brand. Secondly, the hashtag is used to generate more publicity on the media of the brand. Thailand has many great products. However, Thai small business owners possess a lack of English and online marketing knowledge. As a result, they could not reach their potential consumers. Therefore, in order to help them promote their brand and products, our goal is to compare recommendation methods in suggesting hashtags for promoting Thai local products. The recommendation methods are implemented and applied to the collected Twitter data. The first method is depending on the tweets' content. Hashtag recommendations for a tweet are suggested by ranking the hashtags extracted from similar tweets. The second method is to use the Naive Bayes model to predict the hashtags. Finally, two metrics Recall and Precision were used to compare these methods' performances in order to figure out the most suitable one.

January 23 (Wednesday), 09:00–10:30

Room C

GS19 Multi-agent systems

Chair: Sadayoshi Mikami (Future University Hakodate, Japan)

GS19-1 Library book recommendation for students at faculty of education, Mahasarakham University

Wongnarin Sukwichai and Manasawee Kaenampornpan
(Mahasarakham University, Thailand)

In the library online systems, the recommendation system helps to ease the search process and suggests the suitable books for each user. In our studies, the data is collected from the library automation system (Sierra). The records of book details that are borrowed more than one times or recommended by instructors in the faculty of education at Mahasarakham University are extracted and collected through the system. The collected data is preprocessed in order to remove incomplete or irrelevant data. Then the preprocessed data is analyzed in order to find the features of the books to be used in the content-based technique using K-Nearest Neighbors algorithm. Due to the limitation of the current library system, the review or rating score of the books are not available. For collaborative filtering technique, we propose method for calculating the rating score based on the amount of times each item has been borrowed. Finally, three metrics have been used to evaluate the recommendation techniques which are accuracy, precision and recall.

GS19-2 A Large-Scale Parallelization of the Boids Model on the K Computer and the Heterogeneous Multi-Processing Unit

Yuichi Hirokawa[1], Masaaki Terai[2], Teruo Matsuzawa[3], Noriaki Nishikawa[1], and Toshiyuki Asano[1]
([1]Japan Agency for Marine-Earth Science and Technology, Japan)
([2]RIKEN R-CCS, Japan)
([3]Japan Advanced Institute of Science and Technology, Japan)

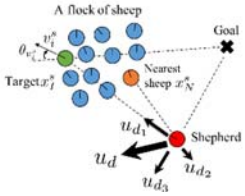
In the parallelization of multi-agent systems (MAS), a load imbalance often slows down the calculation. We have presented a multi-level hierarchy of parallelism to mitigate the problem of load-imbalance problem in the Boids model, using pseudo-quadruple arithmetic. In this paper, we modify the hierarchies of parallelization for both the K computer and the Heterogeneous Multi-Processing (HMP) unit, and evaluate the performance of these systems. We confirm that parallelization can decrease the negative effects of a load imbalance. Power consumption is effectively controlled based on the calculation load, and the simultaneous use of both the high-performance cores and low-energy cores slows down the calculation in the HMP unit. Parallelization is confirmed to have the potential to complete a simulation in real time and the ability to calculate 1,000 billion agents using the K computer.

January 23 (Wednesday), 09:00–10:30

GS19-3 Analysis of sheepdog-type navigation for a sheep model with dynamics

Yusuke Tsunoda, Makihiko Ishitani, Yuichiro Sueoka, and Koichi Osuka
(Osaka University, Japan)

This paper investigates group navigation method of multi-agent system with the aid of strong interaction between two different kinds of agents: a sheepdog (shepherd) and sheep. This navigation system is motivated by sheepdog system, in which a sheep is trained to be escaped from the shepherd and the shepherd drives all sheep group to a given goal position. It is an interesting control system because one or more sheepdogs, who move as a small number of controllers, can control many sheep that cannot be directly controlled. In this research, we analyze the navigation performance for a sheep model with dynamics. We adopt the sheep model based on a flock model, and design a new shepherd's controller in which the shepherd approaches the sheep escapes from the goal fastest. Simulation analysis shows that our proposed method can herd the flock to the goal position efficiently.



GS19-4 Evaluation-Function Modeling with Neural Networks for RoboCup Soccer

Takuya Fukushima[1], Tomoharu Nakashima[1], and Hidehisa Akiyama[2]
([1]Osaka Prefecture University, Japan)
([2]Fukuoka University, Japan)

In the RoboCup soccer simulation 2D league, players make decisions at each cycle in real time. The performance of a team highly depends on the agents' decision making processes. Decision making of a soccer agent is composed of a path planning method and an evaluation function of the soccer field. In this work, a cooperative action planning based on the tree search is employed to model the decision making process. We employ a neural network to model evaluation functions.We examine the performance of the soccer agents when various sets of features are used as the input of the neural network. Training data are made of kick sequences executed by an expert team extracted from log files. To investigate the efficiency of our approach, we compared the performance of a team using an evaluation function modeled by neural networks against a team using a hand-tuned evaluation function.

GS19-5 Multi-Robots Exploring Maze-like Area with Ad-hoc Communications

Keita Nakai[1], Kousuke Yamashima[1], Tomoki Tanaka[1], Munehiro Takimoto[2], and Yasushi Kambayashi[1]
([1]Nippon Institute of Technology, Japan)
([2]Tokyo University of Science, Japan)

In this paper, we describe a control method of cooperative multiple robot exploration in an unknown environment. The proposed approach aims to minimize the overall exploration cost of multiple robots marching during the march. The approach proposed to achieve the goal employs multiple mobile software agents that are free to move from robot to another robot and can bring specific roles and capabilities to the robot. In the previous paper, we have proposed a system like this and implemented a simulation system to investigate the feasibility of that approach. Although the result was encouraging, it is unclear how effective it is in the real world. In particular, the feasibility of ad hoc communication for mobile software agents was unknown. In this study, we implemented a mobile software agent based on ad hoc network on physical multiple robots.

GS19-6 Forex Forecasting with Gold price and Indicator machine learning

Tanasak Tonpo and Manasawee Kaenampornpan
(Mahasarakham University, Thailand)

Forex market is a foreign exchange market where traders try to profit from buying and selling currencies by actively speculating on the direction of the currencies which are likely to take in the future. Unlike stock market, traders can buy and sell the currencies every day and 24 hours a day. This is one reason for the higher amount of trade in Forex compare to stock market. It creates flexibility to full time and part time traders. Therefore, many traders are looking for tool to help them in making decision during trade. The research in data mining nowadays is taking advantages of amount of data available online to forecast the exchange of different money currencies. In this research, we present the extension of the Sarimax Model to predict the exchange of money currencies by including others variables which are: gold price (XAU/USD) and New York Stock Exchange (NYSE).

January 23 (Wednesday), 09:00–10:30

Room D

GS20 Neural networks

Chair: Hee-Hyol Lee (Waseda University, Japan)

GS20-1 Recognition of connected spoken Japanese prefecture words using a modified cascaded neuro-computational model

Tetsuya Hoya
(CST, Nihon University, Japan)

A novel neural network-based approach for connected spoken word recognition is proposed in this paper. In the proposed approach, a modified version of the previously proposed cascaded neuro-computational model is used; a new non-linear metric to each second layer unit is introduced, in order to perform effectively the pattern matching at the word-feature level. Simulation studies were conducted using connected speech datasets of a larger lexicon than those used in the previous works; the datasets consisted of the naturally spoken strings, each string containing a varying number of 2-7 words chosen arbitrarily from a total of 47 Japanese prefecture names. The simulation results show that the modified model yields a promising recognition performance, i.e. 94.3% in terms of the word accuracy rate, compared to that (i.e. 98.1%) of a benchmark approach using hidden Markov model with embedded training.

GS20-2 Creative Animating Sketchbook with Sketch-rnn for Stroke based Visual Search Picture Puzzle

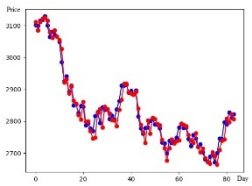
Ryosuke Fujii and Naoki Mori
(Osaka Prefecture University, Japan)

We propose a visual search automatic production system (VSAPS) for realizing interactions based on human sensibility. VSAPS provides each users with a unique game that applies a visual search picture puzzle based on user's own sketches and stroke orders; in addition, VSAPS can even show the user the stroke order of their motions on the visual search picture puzzle. In this paper, we evaluate VSAPS to determine the difficulty of the questions generated. Through an experiment, collaborators responded to questionnaires regarding the degree of difficulty when changing the problem form and parameter values. We then checked checks whether VSAPS is able to extract and control the stroke order feature information.

GS20-3 Stock high price prediction using long short-term memory based bidirectional recurrent neural network

Zhiguo Bao[1], Tingyu Zhou[2], Xin Jiang[3], and Takahiro Watanabe[2]
([1]Henan University of Economics and Law, China)
([2]Waseda University, Japan)
([3]National Institute of Technology, Kitakyushu College, Japan)

This research focuses on predicting stock high prices by using long short-term memory based bidirectional recurrent neural network (LSTM-BRNN). LSTM can avoid the vanishing gradient problem, and remember values over arbitrary time intervals. BRNN can increase the amount of input information available to the network. Thus, the LSTM-BRNN model is introduced as a novel method to predict the high price of the stock market. In the simulations, the stock prices from June 2011 to May 2018 are used as training data and those from June 2018 to September 2018 are as testing data. From the experimental results, we can show that our forecasting system gives slightly higher prediction results for the stock high price of the next day, which outperforms the conventional comparison models.



January 23 (Wednesday), 09:00–10:30

GS20-4 A Comparison of Thai-English Printed Recognition on BEST2014 Dataset using CNNs

Rapeeporn Chamchong, Umaporn Saisangchan, and Chatklaw Jareanpon
(Mahasarakham University, Thailand)

Currently, a large amount of digitizing documents have been stored and processed in a computer. To access the knowledge from Thai documents, it is possible to use Thai Optical Character Recognition (OCR) systems. There are some Thai OCR that develops to be a commercial software for editable with promising recognition rate. However, they are not supported for any developers to use them as an open source. In 2013-2014, BEST2014 benchmark dataset was proposed for a competition of Thai Character Recognition Contest. There are English and Thai alphabets as isolated characters. Nowadays, Convolution Neural Networks (CNNs) for character recognition has been proposed. To improve Thai OCR, this paper compared isolated characters of Thai-English Printed Recognition using CNNs architecture. The proposed architecture based on CNNs was compared to LeNet-5 and VGGNet. The proposed architecture was applied to the BEST2014 dataset and gave a better result than other architectures.

GS20-5 Forecasting for Particulate Matter 2.5-micron pollution with deep learning neural networks

Kaveepoj Banluewong and Manasawee Kaenampornpan
(Mahasarakham University, Thailand)

This work aims to predict PM2.5 using deep learning neural network techniques and compare the results obtained from the proposed technique with a standard neural network. A time series dataset, Beijing PM2.5 Data dataset, is applied and used in this work. The dataset was collected from the measured level of PM 2.5 for 3 hours between December 1-31, 2014 and it is collected from the roads in in Beijing China. The data is separated into 2 sets, i.e. training of 70% and testing of 30%. A model is generated using a deep learning neural network, composing 2 network types, i.e. (i) Long Shot-Term Memory neural network and (ii) Feed Forward Neural Network (FFNN). The evaluation shows that deep learning feed forward provides a promising result and is superior to the base-line and the other methods.

GS20-6 Lot-Number Recognition System for Cast Metal on Android Devices

Yuto Mukai and Michifumi Yoshioka
(Osaka Prefecture University, Japan)

A lot-number on cast metal is difficult to divide into foreground and background by using image processing because cast metal has roughness surface, metallic luster and specular reflection characteristics. We utilize deep learning model to solve the problem without dividing them. To improve the accuracy of the model, we utilize original post-processing and data augmentation with image processing. We conducted the experiment to evaluate the effect of post-processing in a computer. We also conducted the experiment on an Android device to evaluate the model in terms of speed. As the result, post-processing improved accuracy compared by 17.8% to without it. Processing time of our recognition system for a cast metal was approximately from 1.6s to 2.4s.

January 23 (Wednesday), 09:00–10:00

Room E

GS22 Robotic Mechanism

Chair: Keigo Watanabe (Okayama University, Japan)

GS22-1 Soft Material Gripper for Extending Robotic Hand Embodiment

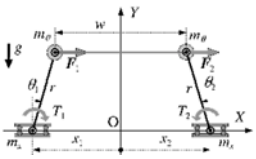
Jun Ogawa, Syota Seki, Ryuya Ninomiya, Yuki Funayama, and Keita Nakamura
(The University of Aizu, Japan)

The grasping operation by a robot requires strong friction between the robotic gripper and the object. The embodiment of robotic gripper imagined by an operator is an important factor for accomplishing grasping operations. This paper describes a way to extend an embodiment of robotic gripper by soft material. Our soft material supporter based on the robotic gripper prevents heavy load from being applied to the joint by bringing soft material into close contact with the fingers. The supporter can create a margin in the force required to accomplish the task with the original robot gripper. Experiments on teleoperation of actual disaster response tasks showed that human operators can perform operations faster than standard grippers.

GS22-2 Improving controller performance for modeling two individuals artificial wrestling by underestimating basins of attraction

Katsutoshi Yoshida and Yoshikazu Yamanaka
(Utsunomiya University, Japan)

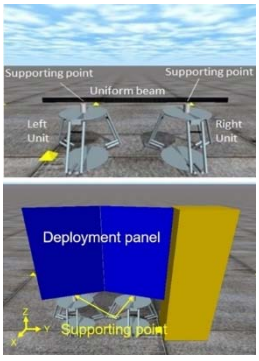
In this study, we develop a preprocessing method that overcomes the misprediction problems in intelligent motion controllers for modeling two individuals wrestling. We devoted our previous study to solving the competitive problems on a coupled inverted pendula model, in which an intelligent controller outputs impulsive forces to produce the desired final states on the basis of a look-up table (LUT) that stores dynamic correspondences from initial to final states. In this study, we first derive a simple algorithm that fully removes the boundary points of the LUT and then show that the resulting controller largely reduces the mispredictions but at a cost of making the controller too conservative. Hence, we propose an adaptive algorithm that removes only the boundary points that actually cause the noted mispredictions. Our second algorithm successfully derives a less conservative controller and improves the overall control performance without increasing the resolution of the LUT.



GS22-3 A study of a gravity compensation system for the spacecraft prototype test by using multi robots

Tomohiro Hirata and Katsuyoshi Tsujita
(Osaka Institute of Technology, Japan)

Recently, the various types and various sizes of spacecraft are now planning and under construction. In the process of prototype test of the spacecraft, ground validation tests are carried out to ensure reliability and good performance in space. However, the gravitational environment and the self-weight loading on the spacecraft should be compensated with a support system in order to simulate the real motion in the space. This paper proposes a prototype test system for variable flexible spacecraft by using multi robots. The system is designed for gravity compensation of the prototype model of spacecraft which has flexible structures. Multi robots have parallel mechanism to follow the fast motion of the structural vibration and deployment. The robots are controlled by the force control to support the structures. In this study, the validity of the proposed system were verified by numerical simulations. We performed simulations using ODE (Open Dynamics Engine). On the simulations, we built two robot models with the proposed control system and a flexible beam model that can be understood theoretical vibration characteristics. The parallel link robot well supported the flexible beam without …

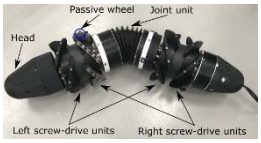


January 23 (Wednesday), 09:00–10:00

GS22-4 Development of a two-link underwater snake robot in a 2D plane using screw-drive mechanism

Xiaoyu Wang[1], Toru Takano[1], Motoyasu Tanaka[2], and Fumitoshi Matsuno[1]
([1]Kyoto University, Japan)
([2]The University of Electro-Communication, Japan)

In this paper, we designed a new type of two-link underwater snake robot using two screw-drive units which are connected by an active joint. The screw-drive mechanic unit provides the snake robot with the capability of omnidirectional locomotion. Here, we focus on the development of this robot and the realization of the underwater locomotion in the 2D plane. And the identification including the robot model and hydrodynamic model is done with the help of the Computational Fluid Dynamics (CFD) simulation and the real experiment. Then, the different types of locomotion are analyzed based on the model. Finally, basic experiments done by teleoperation for different types of locomotion are carried out.



January 23 (Wednesday), 13:00–14:15

Room A

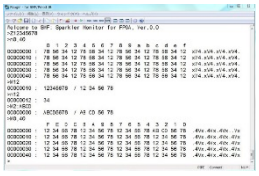
GS13 Intelligent control

Chair: Kazuyuki Ito (Hosei University, Japan)

GS13-1 An integrated machine code monitor for a RISC-V processor on an FPGA

Hiroaki Kaneko and Akinori Kanasugi
(Tokyo Denki University, Japan)

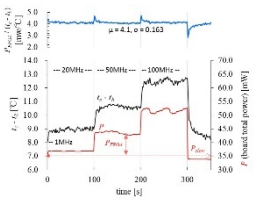
This paper proposes an integrated machine code monitor (iMCM) written in hardware description language (HDL) and implemented in an FPGA together with a processor. The iMCM reconfigures monitor functions to be provided according to the verification progress of the processor design and the development situation of programs. A subset composed of 27 instructions from the compression type instruction set extension ("C" Standard Extension) with the smallest 16-bit instruction word length among RISC-V was adopted as ISA of the target processor. A forty-one percent LUT was added to the implementation of the iMCM for the processor implementation. This addition depends on the monitor function to be selected.



GS13-2 Power consumption estimation by a die temperature for processors implemented on an FPGA

Hiroaki Kaneko and Akinori Kanasugi
(Tokyo Denki University, Japan)

This paper proposes a processor power estimation method based on an on-chip temperature of an FPGA chip with implemented processors for embedded systems. The power consumption is estimated from a die temperature which corrected the on-chip temperature with a temperature of a system board and an ambient temperatures outside the system board. A 32-bit target processor based on RISC-V as a main heat source and a temperature measurement system were written in Verilog HDL and implemented on the FPGA. The processor executed five groups of heat generation programs (HGP) from 1Hz to 100MHz clock speed and caused the FPGA chip to generate heat. Data showing the linear approximation relation of power consumption from the heat generation inside the chip generated by the hardware and software of the embedded processor was confirmed.



January 23 (Wednesday), 13:00–14:15

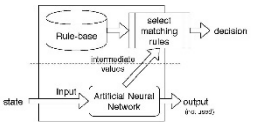
GS13-3 Construction Campus Map considering Terrain Slope and its Development of Virtual Experience Campus Systems using Mobile Device

Tomoko Tateyama, Asuka Kigami, Tetsuro Katada, and Shimpei Matsumoto
(Hiroshima Institute of Technology, Japan)

In this paper, we propose a novel and effective Campus Guidance system based on Virtual Reality system. In general, many guidance systems require not only a high-capacity presentation system but also a large device and location whether VR system including or not. To overcome this problem, our system visualizes on common smartphone device (android mobile phone) and VR goggle, for VR campus demonstration system. Furthermore, since our campus is located in a hilly area, we constructed a highly immersive campus model which consider gradiant topography slope. The system can provide an ef fective and high-cost performance system to support for VR campus guidance.

GS13-4 Investigation on pragmatic rule-bases for imitating artificial neural networks by using the mountain-car problem

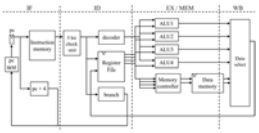
Tsutomu Inamoto and Yoshinobu Higami
(Ehime University, Japan)



In this study, we display some results by investigating implementations of the sensation function through constructing pragmatic rule-bases which imitate artificial neural networks (ANNs) for a toy decision-making problem. The pragmatic rule-base is based on the pragmatic rule format which has been proposed by one of the authors. The pragmatic rule differs from the conventional IF-THEN rule in terms that the former rule does not have any THEN-part and supports all decisions which exert the effects represented by that rule. The heart of the pragmatic rule format is the functions which represent those effects. Those functions are called sensation functions. In this study, the feasibility whether the ANN can be used as a basis of sensation functions is investigated by constructing pragmatic rule-bases which encode optimal decisions of the mountain-car problem.

GS13-5 A design of EPIC type processor based on MIPS architecture

Takahito Hayashi and Akinori Kanasugi
(Tokyo Denki University, Japan)



This paper propose an EPIC (Explicitly Parallel Instruction Computing Architecture) type processor based on MIPS. To implement EPIC type processor, five bit field is embedded in the machine instruction code. For comparison, a 5-stage pipeline processor (basic processor), and a VLIW processor is designed. The proposed processors is described in hardware description language (VHDL) and implemented using FPGA. Operations are confirmed by software Tera Term. Processors are evaluated instruction parallelism and program size using bubble sort program. It is confirmed that the proposed processor is 1.9 times faster than the basic processor. In addition, the program size of the proposed processor is 64 bytes, the basic processor is 56 bytes, and the VLIW processor is 80 bytes.

January 23 (Wednesday), 13:00–14:30

Room C

GS14 Learning

Chair: Keiki Takadama (The University of Electro-Communications, Japan)

GS14-1 Maximum Entropy Inverse Reinforcement Learning with Incomplete Experts

Satoshi Hasegawa, Fumito Uwano, and Keiki Takadama
(The University of Electro-Communications, Japan)

Inverse Reinforcement Learning (IRL) estimates the reward function for acquiring the behavior that imitate expert. However, IRL has a problem that estimation of reward function is highly dependent on expert's behaviors. The wrong behaviors cause the agent to make the incorrect reward function. If the expert's policy goes through the bad states, the learned policy by generated reward function can't avoid the bad states. To solve this problem, we have two approaches. First approach is to divide the expert's trajectories into expert's wrong behaviors. This improvement is expected to learn only expert's correct behaviors. Second approach is discounting the reward values to avoid the bad states. We veri fied that the proposed method is effective by employing the maze problem with the bad states. As a result, it was con rfirmed that only the proposed method is adaptive to the newly added bad states.

GS14-2 Clustering Defect on the Surface of the Steel using Unsupervised Learning

Min Su Kim[1], Jong Pil Yun[2], and PooGyeon Park[1]
([1]Pohang University of Science and Technology, Republic of Korea)
([2]Korea Institute of Industrial Technology, Republic of Korea)

Classification of defects occurring in the localized part of the steel sheet surface is difficult to classify due to the variability of each defect, and in some cases, irregular illumination is applied to the iron surface during the defect detection process. In order to solve this problem, researches on defect detection and classification using machine learning have been actively carried out. However, the classification of the actual data used in the current learning is carried out by the person. Therefore, there is a limitation that personal subjectivity is reflected in classification criteria and accuracy. In particular, in the case of steel surface defects, it is often judged differently for each individual. Therefore, in this study, we perform a defect clustering algorithm using unsupervised learning to determine whether existing defect classification criteria are appropriate or new defect classification criteria can be presented. We use variational auto-encoder to obtain a low dimensional representation of steel defect images and apply various clustering methods.

GS14-3 An Answer Retrieval Method for Non-factoid Question Answering

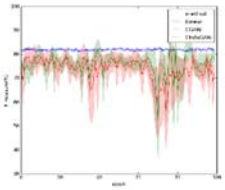
Natthakit Srikanjanapert, Jantima Polpinij, and Bancha Luaphol
(Mahasarakham University, Thailand)

Question answering (QA) aims to automatically find and generate an answer that is relevant to a question posed by humans in a natural language. Today, the most popular QA systems that are being given more attention are non-factoid. However, the current problem found in non-factoid QA is to find the most appropriate passage in the candidate documents that is considered as the answer. Therefore, this work presents a method of answer retrieval for non-factoid QA. The proposed method consists of two main stages. The first stage is preliminary stage that concentrates in providing the question and answer patterns based on Markov Model (MM). These patterns will be used for the question-answer processing stage. After evaluating the answer retrieval performance by BLEU-1 and ROUGE-L, the results are 0.43 and 0.41 respectively. To the best of our knowledge, these results are acceptable.

January 23 (Wednesday), 13:00–14:30

GS14-4 Generating Trajectories Using Conditional Information Maximizing Generative Adversarial Network

JiaWei Niu, Thibault Barbié, and Takeshi Nishida
(Kyushu Institute of Technology, Japan)



Most path planning algorithms do not use data from previous plans but rather plan from scratch every time new planning is requested. Trajectory prediction leverages past knowledge and can cut down the time required to generate trajectories. However, existing methods require a motion dataset during at the time of computation. Thus, we propose a trajectory prediction method that does not require an online dataset as it uses a conditional information maximizing generative adversarial network (CInfoGAN), which learns from a previously computed dataset. The CInfoGAN algorithm takes advantage of information theory to find interpretable representations from the dataset. We applied our proposed method to a two-dimensional configuration space problem and observed a 18.96% decrease in the number of colliding trajectories compared with that of linear initialization. Furthermore, the results implies that our method is on average 6.74% better than when using a standard conditional generative adversarial network (CGAN). We performed an implementation experiment using our method to feed the stochastic trajectory optimization for motion planning (STOMP) planner and observed that the proposed method can reduce the computation time for the optimized trajectory compared with linear initialization and CGAN initialization.

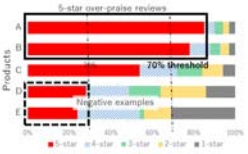
GS14-5 A Method for Handling Text Classification with Imbalanced Data

Jantima Polpinij and Chumsak Sibunruang
(Mahasarakham University, Thailand)

This work aims to present a method for handling binary text classification with imbalanced data, where it concentrates on the problem of imbalanced text document size. A dataset of customer reviews gathered from TripAdvisor is used for our experiment. When text is tokenized into words, those words are transformed to a new form, called concept, by our proposed dictionary. A concept is the inclusion of relevant words together. Afterwards, those concepts are represented as a vector space model with the Multi aspect Term Frequency (MATF) weighting scheme, which is also developed to handle the problem of varied length of documents. Finally, the support vector machine (SVM) is applied to model binary text classifiers. After comparing the proposed method with the traditional method of text classification, our proposed method returns the satisfactory results of recall, precision, and F1 at 0.83, 0.81, and 0.82 respectively.

GS14-6 Construction of over-praise removal filter for useful product review extraction

Yuko Kusakari, Takahiko Suzuki, and Sachio Hirokawa
(Kyushu University, Japan)



When shopping at the EC site, product reviews are important factors for purchase decision. However, it is a well-known fact that the product reviews contain many useless reviews including fake reviews. It will be useful if one can filter out such useless reviews automatically. We propose a method for construction of a filter which can remove ‘over-praise’ reviews. In order to construct the filter by using supervised learning, it is necessary to prepare a certain amount of positive and negative examples. However, it is not a simple task to construct such sets of examples. We introduce a simple method of constructing the positive and negative examples of over-praise reviews. We focus on products that receive 5-star reviews more than a certain ratio. We use SVM with feature selection in supervised learning. We examine the selected feature words by SVM-FS.

January 23 (Wednesday), 13:00–14:30

Room D

GS21 Robot vision and image processing

Chair: Kikuhito Kawasue (University of Miyazaki, Japan)

GS21-1 A study on robot tracking based on Camshift algorithm

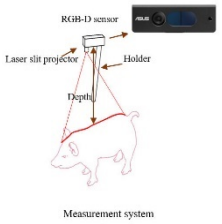
CHEN YIYANG[1,2] and ZHANG LIFENG[1]
([1]Yangzhou University, China)
([2]Kyushu Institute of Technology, Japan)

At present, the problem of aging is getting more and more serious. Many elderly people live alone and their physical strength is gradually declining. In Japan, 80 percent of elder accidents happened at home. In order to alleviate this problem, the indoor mobile robot will play an very important role in our life. This paper is mainly introduces the implementation of Camshift algorithm to the mobile robots. We mount a USB camera on the cleaning robot and use ROS framework to understand the indoor environment, like people scanning, target tracking, face recognition, and security analysis. The final goal is if the emergency happens, the proposed system can immediately inform the family or hospital.

GS21-2 Extraction of Body Parameters for Pig Weight Estimation Using RGB-D Sensor

Hsu Lai Wai[1], Khin Dagon Win[1], Kumiko Yoshida[2], and Kikuhito Kawasue[1]
([1]University of Miyazaki, Japan)
([2]Koyo Machinery Works Co., Ltd., Japan)

Though the daily growth rate of pigs need to be monitored for checking their activity performance and health. Generally, the weighting machine with a load cell is used to measure the weight of pig. It is hard to guide a pig to the weighting machine and it takes over 20 seconds to get the stable result. Therefore, the development of a mobile weight measurement apparatus is required. In this paper, the RGB-D sensor with a slit laser is used to capture the depth image of the pig body and the data is used to estimate the direction of the weight. Data such as body length and the girth of the pig are used to estimate the weight. These data are extracted automatically in our proposed method. The experimental results show the feasibility of the system.



GS21-3 Duplicating Same Argument of Function to Realize Efficient Hardware for High-level Synthesis

Moena Yamasaki and Akira Yamawaki
(Kyushu Institute of Technology, Japan)

High-level synthesis (HLS) automatically converting software into hardware is a promising technology to reduce the design burden significantly. However, to use HLS technology efficiently, software program must be described considering the hardware organization that HLS tool will generate. We are developing the HLS image processing library. However, some caution is required when using HLS for programs that read images. When the same image is read through an argument of the function, the input port corresponding to this argument on the hardware generated by HLS tool may cause the port conflict. As a result, the image reading is made serialized and this serialization disturb the performance of the data path well pipelined by the HLS tool. This paper shows how to write a software program to avoid this problem. In addition, we adapt this method to two image processing and evaluate the effect of our proposal to them.

January 23 (Wednesday), 13:00–14:30

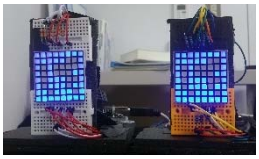
GS21-4 A Performance Evaluation of Read / Write Burst Transfer by High-level Synthesizable Software for the Alpha Blending Processing

Yuki Yamagata and Akira Yamawaki
(Kyushu Institute of Technology, Japan)

High-level synthesis, HLS is a technology to convert the software into the hardware automatically. It is expected as a technology that can greatly reduce the load of the hardware development. However, the current HLS can't convert the software not considered the hardware configuration into the optimum hardware. One of characteristics of the hardware to be considered is the burst transfer of memory access. In this paper, we evaluate the burst transfer with a subject of alpha blending processing as a theme. It is necessary to describe the program so that the HLS tool can implicitly infer the burst transfer, because HLS tool doesn't have a pragma designating the burst transfer. We consider the description method of the program to infer the burst transfer and clarify the influence of read/write burst transfer on alpha blending.

GS21-5 Development of optical wireless communication with LED marker for underwater ROV

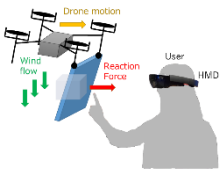
Kyohei Kaneshiro, Naoki Oshiro, and Hiroshi Kinjo
(University of the Ryukyus, Japan)



In recent years, remotely operated vehicles (ROVs) have been widely used in underwater research and activities. They are basically remotely operated using a cable, but if they could be wireless, it could improve the range of activities in the sea. However, electromagnetic waves are greatly absorbed by the sea, making wireless communication difficult. Therefore, we paid attention to visible light communication, which is not affected in this way. The purpose of this study is to devise wireless communication for unmanned submarines by use of the augmented reality (AR) marker and visible optical communication with a Web camera. This communication method using a camera as the receiving unit is robust to disturbance by image processing, and parallel processing can be expected. We create systems and equipment for detection of AR markers and simple data transmission experiments and verify system performance through experiments.

GS21-6 UHD: Unconstrained Haptic Display Using a Self-Localized Quadrotor

Photchara Ratsamee[1], Kotaro Yamaguchi[1], Kiyoshi Kiyokawa[2], Haruo Takemura[1],
Seokhee Jeon[3], and Yoshihiro Kuroda[1]
([1]Osaka University, Japan)
([2]Nara Institute of Technology, Japan)
([3]Kyung Hee University, Republic of Korea)



This paper presents the concept of an unconstrained haptic display; an encountered-type haptic device with unlimited working space in mid-air. Our prototype system utilizes a micro aerial vehicle with an on-board localization system and a flat surface hanging under a quadrotor. Based on an integrated visual sensing system, the device is able to localize itself without an external motion capture system. It then presents a force to the user when the user touches the flat surface thanks to wind flows acting as a reaction force behind the surface. Our experimental results confirmed that the prototype can present a force with a profile close to that of an elastic force in the horizontal direction, where the amount of force can be adapted based on pushing distance to the flat surface.

January 23 (Wednesday), 13:00–14:15

Room E

OS15 Vehicle dynamics and control

Chair: Shinichi Sagara (Kyushu Institute of Technology, Japan)
Co-Chair: Masahiro Oya (Kyushu Institute of Technology, Japan)

OS15-1 Trajectory Tracking Control of Octocopters with Tilted Rotors

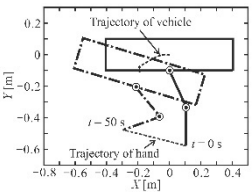
Shingo Kase[1], Hideki Wada[2], Katsuhiro Okumura[3], Yuichiro Taira[4], and Masahiro Oya[1]
([1]Kyushu Institute of Technology, Japan)
([2]Shin-Nippon Nondestructive Inspection Co.,Ltd, Japan)
([3]Fukuoka Industrial Technology Center, Japan)
([4]Sojo University, Japan)

In this paper, we propose a trajectory tracking control method for octocopters with a wind disturbance. Conventional controllers cannot control position and attitude independently. Using tilted rotors, it is expected that the problem of conventional controllers can be overcome. Therefore, we develop a trajectory tracking controller for octocopters with tilted rotors. The developed controller can ensure good control performance when there exist unknown parameter variations of octocopters and an unknown wind disturbance. Finally, to confirm the usefulness of the proposed controller, numerical simulations are carried out.

OS15-2 Design of two types of kinematic control for an underwater vehicle-manipulator system with a differently-controlled vehicle

Yuichiro Taira[1], Shinichi Sagara[2], and Masahiro Oya[2]
([1]Sojo University, Japan)
([2]Kyushu Institute of Technology, Japan)

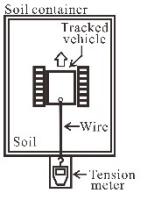
This paper deals with a motion control scheme for an underwater robot equipped with a manipulator. The manipulator is directly driven by electric motors, and velocity-controlled servo systems are frequently used as their motor drivers. On the other hand, the robot body is propelled by marine thrusters, whose thrust forces are generated by means of hydrodynamic effects produced by the rotations of their propellers. It is known that the positioning accuracy of a marine thruster is practically much lower than that of an electric motor, because it is generally difficult to accurately generate hydrodynamic forces such as the thrust force of a marine thruster. In this paper, we develop two types of kinematic motion controllers for the manipulator under the condition that the robot body is independently controlled by a motion controller with poor performance.



OS15-3 An experimental analysis of dynamic force characteristics for tracked vehicles

Ryota Ozaki and Yuichiro Taira
(Sojo University, Japan)

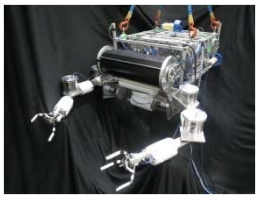
This paper deals with the development of a tracked vehicle. Its dynamic model is considerably important for the design of an automatic driving controller. However, the structures of its rigorous models are highly complicated, because the motion of a tracked vehicle depends on the dynamic interaction between its tracks and a terrain. This leads to a controller with a complex structure. In view of this situation, some control schemes based on approximate dynamic models have been developed. However, their experimental analyses were not performed for most of them. Therefore, the practical validity of each dynamic model as well as its controller is unclear. Our study aims to develop an automatic driving controller based on a dynamic model. In this paper, at its first stage, we investigate the dynamic behavior of an experimental tracked vehicle for the validation of a dynamic model.



January 23 (Wednesday), 13:00–14:15

OS15-4 Resolved acceleration control and sliding mode control of a dual arm underwater vehicle-manipulator system

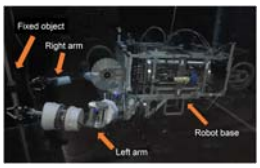
Hikari Nakano[1], Shinichi Sagara[1], and Radzi Ambar[2]
([1]Kyushu institute of technology, Japan)
([2]Universiti Tun Hussein Onn Malaysia, Malaysia)



Since Underwater Vehicle-Manipulator Systems (UVMS) are expected to make important contributions in ocean exploration, there are many studies about the control of UVMS based on the computed torque methods. We have proposed a resolved acceleration control method for UVMS and the effectiveness of the control method have been demonstrated in underwater experiments using a 3-link dual-arm underwater robot. In this paper, we compare our proposed method with a sliding mode control method via computer simulation to show the effectiveness of the proposed method. Simulation results show that the control performance of our proposed method is better than the sliding mode control method.

OS15-5 Force control of a dual arm underwater vehicle-manipulator system

Yutaka Seki[1], Yuichiro Taira[2], Shinichi Sagara[1], and Radzi Ambar[3]
([1]Kyushu Institute of Technology, Japan)
([2]Sojo University, Japan)
([3]Universiti Tun Hussein Onn Malaysia, Malaysia)



Ocean development has been carried out for various purposes such as construction and mining of natural resources. However, underwater activities are dangerous to humans due to the harsh environment. In order to solve this problem, various research studies on underwater robotic systems called Underwater Vehicle-Manipulator System (UVMS), which are robots equipped with multiple manipulators are currently underway globally for the purpose of supporting and substituting humans. Since, most of underwater tasks involve interaction with the environment, it is considered necessary to develop not only position control method, but also force control method for UVMS. Therefore, based on several methods, we also aim at developing a force control method for UVMS by considering the robot dynamics. This paper reports the results of the experiment to show the effectiveness of two proposed force control methods for UVMS.

January 23 (Wednesday), 14:45–16:15

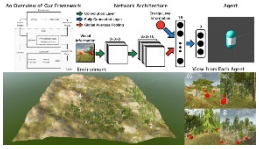
Room A

GS3 Artificial life

Chair: Jun Ogawa (The University of Aizu, Japan)

GS3-1 Emergence of Motivation by Agent-Environment Interaction

Masafumi Takahashi and Sadayoshi Mikami
(Future University Hakodate, Japan)



We propose a motivational framework based on the perspective of an agent. Unlike previous researches focusing on the optimization of the objective function, we focus on the emergence of motivation by the agent-environment interaction and attempt to bridge the gap between the motivation and the perspective of the agents. The agents have a convolutional neural network which determines action from energy level information and visual information, and their neural networks evolve by mutation and natural selection. We empirically demonstrate that despite not using the objective function, the agents based on our framework could survive by ingesting resources and grow as a population by breeding in the complex 3D environments with high-dimensional visual input. Our results support the hypothesis that the fundamental problems in artificial intelligence such as the frame problem can be solved through a new approach that capitalizes on …

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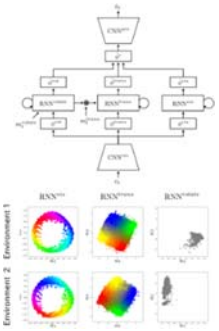
GS3-2 Modeling place and head-direction cells self-organized in different environments using recurrent neural networks

Wataru Noguchi, Hiroyuki Iizuka, and Masahito Yamamoto
(Hokkaido University, Japan)

The place and head-direction cells are the brain cells that represent the spatial position and head-direction of individuals. These spatial representations are shared between different environments and the individuals can recognize the world under the same metric. In this study, we proposed a neural network model that can develop the spatial representation shared between different environments by visuomotor integration using recurrent neural networks. Our network receives subjective visuomotor experiences of a simulated mobile agent where the objective information like spatial position was not provided, and was trained to predict the agent's visual sequences. After the training, the network became able to correctly predict the visual sequences by integrating the agent's vision and motion. The internal states analysis showed that the positional and directional representations were self-organized in the internal states in the trained network. Furthermore, the self-organized spatial representations were shared between different environments.



GS3-3 Biomechanical analysis of C-start and cyclic swimming in larval zebrafish using a computational fluid dynamics model

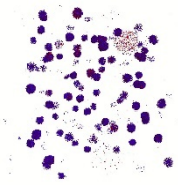
Naohisa Mukaidani[1], Zu Soh[1], Kazuhide Asakawa[2,3], Koichi Kawakami[2,3], and Toshio Tsuji[1]
([1]Hiroshima University, Japan)
([2]National Institute of Genetics, Japan)
([3]Graduate University for Advanced Studies (SOKENDAI), Japan)

To understand the biomechanics of swimming in small fish, recent biological experiments using zebrafish larvae have clarified the fluid dynamics associated with typical swimming patterns. However, the relationships among neuronal activities, muscle contraction patterns, and swimming postures are not fully understood, because it is technically difficult to directly measure force and mechanical characteristics in larvae. To overcome such limitations, we employed a computer simulation approach. We constructed a computational model of fish bodies and fluid, and solved a two-dimensional fluid–structure interaction problem using the finite element method with the moving mesh technique to analyze the swimming dynamics of zebrafish larvae. The experimental results showed that the swimming postures computed by the model effectively approximated those of the actual larva, and revealed the existence of a difference in the time-delay patterns of joint torque generation from the head to the tail for C-start and cyclic swimming movements in larval zebrafish.

GS3-4 Emergent patterns of cooperative clusters in a large-scale social particle swarm model

Zineb Elhamer, Reiji Suzuki, and Takaya Arita
(Nagoya University, Japan)

We study the impact of network size in the context of interactions within Social Network Services (SNS) on cooperation among its users, using an enhanced version of a swarm model that uses Prisoners Dilemma as social interaction strategy and models users' interactions through kinematics. We also focus on the speed of information update about social environments and study the inter-relationships with the resulting patterns of cooperation. We observed the large variations among emerging many cooperative clusters in size, speed, and cooperation rate in the large population. However, such a diversity and high cooperation rate could be limited when the information update rate was small, and the population converged to a single or a few large clusters with many wandering defectors.



January 23 (Wednesday), 14:45–16:15

GS3-5 Creating metamemory by evolving artificial neural network with neuromodulation

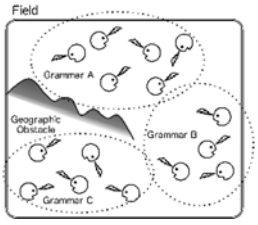
Yusuke Yamato, Takaya Arita, and Reiji Suzuki
(Nagoya University, Japan)

Human have the ability to consciously aware of the presence or absence of their memory. This kind of the ability called metamemory plays important roles in human cognition. We aim to evolve artificial neural networks with neuromodulation, that have a metamemory function. Our constructive approach is based on the repetition of evolutionary experiments, analysis of the evolved networks and refinement of the measure, so as to reducing the gap between the functional properties of behavior and subjective reports of phenomenal experience. This paper reports on the current state of the approach based on the evolutionary experiments with a delayed matching-to-sample task.

GS3-6 A study on a language emergence model based on causality-oriented reasoning

Masato Ishikawa
(Osaka University, Japan)

In this paper, we discuss formation of languages through continuous communication among multi-agents, with particular focus on effect of locomotion. Starting from a hypothesis that the driving force for language formation is ‘innate motivation of humans to establish consistent communication', we propose a simple model composed of speaker agents and a field in which the agents are allowed to move around. Each agent is capable of memorizing its itinerary of locomotion, and tells it to other agents according its own grammar, while it also tries to infer the others’ internal grammar by logically comparing the actual and the spoken itineraries. The proposed model is examined by numerical simulation, with observation of emergence of a common grammar, geographical variation and influence of agent-behavior parameters.



January 23 (Wednesday), 14:45–16:00

Room C

GS8 Data mining 1

Chair: Ryosuke Saga (Osaka Prefecture University, Japan)

GS8-1 Automatic Legal Cases Assembling by the Spherical K-mean Clustering

Poramin Bheganan[1,2], Patcharee Sriputta[2], Bancha Luaphol[2], Boonchoo Srikudkao[2],
Natthakit Srikanjanapert[2], Jantima Polpinij[2], and Apirak Tooltham[2]
([1]Mahidol University, Mahasarakham University, Thailand)
([2]Mahasarakham University, Thailand)

Civil cases usually refer to legal cases involving private disputes between persons or organizations. After these cases are “decided case”, is archived as hard copies in Thailand and many countries’ court archives. They can be useful for further legal studies. Unfortunately, there are substantive number of cases pleaded to the court. It causes information overloaded for legal area. If these documents are grouped in the proper way, this may help retrieved relevant cases. Therefore, our study proposed automatic assembling of similar civil cases with Thai language into the same cluster by the spherical k-means clustering. Furthermore, this study compares three weighting schemes such as tf, tf-idf, and BM25. After testing the performance of the pro-posed method by recall, precision, and F1, the results are satisfactory and acceptable. Simultaneously, it is found that BM25 can improve the accuracy of tf and tf-idf.

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GS8-2 The Hotel Feature-Based Opinion Mining from Customer Reviews

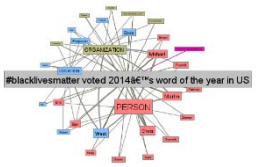
Montakarn Tummawat and Chatklaw Jareanpon
(Mahasarakham University, Thailand)

Business information affects the business management, especially in the hotel business. It is a business that earns majority income from the service charge, so the feeling or opinion of the guest experience in the hotel is very important. The feeling is both positive and negative. The positive side means the impression to the hotel, and negative side, business owners should focus on improving the hotel to meet the needs of users. This research uses 695 hotel reviews from Ibis Styles Bangkok Khaosan Viengtaito analyzing how each feature such as Room, Service, Food, Price, and Location. This research has gathered reviews from www.tripadvisor.com. In the process of reviews, classification uses the weighting algorithm technique to specify the polarity of the comment in each feature. It can be concluded that how many each feature has positive and negative perceptions. The accuracy was 63.61% and the recall was 72.81%.

GS8-3 Ebola news visualization using Topic maps

Thanakorn Yarnguy and Wanida Kanarkard
(Khon Kaen University, Thailand)

The news content has increasing in volume and consume a lot of time to understanding. Ebola is a threat which people have following closely. So that, there will represent news in other form which can understand new content easily. This paper presents how to present news in the form of topic maps which has been process using natural language processing algorithm and topic modelling to find sentiment of the news content, category, hidden topics and entities. The results shown that Ebola news content can be shown in graphical topic maps with topic, association and occurrence which consist of extracted entities, related topics, categories, sentiment and hidden topics.



GS8-4 DEA based on extraction differences between two groups

Yuto Kamitaka, Shingo Aoki, and Kazushige Inoue
(Hiroshima Institute of Technology, Japan)

There is an evaluation method that relatively measures the efficiency of the decision making unit (DMU) using multiple input / output items called Data Envelopment Analysis (DEA). One of the features of DEA is that DMUs are evaluated based on the Pareto-optimal line composed of efficient DMUs (this line is called as “Efficiency Frontier” in DEA). This paper proposes the method to extract differences between two groups of DMUs based on DEA. The proposed method consists of two steps. In step1, to classify DMU into two groups and evaluate from each group. In step 2, we extract the differences by Mann-Whitney U test. A numerical example with the dataset of Japanese baseball players data is used to illustrate the features of the proposed method.

GS8-5 Proposal of Quantitative Evaluation for Multi-type Edge Bundling based on Color Distribution

Ryosuke Saga
(Osaka Prefecture University, Japan)

This paper describes the verification about quantitative evaluation criteria of multi-type edge bundling. Recently edge bundling method is used for reducing visual clutter in graph drawing area. Actually several methods have been proposed and in order to evaluate these edge bundling methods, the author proposed evaluation criteria based on aesthetics rules. However, there is no method to evaluate the result of multi-type of edge bundling. Therefore, this paper proposes brand-new criteria for multi-type edge bundling.

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Room D

GS11 Human-machine interaction and collaboration

Chair: Photchara Ratsamee (Osaka University, Japan)

GS11-1 Development of distributed control system for vision-based myoelectric prosthetic hand

Ryusei Shima, Yunan He, Osamu Fukuda, Nobuhiko Yamaguchi, and Hiroshi Okumura
(Saga University, Japan)

This paper develops a distributed control scheme for vision-based prosthetic hand system. Vision-based prosthetic hand features a camera integrated in the end-effector. The camera is used for object and environment understanding. The information is further used to make decisions on grasping. A typical control flow of such system is capturing the image, recognizing the object, selecting a grasp posture from posture candidates and generating control signals for motor driver. Vision-based prosthetic hand control system usually suffers from the computation cost of image processing, which leads to the delay of reach-to-grasp movement. To perform nature control of the vision-based prosthetic hand, we designed a distributed control system that assigns the tasks in the control flow to multiple processing nodes over the local network. In the experiment, five kinds of common objects are selected as the grasp targets to validate the system performance.

GS11-2 Comparison of active/passive motor-learning characteristics with vision/haptic feedback

Takaaki Yasui, Fumihiro Akatsuka, Yoshihiko Nomura, Tokuhiro Sugiura, and Norihiko Kato
(Mie University, Japan)

This study examined a motor-learning task in which the subjects learned the length, angle and maximum velocity of a straight-line stroke. For the purpose, we conducted an experiment in which subjects learned the target trajectories and reproduced them. Comparing the errors that are the differences between the reproduction trajectories and the target trajectories, we evaluated the learning effect based on short-term memory. Then, we classified three instruction systems based on the receptors perceiving the target trajectories, i.e., haptic/visuo-haptic, and the degree of activity in learning, i.e., active/passive movement. As a result, the reproduced lengths and maximum velocities were significantly smaller when the target trajectory was presented through vision-combined visuo-haptic than those when the target trajectory being presented through only haptic. As the activity is high, the reproduced lengths and maximum velocities decreased.

GS11-3 Comprehensive evaluation of velocity-change perception on elbow passive movement

Takaaki Yasui, Fumihiro Akatsuka, Yoshihiko Nomura, Tokuhiro Sugiura, and Norihiko Kato
(Mie University, Japan)

This study clarified the velocity JNDs: the JNDs are the minimal velocity differences humans can discriminate. For this purpose, we conducted an experiment, assuming an elbow-joint movement pattern in which velocities were increased from constant values to other constant ones for elbow joints. In the experiment, subjects' elbow joints were enforced to move by a device. After the movements, the subjects answered whether they perceived a velocity change during the movement. Iterating this trial with various velocity differences, velocity JNDs were obtained. The three factors to be evaluated were the time duration of the before-acceleration section, τ_{before}, the time duration of the after-acceleration section, τ_{after} and the acceleration during velocity-change, acc. As a result, a tendency for the velocity JNDs was significantly observed to decrease with the larger τ_{before} factor. On the other hand, the velocity JNDs almost remained unchanged when τ_{after}, acc factor were varied.

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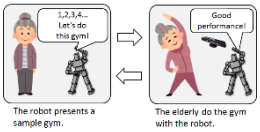
GS11-4 An Instructor Robot in Keep-fit Class of Elderly People and Gymnastics Assessment for Motivative Exercise

Hideki Kato, Shohei Kato, and Seo Mina
(Nagoya Institute of Technology, Japan)

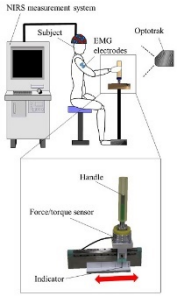
A system for promoting a practice of physical activities is important to extend healthy life expectancy. This paper proposed a gymnastics system using a humanoid robot as an instructor and a method to assess movements of elderly people using dynamic time warping. We confirm that the system improves motivation of elderly people in gymnastics. We indicate that dynamic time warping is applicable to gymnastics assessment.



GS11-5 Analysis of muscle activity of upper limbs and cortex brain function in cylindrical object manipulation

Kai Tanaka, Toru Tsumugiwa, and Ryuichi Yokogawa
(Doshisha University, Japan)

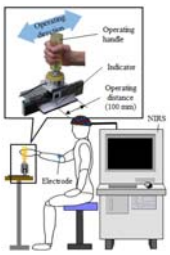
The purpose of this study is to quantitatively evaluate the maneuverability of the cylindrical handles focusing on the influence of the sizes and the gripping forms of the manipulation target objects on the manipulation sensation. The maneuverability was quantitatively evaluated using measurements of the cortex brain activation state and the surface myoelectric potential signal by near-infrared spectroscopy (NIRS) and electromyogram (EMG) sensors. The subjects were instructed to move the cylindrical handles between previously determined two points. As experimental conditions, the subjects were also forced to move them with two kinds of cylindrical handle diameters and two types of gripping shapes, which are 4 conditions in total. In regard to the experimental results, it was suggested that the maneuverability can be quantitatively evaluated by analyzing the cerebral and muscle activation states.



GS11-6 Identification of brain/muscle activation and instrument maneuverability under pinching and grasping condition

Yosuke Yamamoto, Toru Tsumugiwa, and Ryuichi Yokogawa
(Doshisha University, Japan)

The purpose of this paper is to analyze the reactions of brain/muscle activity necessary for the quantitative evaluation of the maneuverability during the instrument operation. In this study, we measured the brain activity during the instrument operation using NIRS and muscle activity necessary for operation. We evaluated the maneuverability of the cylindrical handle operation under the pinching/grasping conditions with the brain/muscle activities and the questionnaire survey. In the questionnaire-based responses, the specific functional brain area became active condition under the top performance of the maneuverability, and as for the muscle activity, a significant difference was observed between the top and bottom performance of the maneuverability condition.

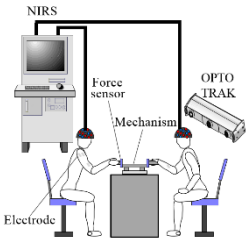


January 23 (Wednesday), 14:45–16:30

GS11-7 Influence of leader and follower role in human-human cooperative transportation task on brain/muscle activation

Shinobu Nakajima, Toru Tsumugiwa, and Ryuichi Yokogawa
(Doshisha University, Japan)

The purpose of this study is to present the influence of leader/follower roles on brain/muscle activations and motions in a human–human cooperative task. In this study, we simultaneously measured brain activations, surface electromyography (EMG), force applied by the subjects and hand positions in the human–human cooperative reciprocating transportation task. The experimental results lead important basic data that show the difference of brain activations due to the role of the leader and the follower. Furthermore, the interaction results lead to the interpretation of the human characterization in the human–human cooperative task.



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Room E

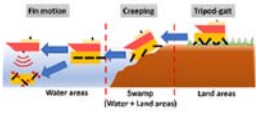
GS7 Control techniques

Chair: Keita Nakamura (The University of Aizu, Japan)

GS7-1 Development of the environment survey robot corresponding to tideland

Kei Nakamura, Junichiro Tahara, Masakazu Koike, Feifei Zhang, and Mikihiro Saito
(Tokyo University of Marine Science And Technology, Japan)

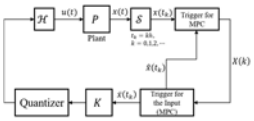
In this paper, we propose the multi-legged walking robot equipped μ-ASV (Micro-Autonomous Surface Vehicle). This robot is used as the survey equipment corresponding to tideland. It consists of μ-ASV at the top and multi-legged walking robot at the bottom. μ-ASV is used as the carrier of multi-legged walking robot and as an offshore repeater with land in water areas. We have been considering about the motion control system of multi-legged walking robot. So, in this paper, we mainly considered about the motion control system of μ-ASV. This system moved μ-ASV model to the any target point and was staying at the target point. We aimed at the making system like simple DPS (Dynamic Positioning System) control. As a result of considering, we confirmed that simple DPS control system could be realized by using sliding mode control. We mainly show the details of this result.



GS7-2 A path searching algorithm for the event-triggered model predictive control

Yoshiki Nagatani, Kenji Sawada, and Seiichi Shin
(The University of Electro-Communications, Japan)

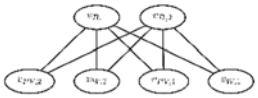
This paper considers the event-triggered control for the reduction of computational load. There are two propositions to achieve the purpose. The first proposition is a path search algorithm based on dynamic programming for the optimal control problem. The key point is the sharing of vertices in the event transition tree and leads to the reduction of computational load. The second proposition is event-triggered control for the model predictive controller. The finite optimal control problem is solved only if some disturbance is input to the system. A quantizer is supposed as a source of the disturbance. The numerical experiments show that the control performance is kept while the computational load is reduced.



January 23 (Wednesday), 14:45–16:15

GS7-3 Grouping optimization for Wind-Photovoltaic-Battery Hybrid System using graph enumeration

Kengo Takeda, Kenji Sawada, Shinji Yokogawa, and Seiichi Shin
(The University of Electro-Communications, Japan)



Wind turbine power generators (WTG) and photovoltaic power generators (PV) cause electric power fluctuations, batteries are combined with such the renewable energy generators to absorb power fluctuations, so-called, wind turbine and photovoltaic power and battery hybrid system (WPBHS). Such the system mainly focuses on the distributed operation in which a large number of system devices are managed decentrally. When the number of devices increases, it is necessary to optimize how to separate devices into small groups in which components are managed centrally (We call it grouping). This paper considers the formulation of grouping optimization and a method of solving this optimization problem using Zero-suppressed binary decision diagram.

GS7-4 Remote control system of quick charger for battery powered boat

Hidemasa Kimura, Tuyoshi Oode, Etsuro Shimizu, Takumi Nishina, Katsuya Hakozaki, and Ai Hoshino
(Tokyo University of Marine Science and Technology, Japan)

Most of imported products are transported by vessels and vehicles. Because of environment issues like global warming and pollution, vessels and vehicles are required to reduce exhaust gas. In fact, automobiles are going to change to an electric vehicle. Vessels are required to change from vessels which mount engine to electric vessels. Therefore, our laboratory has been developed battery powered boats. Since the control system for battery powered boats is the same as it for electric vehicles, the quick charger for electric vehicles can be used. In general, in order to start the battery charger, the crew of the battery powered boat has to be moved between the charger and the boat. Therefore, the remote-control system for the quick charger is desired. In this paper, the remote-control system using a 426MHz wireless transmitter is developed. The communication distance and the influence of obstacle between these have been examined.

GS7-5 Locomotion simulation system in Virtual Experience Campus using Balance Wii Board and its evaluation

Tomoko Tateyama, Tetsuro Katada, Asuka Kigami, and Shimpei Matsumoto
(Hiroshima Institute of Technology, Japan)

By today’s information progress, it changes greatly from analog to digital such as Web service and Presentation of digital contents also University Campus Guide was shown with document and sign board as before. Our laboratory advances the development of Virtual Experience Campus Guide System of Hiroshima Institute of Technology with VR technology. Generally, campus guide with VR need large-scale facility and instrument. But, In previous study, we developed Experience VR Campus Guide System using VR goggle and smart phone aiming at “always, anywhere, anybody”. However, the evaluation was low as high immersion system because the action was limited such as move around freely in experience system environment. In this study, to overcome the above problem, propose high immersion experience system that is able to locomoting freely using balance Wii board in constructed virtual campus.

GS7-6 Development of Automatic Laundry Folding System

Kosuke Ando and Yuhki Kitazono
(National Institute of Technology, Kitakyushu College, Japan)

In this paper, we discuss the development of a system that automatically folds laundry. In today's society, technological development is actively under way to improve the efficiency of house work using system. Although every task exists in household chores, it is said that it is difficult to automate a series of operations (laundry, hanging, drying, folding, etc.) of laundry, especially through human hands. In recent years, although there is a flow of automation by development such as 'Randroid' [1], which is a robot automatically folding laundry, these previous studies are aimed at only folding laundry which has been dried, so from the drying work it is necessary for human beings to take in work to the robot. Also, since the time until the laundry is dried depends on the weather, it takes time and effort to confirm whether it is dry. In this research, based on these previous studies and problems, we develop an automatic laundry folding device which loads laundry in a state hung on a hanger rack after detecting drying and folds it.

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Room F

GS9 Data mining 2

Chair: Tomoharu Nakashima (Osaka Prefecture University, Japan)

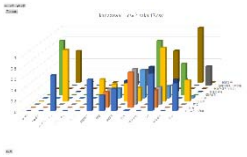
GS9-1 A comparison between Word2Vec and FastText regarding with suggestion of predicates of OpenData

Bo Chen, Tadanori Hisanaga, Daisuke Noto, Daiki Tomari, and Takayasu Fuchida
(Kagoshima University, Japan)

"G8 Open Data Charter" was presented in 2013[1], efforts of Open Data has begun in each country, the worldwide interest in Open Data has been increasing. The utilization of Open Data has been promoted, and many organizations including the national government, local governments and other organizations are working on opening and utilizing Open Data. The data released as RDF have been hardly done for the communization of the namespace so far. In this research, we focused on the vocabulary that corresponds to the predicate of the RDF form for Open Data, and we compared learning word vectors by utilizing Word2Vec and FastText in order to share the vocabulary. Further, we verified the reliability of the made dictionary.

GS9-2 Calculation of cooperation possibility of open data using predicate vector method

Tadanori Hisanaga, Bo Chen, Daisuke Noto, Daiki Tomari, and Takayasu Fuchida
(Kagoshima University, Japan)



In this proposal, cooperation possibility was calculated for the following three methods, 1. a method of calculating the average of similarity of all columns, 2. a method of calculating a weighted average by a Gaussian distribution, and 3. a method of calculating only a column having a high similarity using a certain threshold. Experiments were conducted to calculate the degree of cooperation between data among open data using this predicate vector method. We also conducted experiments to calculate collaborative possibilities by considering item names as well as items. The item judgment function used for calculating the predicate vector is about 300 and the number of dimensions of the predicate vector obtained is 300 dimensions. The data used for the experiment was collected from 30,000 CSV data from the local public organization database site of the data catalog site DATA.GO.JP established by the Japanese government, of which approximately 15,000 data was used.

GS9-3 Automatic Bug Report Analysis: Actual-bug and Non-bug

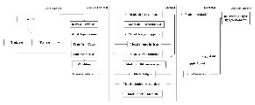
Boonchoo Srikudkao, Bancha Luaphol, Natthakit Srikanjanapert,
Poramin Bheganan, and Jantima Polpinij
(Mahasarakham University, Thailand)

Bug reports are important information for improving software quality. To have a better way of collecting the large bug reports from more users, many bug tracking systems (BTS) have been developed. These systems allow users to report, describe, track, classify, and comment on their bug reports. Unfortunately, various tasks on the BTS are still performed manually by bug triagers. They are time consuming and errors prone tasks for bug report analysis. Therefore, many works focus on studying related to bug reports. One of the most common issues of bug report studies is to classify bug reports into real-bug and non-bug report. This study aims to present a method of automatic analyzing and classifying bug reports into real-bug and non-bug. We also study various weighting schemes and machine learning algorithms to obtain the most appropriate solution for the proposed study.

January 23 (Wednesday), 14:45–16:15

GS9-4 Major depressive disorder (MDD) classification from user behaviors from Twitter

Damrongdet Doenribram[1], Chatklaw Jareanpon[1], Jariya Jiranukool M.D.[1], and Sudarat Sonbua[2]
([1]Mahasarakham University, Thailand)
([2]Ramkhamhaeng University, Thailand)



In 2017, WHO indicated that MDD was the second cause of death among the 15-29-year olds. Person has a chance of depression and uses social media, there may be an expression of their feeling in the post. Therefore, this research proposes the classification from user behaviors using Bayes algorithm from Twitter that created the 9 various models, based on symptoms criteria for MDD of the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) including as follow: 1) depressed mood 2) diminished interest 3) change in appetite 4) change in sleep 5) slowed thinking 6) worthlessness or guilt 7) fatigue 8) agitation or retardation and 9) suicidal ideation. The data set is divided into 2 sets: training set and test set came from real tweets of celebrities. Finally, the results demonstrated of training set showed that the accuracy = 95.85% and test set showed that the accuracy = 80.00%

GS9-5 The Relation of Major Depressive Disorder (MDD) Symptoms using Association Rules on Twitter

Chatklaw Jareanpon, Damrongdet Doenribram, and Waranyoo kiatjindarat
(Mahasarakham University, Thailand)

Relation of major depressive disorder (MDD) is the psychopathy found in everyone. The 9 symptoms of MDD are 1) depressed mood, 2) diminished interest, 3) change in appetite, 4) change in sleep, 5) slowed thinking, 6) worthlessness or guilt, 7) fatigue, 8) agitation or retardation, and 9) suicidal ideation that effects with the daily life. Additionally, the mental patient will suicide. The diagnosis of the psychiatrist is coming from interview and calculating the score of questionnaire created from the psychiatric association of America called the diagnostic and statistical manual of Mental 5th Disorders (DSM-5). The condition of the diagnosis is that the patient will show the 5 symptoms of 9 symptoms continuing 2 weeks. This research proposes the association rule for finding the relationship of MDD symptoms of Twitter of patient in one day using FP-Growth. The dataset is coming from the 15 Twitter accounts consisted of 54,780 transactions. The accounts posted more than 2 weeks, and they are patients. The minimum support is set to 0.01 and minimum confidence is set to 0.2. The RapidMiner is used for demonstrating the experiment. The computational time of this experiment is 1 seconds. The 4 rules are created by FP-growth.

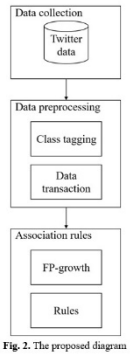


Fig. 2. The proposed diagram

GS9-6 Relevant Software Requirement Sentences Retrieval from A Software Requirement Repository

Kanin Ngammana and Jantima Polpinij
(Mahasarakham University, Thailand)

An automatically finding of system requirements specification (SRS) in software requirements is a problem in requirement engineering. This is because this task becomes a time-consuming and labor-intensive in system analysis and design stage, when it is manually working on a large scale of textual software requirements. Therefore, this study aims to presents a method of automatically finding and gathering the relevant software requirement sentences of each “actor” in a software requirement collection written in English. The main mechanism of the proposed method is an information retrieval (IR) and natural language processing (NLP). After testing by recall, precision, and F-measure, it returns the average results as 0.77, 0.74, and 0.75 respectively. These results of the proposed method may be a satisfactory, and it may provide a substantial saving for major development organizations.

January 24 (Thursday), 09:15–10:45

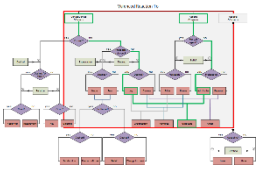
Room A

GS5 Cognitive science

Chair: Hideo Araki (Osaka Institute of Technology, Japan)

GS5-1 Cognitive Structure based Individual Emotion Model for Personality-Rich Robots

Shiqin Yang and Mengzhao Yang
(Shanghai Ocean University, China)



Many researchers employ the OCC model to generate emotions for embodied characters, however most of them restrain a character to a few of emotions among 22 formalized emotions. In this study, we propose a computational Cognitive structure based Individual Emotions Model (CIEM), which can generate full 22 types of emotions for a simulated character. The CIEM is based on the OCC model but taking account of individual features and personality and enabling the calculation of emotion intensity. Empirical study demonstrates that the agents or robots with CIEM can generate a wider range of personality related emotions.

GS5-2 A basic analysis on toggle function for improving the learning effectiveness of card operation-based programming learning support system

Shoko Morinaga[1], Shimpei Matsumoto[1], Yusuke Hayashi[2], and Tsukasa Hirashima[2]
([1]Hiroshima Institute of Technology, Japan)
([2]Hiroshima University, Japan)

Programming lectures mainly in higher educational institutions have required a system for encouraging essential learning of programming that the instructor aims. Then, previously a card operation based programming learning system focusing on thinking between the relations of parts has been developed. This system focuses on the relations of each part consisting of one or more statements and aims to control cognitive resources by limiting learning activity patterns. Through the real operation into a programming class, the card-based method was able to focus learners on the learning intended by the teacher while reducing cognitive load. However, since the card-based method simplifies learning activities, it seems that the card-based system doesn't have more learning effectiveness than the usual coding exercise. Therefore to improve the learning effectiveness, this paper designs and implements toggle function for the card-based method.

GS5-3 Examining Presentation Method of Question's Requirement for Game Development-Based Programming Learning Support System

Tomoya Iwamoto[1], Shimpei Matsumoto[1], Yusuke Hayashi[2], and Tsukasa Hirashima[2]
([1]Hiroshima Institute of Technology, Japan)
([2]Hiroshima University, Japan)

The aim of this research is to study and verify a new method in programming learning using game development. The proposed method provides targets to learners on the screen, not in natural language. The proposed system can feed back the execution result of the program in real time and the operation screen of the correct answer program as an example. The learner examines the correct answer of each question while comparing the result screen with the example screen. Regarding the effectiveness of the presentation function of the model screen, we compare the learning effect with the learning time by comparing learning methods of problem presentation by natural language.

January 24 (Thursday), 09:15–10:45

GS5-4 A Basis Analysis on Novice Programmers with a Server-Client System for Learning C Programming Language

Masanori Oshita, Kosuke Kaida, and Shimpei Matsumoto
(Hiroshima Institute of Technology, Japan)

The authors compare Hello C Client, a C language editor for Windows terminals and compilation environment for enabling learners who are not accustomed to handling computers easily to perform programming learning and exercises delivery and learners We are developing Hello C Server which is a system for teachers to support progress management. This paper aims to describe the details of Hello C concepts and functions. Also, we aim to verify the possibility of Hello C as one of the tools of learning analytics in programming education. As a result, Hello C could visualize the time interval data that the learner did not compile and confirmed that it is useful for detecting impass from it. Also, by giving various conditions to learner 's answer code, we confirmed that there are learners who are progressing learning and learners who may not.

GS5-5 Kinect-based Rehabilitation Exercise System for People with Office Syndrome

Prerth Nasa-ngium and Jantima Polpinij
(Mahasarakham University, Thailand)

This work presents a developing of the Kinect-based rehabilitation exercise system for people with office syndrome, where this disease is pain and sore in the spine or muscles caused by sitting or remaining in the same position for long period of time or working in poor environment. We commences with collecting the skeletal data (3D joint positions data and relevant angles of joints) from volunteers using the Kinect Sensor and also verified by the physical therapist in order to have all correct skeletal stream of data. The proposed system can offer a correct guideline for exercise to busy people, who may have no time to meet a rehabilitation professional.

GS5-6 Modeling deceptive communication based on information flow

Seiko Myojin and Noboru Babaguchi
(Osaka University, Japan)

Clever tricks to deceive people by using spam mails, conversation have become a great concern in our society. In this paper, we focus on deceptive communication in business mail frauds and aim to develop a theoretic framework that accounts for phenomena in relation to deception by using Channel Theory that is regarded as a kinds of logical approach. We model behavior of a cautious person and a not cautious person and show differences of mapping to protect them. In addition, we analyze an actual incident of a business email fraud that a cautious person encountered. As a result, context of deceptive communication is likely to be concretely described as a logical argument. This paper contributes to providing an approach for observing a flow of information in deceptive communication by transferring problems of frauds to logical arguments that consist of several concepts of Channel Theory.

January 24 (Thursday), 09:15–10:45

Room B

GS10 Evolutionary computations (Genetic algorithm)

Chair: Reiji Suzuki (Nagoya University, Japan)

GS10-1 Design of logic circuit by genetic algorithm

Kenshiro Fujita and Akinori Kanasugi
(Tokyo Denki University, Japan)

This paper proposes a circuit design method using genetic algorithm. The feature of this method is that it can simultaneously optimize the circuit and synthesize the approximate circuit. The degree of matching between the output result of the generated circuit and the truth table is set as an evaluation function. As a simple example, we can reduce the literal number by 77% in the approximate circuit generation of the 2-bit multiplier circuit.

	Contents of error (3×3=)	Literal number	Literal number Reduction rate(%)
Optimized circuit	9 (1001)	24	
Absolute value method	10(1010)	17	29
Relative value method	7 (0111)	8	77

GS10-2 Escher-like Tiling Design Using Estimation of distribution algorithm

Asuka Hisatomi[1], Hitomi Koba[1], Kazunori Mizuno[2], and Satoshi Ono[1]
([1]Kagoshima University, Japan)
([2]Takushoku University, Japan)

This paper proposes a method that generates a tileable shape similar to a given image. Tiling is an act of covering the plane with one or very few types of figures without any overlaps and gaps. To automatically design a tilable figure, a hierarchical optimization method has been used, which outputs tilable shapes similar to a given figure, with less user effort. However, it has high computational cost since the upper solver is based on simple genetic algorithm (GA). Therefore, the proposed method in this paper improves on the hierarchical optimization method by replacing the simple GA used in the upper layer with Estimation of Distribution Algorithm. Experimental results show that the proposed method can generate tilable shapes faster than the previous hierarchical method.

GS10-3 Solution to an irregular strip packing problem by hierarchical genetic algorithm

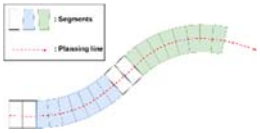
Tomoya Inoue and Shudai Ishikawa
(National Institute of Technology, Oita College, Japan)

The irregular strip packing problem has been studied for a long time in the field of geometry and combinational optimization, and it has been applied to determining the arrangement of patterns in the processing industry. In many of studies that relate to the packing problem, the rotation or fixed the rotation angle not considered. Therefore, the solution space is small and it is not difficult to find the solution. We focus on the irregular strip packing problem with free rotation. In this paper, we propose the new evaluation criteria in the hierarchical genetic algorithm. In the hierarchical genetic algorithm, many small solutions determine in the lower layer, and in the upper layer, the solution of the problem determine by combined the small solutions. Therefore, the evaluation criteria have to be designed properly and severely for finding a good solution because the evaluation process performed plural times. We improved the previous evaluation criteria and propose the new criteria based on the vector direction of the object. From the simulation results, we found that a good solution is obtained compared with the previous evaluation criteria.

January 24 (Thursday), 09:15–10:45

GS10-4 A GA Based Approach for Segment Assignment to Reduce Excavated Soil in Shield Tunneling

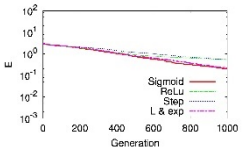
Koya Ihara and Shohei Kato
(Nagoya Institute of Technology, Japan)



Shield tunneling is a tunnel construction method used around the globe. In the planning process of the shield tunneling, segments of the tunnel are assigned along to the predetermined curve called the planning line. Each gap between the segments and the planning line must be less than a tolerance, and it is assumed that reducing the amount of soil excavated along to the segments improve productivity. In this paper, the authors addressed the segment assignment as a constrained combinatorial optimization problem, and proposed ε constrained discrete genetic algorithm (εDGA), which combined discrete genetic algorithms with a constraint handling method called the ε constrained method, for the problem. The experimental results show that the proposed method have a potential to find the segment assignment reducing the amount of excavated soil as compared to the conventional method (skilled engineer) while keeping the all gaps falling within the tolerance.

GS10-5 Training of Convolution Neural Network by Genetic Algorithms for Road Map Image Recognition

Betere Job Isaac, Hiroshi Kinjo, Kunihiko Nakazono, and Naoki Oshiro
(University of the Ryukyus, Japan)



This article presents a study on the training of convolution neural network performance by genetic algorithms (GA) for road map image recognition. Genetic algorithm has been considered globally as one of the robust search optimization methods in machine learning and artificial intelligent systems. Recently in 2D image recognition, convolution neural network (CNN) is well used where ReLU activity function is mostly applied with back-propagation (BP) for signal processing and image recognition because Sigmoid function has a gradient disappearance problem. However Sigmoid function is good for 3 layered neural network but degrades for multi-layer neural networks especially in back-propagation training. In this study, we also aim at the training performance of an activity function with CNN by GA especially when the intermediate convolution layers are used. We have tried to apply and check the degree of accuracy for road map image recognition with convolution neural networks for automatic driving application using genetic algorithms training method. Key Words: Convolution neural network training, genetic algorithms, multi-layer neural networks, road map image recognition and artificial intelligent systems.

GS10-6 An improved social-spider optimization algorithm for tracking peak in dynamic environments

Ryo Takano and Keiki Takadama
(The University of Electro-Communications, Japan)

This paper focuses on social-spider optimization (SSO) algorithm in dynamic optimization problems (DOPs), and proposes the two improvements for SSO in DOPs. The one improvement is that individual can search with jumping over the current best individual. On the other hand, another improvement is to spread the part of the population in order to search more the large space. To investigate the tracking ability to dynamic change of SSO, this paper compares the improved algorithm to three cases of dynamic change. The experimental results revealed that the following implications: (1) SSO can adapt only with small dynamic changes; (2) the improvements of SSO has high tracking performance against the dynamic change of continuity.

January 24 (Thursday), 09:15–10:30

Room C

OS7 Intuitive Human-System Interaction

Chair: Masao Yokota (Fukuoka Institute of Technology, Japan)

OS7-1 Proposal of a Furniture Layout Simulation System using Mixed Reality Technology

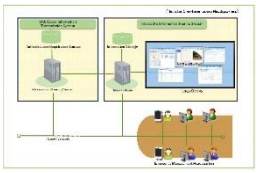
Yangzhicheng Lu[1], Tomoyuki Ishida[2], and Hiromasa Habuchi[1]
([1]Ibaraki University, Japan)
([2]Fukuoka Institute of Technology, Japan)

The recent advance in virtual reality technology and augmented reality technology, many simulation systems using these technologies have been developed in the field of interior design. However, the system using augmented reality technology has the inconsistency problem of shielding relation between the virtual object displayed superimposed and the real object. In addition, the system using virtual reality technology require the creation of virtual space beforehand, and it is difficult to customize by users. In this research, we propose a furniture layout simulation system using mixed reality technology with high reality.

OS7-2 Proposal of a Scalable Interactive Visualization Environment using Large Display in Emergency

Ryo Nakai[1], Tatsuya Ohyanagi[1], Tomoyuki Ishida[2], and Hiromasa Habuch[1]
([1]Ibaraki University, Japan)
([2]Fukuoka Institute of Technology, Japan)

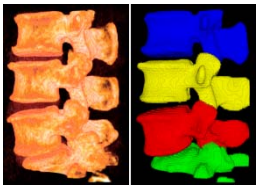
In this paper, we proposed a scalable interactive visualization environment to support information sharing and decision making in emergency at the emergency management headquarters using large display. This interactive information sharing system consists of an interactive information sharing system and a web-based information transmission system. The interactive information sharing system visualizes various disaster information and evacuation centre information shared at the emergency management headquarters on the large display. And, the web-based information transmission system transmits information from a smart phone, tablet, PC to the interactive information sharing system through the web browser.



OS7-3 Development of automatic bone extraction tool from CT images using deep neural network

Shoto Sekimura[1], Toru Kato[1], Hiroki Takahashi[1], Akio Doi[1], Taro Mawatari[2], and Taku Sugawara[3]
([1]Iwate Prefectural University, Japan)
([2]Hamanomachi Hospital, Japan)
([3]Research Institute for Brain and Blood Vessels-Akita, Japan)

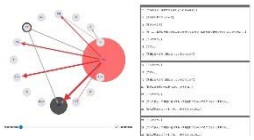
Hip surgery has been increasing year by year, with more than 70,000 artificial hip replacement surgery in 2015. In hip surgery, accurate extraction of the pelvis and femoral region is required from the hip CT image in order to prepare a preoperative plan for each patient. In spinal diseases, spondylolysis, vertebral fracture, etc. are involved, and even in these preoperative planning, bone region extraction is necessary. Therefore, we have developed an automatic bone extraction tool from CT images using deep neural network. We have utilized semantic and instant segmentation for extracting the pelvis and femur, with deep learnig.



January 24 (Thursday), 09:15–10:30

OS7-4 A consideration on visual analytics of cognitive rectifying with conversation documents in psychological counseling

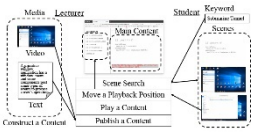
Yasuo Ebara[1], Tomoya Uetsuji[1], Minoru Kamata[2], and Koji Koyamada[1]
([1]Kyoto University, Japan)
([2]Kurokawa Clinic, Japan)



In psychological counseling, the client's cognitive rectifying is progressing, when the percentage of the behavior about the client oneself increase than the behavior of others to the client in the client's utterances. To understand the progression of the client's cognitive rectifying, the counselors often make confirmations through the verbatim record of the conversation documents in the counseling. However, as the counseling by the same client and counselor is usually conducted multiple times, Amount of the verbatim record become enormous. Therefore, it is difficult to understand how cognitive rectifying are progressing by referring all verbatim record. In this paper, we proposed the prototype system for visual analytics with the human relationship chart with directed graphs based on the conversation documents in psychological counseling to understand intuitively the degree of the client's cognitive rectifying.

OS7-5 Some improvements of lecture video content for introducing a beginner programmer to Java programing language

Kaoru Sugita, Satosi Ito, Yusi Machidori, and Ko Takayama
(Fukuoka Institute of Technology, Japan)



In Japanese educational fields, a self-instruction is an important issue so that many students spend short time at a homework. Many educational institutions introduce an information technology to advance learning environments and increase a time on self-instruction. However, these studies are not focused on student abilities and learning histories according to differences in course of self-instruction. Considering this fact, we have introduced a multimedia switching system to e-Learning contents focused on differences in professional knowledge to improve student's understanding and increase a time on self-instruction. In this paper, we discuss some improvements of lecture video content for introducing a beginner to Java programing language.

January 24 (Thursday), 09:15–10:30

Room D

OS10 Robot Control and Signal Processing 1

Chair: Masahiro Yokomichi (University of Miyazaki, Japan)
Co-Chair: Nobuya Takahashi (University of Miyazaki, Japan)

OS10-1 UAV operation support system using GIS and virtual environment

Yoshihiko Harada, Nobuya Takahashi, Masahiro Yokomichi, and Osamu Sato
(University of Miyazaki, Japan)

In recent years, multicopter type UAV has spread rapidly and it is used not only for hobby purposes but also been used for practical purposes, such as logistics and observation. Because, multicopter type UAV become more sophisticated with the reduction in size and weight of sensors and computers, and the price has decreased. Especially, it is remarkably widespread in the field of surveying. Traditionally, triangulation with total station and image based methods with pole camera or radio control helicopter is mainstream. To solve these problems, we propose a system that create a route that avoiding restricted areas, and provides users it with information such as prohibited airspace. In addition, it can be monitored a flying UAV and the surroundings from viewpoint according to the flight state. GIS is a system for utilizing geographical information such as topography, buildings, altitude, vegetation, densely populated areas, etc. These data are provided by various organizations. In this study, we utilized data provided by various organizations including the Geospatial Information Authority of Japan such as digital elevation model, data of airspace around airports, data of densely inhabited districts etc. for build virtual environment. …

January 24 (Thursday), 09:15–10:30

OS10-2 A study of biological signal analysis using CNMF

Nobuya Takahashi, Kazufumi Kai, and Hiroki Tamura
(University of Miyazaki, Japan)

In this paper, we propose an analysis method for the biological signal by using NMF that is a popular method in the field of sound processing. NMF is a clustering algorithm based on the frequent pattern in data. This method is used for an extraction of features or recommender system. Convolutive NMF is an extension of the conventional NMF. By performing convolution processing iteration, it is able to extract a periodic frequent pattern in the time series data. The purpose of this study is to analyze a spectrogram of the biological signal by using CNMF, and to extract significant information regarding the state of the subject. The signal is processed offline. Since this method is an unsupervised machine learning algorithm, it does not require the information of the target signal, in advance.

OS10-3 Development of Flapping Glider Drone

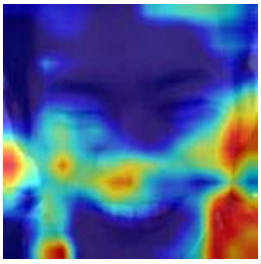
Yasunobu Hitaka and Hideo Yamada
(National Institute of Technology, Kitakyushu College, Japan)

The flapping glider drone (FGD) which achieves low energy flight and high maneuverability has been proposed by us as a new type of unmanned aerial vehicle (UAV). The difference with previous bionic birds is that our FGD is designed in priority to the performance of gliding flight. Therefore, the frontal projected area is designed to be small as far as possible in order to reduce the wind drag. Also, the silhouette of it isn't restricted to the birds, it imitates glider in order to improve the stability of gliding flight. Already, we decided the design concept of the FGD and several main components were designed. In this paper, it is described about the development of the FGD based on our design concept. Moreover, redesign of the FGD and implementation of flight motions; feathering and bending motions of the main wings are described.

OS10-4 Emotion Classification from Smile Images Using Machine Learning

Wataru Murozono, Masahiro Yokomichi, Osamu Sato, and Nobuya Takahashi
(University of Miyazaki, Japan)

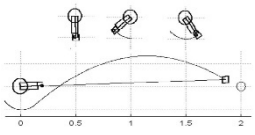
In this work, we focused on the expression of smile showing emotions such as happiness, and classified by learning smile image in machine learning whether that smile is genuine or fake. As a result, we succeeded in classifying genuine smile and fake smile with high accuracy. In addition, we further visualized classification elements using Grad-CAM, which is a visualization method of deep learning model, and tried to elucidate classification elements. As a result, it was found that the learning model used in this study is the area of attention in the site where attention is paid in the existing theory. This result suggests that the machine can estimate genuine emotion hidden in expression.



OS10-5 Speed control of object at release by casting manipulator

Asaji Sato[1], Osamu Sato[2], Masanori Matsuno[2], Nobuya Takahashi[2], and Masahiro Yokomichi[2]
([1]National Institute of Technology, Miyakonojo College, Japan)
([2]University of Miyazaki, Japan)

Conventionally, in order to expand the working space of a manipulator, there is a research example in which a casting manipulator including a flexible string in a link mechanism has been developed. In the case, when using a small motor driven system, energy can be stored and thrown by several swing motions. For improving work efficiency, we think that it is preferable to throw with one swing, not multiple swings. In this research, the behavior of the under-throw is considered from two viewpoints. The first is the motion from the work start to the acceleration start posture and the second is the motion from the acceleration start to the release posture. In each motions, the optimum trajectory with the driving source consumption energy as the evaluation amount is obtained by iterative dynamic programming method. And, we verify its effectiveness by basic experiment. In each motions, the optimum trajectory with the driving source consumption energy as the evaluation amount is obtained by IDP. …



January 24 (Thursday), 09:15–10:45

Room E

OS12 Robotics with Intelligence and/or Informatics 1

Chair: Mamoru Minami (Okayama University, Japan)
Co-Chair: Tetsuya Kinugasa (Okayama University of Science, Japan)

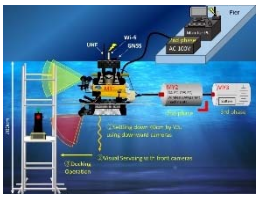
OS12-1 Stereo-vision visibility analyses in relation with turbidity and distance for AUV recharge docking

Horng-Yi Hsu[1], Naoki Mukada[1], Daiki Yamada[1], Khin Nwe Lwin[2], Myo Myint[3], Yuichiro Toda[1], Takayuki Matsuno[1], Keigo Watanabe[1], and Mamoru Minami[1]
([1]Okayama University, Japan)
([2]University of Technology, Myanmar)
([3]Thanlyin Technological University, Myanmar)

Aiming at developing underwater battery recharging system, the authors developed a docking system using stereo-vision based visual servoing and a 3D marker. Real-time relative pose (position and orientation) estimation was implemented by utilizing the 3D model-based matching method and Real-time Multi-step Genetic Algorithm (RM-GA). Given the situation that the docking aims for battery recharging in the deep-sea bottom, the pitch-dark and turbid environment should be considered as an inevitable condition for battery recharging. The main objective of this study is to analyze the visibility space of the proposed system for the docking application by using the 3D marker. The experimental results have confirmed the effective recognition extent in a parameter space of distance between the 3D marker and the AUV, and turbidity level.

OS12-2 Guidance Control and Docking of Remote Operated Vehicles

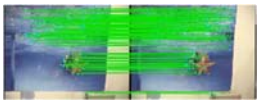
Xiang Li, Yuichirou Toda, and Mamoru Minami
(Okayama University, Japan)



Today, many robots are being researched and developed for various underwater tasks such as seabed exploration. Currently, our research group is working on the development of an automatic charging system based on visual servo technology for the underwater robot which can perform various tasks such as automatic management of marine ranch, sea bottom search. However, the measure of sailing to the working area and returning to the charging equipment have not been completed yet. In this paper, an automatic underwater simulation charging system for realizing the automatic control of the underwater robot will be proposed. The system is using GPS measurement and guidance control method. And the usefulness of this automatic guidance system will be discussed by a repetition accuracy experiment and a guidance control experiment using a mobile robot. Finally, the result of the newest simulated charging experiment in the actual sea of Okayama will be reported.

OS12-3 Adaptive Evolution Strategy SAmple Consensus for 3D reconstruction from two cameras

Yuichiro Toda, Hsu Horng Yz, Takayuki Matsuno, and Mamoru Minami
(Okayama University, Japan)

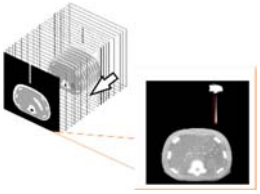


RANdom SAmple Consensus (RANSAC) has been applied to many 3D image processing problems such as homography matrix estimation problems and shape detection from 3D point clouds, and is one of the most popular robust estimator methods. However, RANSAC has a problem related to the trade-off between computational cost and stability of search because RANSAC is based on random sampling. In our previous work, we proposed Adaptive Evolution Strategy SAmple Consensus (A-ESSAC) as a new robust estimator, and we applied ESSAC to the homography matrix estimation for 3D SLAM using RGB-D camera. A-ESSAC is based on Evolution Strategy in order to maintain the genetic diversity. Furthermore, ESSAC has two heuristic searches. One is a search range control for reducing the computational cost of RANSAC. The other is adaptive/self-adaptive mutation for changing the search strategy of A-ESSAC according to the …

January 24 (Thursday), 09:15–10:45

OS12-4 Needle Angle Offset Compensation Based on Volume CT Image for Needle Puncture Robot

Takayuki Matsuno, Tetsushi Kamegawa, Takao Hiraki, Yuichiro Toda, and Mamoru Minami
(Okayama University, Japan)



A medical procedure called Interventional Radiology (IR) gains a lot of attention. Only a needle is inserted into a body of the patient while a doctor observes fluoroscopic image of the body and the needle. Therefore this surgical method is a low invasiveness method. In this surgery, computed tomography (CT) equipment is used, so the doctor is exposed to strong radiation from CT. Thus, we have developed a remote-controlled surgery support robot called "Zerobot", so as to reduce radiation exposure of doctors. Because Zerobot, which has four passive wheels for translation, is placed in front of CT equipment by humans, accurate perpendicularity cannot be guaranteed. Then, perpendicularity between the needle and CT scan plane is required so as to observe whole configuration of the needle on fluoroscopic CT images. Thus, angle offset of the needle, which is held by end-effector of Zerobot, should be compensated. Currently, angle offsets of the needle are measured with visual comparison of CT image by a medical engineer. It is hard for the medical engineer to measure the critically small angle of the needle on the display. In this paper, a method to measure needle angle is proposed. Finally the effectiveness of proposed methods is confirmed through an experiment.

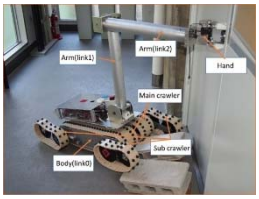
OS12-5 Manipulator controller using the grid-like space with visual obstacle avoidance

Takeshi Ikeda[1], Yoshiki Hirao[2], Fusaomi Nagata[1], and Seiji Furuno[3]
([1]Sanyo-Onoda City University, Japan)
([2]Oita Canon Inc., Japan)
([3]National Institute of Technology, Kitakyushu College, Japan)

Many remote-control robots have been developed. And they are hoped to work in extreme environmental conditions such as rescue. These robots required complicate movement and precise works. Almost remote controller are often discussed for the position control on the end effector under camera images. However, it is difficult to control a robot arm using limited information in the monitor, as it is difficult for personnel to perform sensitive work while controlling a robot with the limited view information. This results in high stress for the driver and can cause operational mistakes. Therefore, it is important to use robot easily under a limited view. In this report, we propose a simplification method for a beginner user. We present a computed support system to control the robot arm easily with increased sensitivity, combined with grid-like space and visual information. We present that the proposed grid-like space controller with visual support system and obstacle avoidance support system are useful.

OS12-6 Determination of optimal postures of sub crawlers and mounted manipulators for improvements of hands performances of search type rescue robots with GA

Kouta Minami and Masatoshi Hatano
(Nihon University, Japan)



In this research, we aim to propose a posture control method of a search type rescue robot for door opening work in rescue robot. There are cases that it is necessary to go beyond the doors with opens of them. However, at the disaster site, it is not always possible to open the door in a well-prepared state, such as a flat plane and so on. In this paper, we propose a determination method of optimal postures with the GA in order to that the robot hand generates maximum power to open doors.

January 24 (Thursday), 12:00–13:00

Room H

Poster Session

PS1 Exploring the adoption intentions on artificial applications

Shiu-Wan Hung and Min-Jhih Cheng
(National Central University, Taiwan)

One of artificial applications is the mobile application. A mobile application is a computer program designed to run on smart phones or other mobile devices. It is estimated that 76.9 billion mobile applications have been downloaded worldwide to date, giving a total value of 35 billion US dollars. Applications have a variety of functions that meet different demands for users in their daily lives. Among the research of consumer's usage intention regarding new IT products, there is a great deal of scholarly research that applies the theory of decomposed TPB. This study uses DTPB to understand all the antecedents of the attitude, subjective norm, and perceived behavioral control, and how they affect the user's behavioral intention to download mobile applications. We collected 320 valid questionnaires through Google Doc, and used a structural equation model to conduct the empirical study. This study finds that network externalities affect user intention and behavior toward downloading mobile applications in an indirect way.

PS2 Study on hardware development of edge computer for IoT platform

Ryo Katai and Kazuya Okamoto
(National Institute of Technology, Wakayama College, Japan)

In recent years, IoT attracted a lot of attention and has been studied and utilized in all fields. Especially the digitization of industries is progressing. It is trying to acquire the data of the production facility and to improve the efficiency of production etc. However, existing old facilities do not have the function of collecting data. Therefore, in this research we develop hardware for data collection. In order to freely change the amount of collected data, the hardware functions as a module. The amount of data collection can be increased by connecting a plurality of hardware wirelessly. The hardware exchanges data by TWELITE which is a wireless module. Data gathered in the parent machine is saved in CSV format and aims to be able to browse with services on the web.

PS3 Development of full color LED control circuit using FPGA

Nakahara Mutsuki and Kazuya Okamoto
(National Institute of Technology, Wakayama College, Japan)

RGB led can be full color emission using PWM control, and these are able to use as LED tape or LED display by linking them. However, to connect a large amount of RGB LEDs and control them in full color, a large amount of PWM controller is needed, and control of high speeds pulse under 1[μs] is required. In general, often used Microcomputer which is easy for control operation to control LED, but it cannot realize stable operation under 1[μs]. So, by designing a dedicated control circuit of RGB LED in FPGA to realize stable operation under 1[μs], and we develop RGB LED display.

January 24 (Thursday), 12:00–13:00

PS4 A study on heartbeat detection system for watching over

Naruhide Takayanagi and Kazuya Okamoto
(National Institute of Technology, Wakayama College, Japan)

Currently, there are problems of lonely death of the elderly due to nuclear families, mainly in England, America and France. In order to cope with this problem, attention has been paid in recent years, it is a watching system that can monitor health conditions daily and find abnormalities. In this study, we focused attention on the heart rate from the index showing the health condition of the subject. Generally, wearable type sensors are used for heart rate measurement, but when everyday measurements are taken, the subjects feel stressed. In this study, we measure the heart rate during sleeping using a microwave Doppler sensor without contact. Many of the previous studies have arranged sensors at short distances such as 5-100 cm. However, since this study assumes sleeping, set the distance from the subject to 1.5 - 2 m so as to hang the sensor from the top of the bed and not to hit the sensor even if the target rises up Measurement shall be performed.

PS5 Power supply and Communication system Using laser

Satoshi Takemoto and Kazuya Okamoto
(National Institute of Technology, Wakayama College, Japan)

Visible light communication is a type of wireless communication using electromagnetic waves in the visible light band visible to the human eye. Since radio wave interference does not occur, it does not affect precision equipment, and practical application is being promoted in recent years because lighting infrastructure for lighting can be used as a transmitter. In this research, we propose a system which can perform power supply together with communication using this visible light communication, and consider devices operating only with electric power supplied by this system. The effectiveness of this system was confirmed within a very limited range by experiments.

PS6 A study on gesture recognition using non-contact sensor

Sho Inada and Kazuya Okamoto
(National Institute of Technology, Wakayama College, Japan)

In recent years, the lives of people are becoming intelligent. Accordingly, there is an increasing expectation for gesture recognition capable of remotely and intuitively operating electronic devices. The goal of this research is to distinguish between linear gesture and circular gesture using a contactless optical sensor. It is difficult to distinguish optically linear gestures from circle gestures. The reason is that in order to draw an approximate curve using the least squares method, it is necessary to give the model to the computer in advance. With this research, gesture recognition using a non-contact type sensor can more intuitively operate electronic equipment.

PS7 Study on tactile sensation module using vibration actuator

Takeru Kita and Kazuya Okamoto
(National Institute of Technology, Wakayama College, Japan)

It is very difficult to share feelings with others. I do not know it only by the perception that I have something and see from others. In recent years, however, researches on pseudo-perceived modules using haptic devices have been greatly developed. Sensory sharing will allow you to experience what you could not experience before. For example, experiential VR, games, movies, etc. can be mentioned. Transmission of sensation like this is considered to be useful widely in tools such as simulation and communication. In this research, we will verify the usefulness of this research by making a pseudo feeling by using vibration actuator and stereophonic technique.

January 24 (Thursday), 12:00–13:00

PS8 A Methodology for Evaluating the Collision Risk on the Route near the Shoreline for Safe Navigation of an Unmanned Surface Vehicle

Chanwoo Yu and Jangmyung Lee
(Pusan National University, Republic of Korea)

This paper presents a new methodology for evaluating the collision risk on the route of an USV. We provide a method of determining whether a ship passing through a particular route can safely avoid a suddenly encountered obstacle. The simulation results show that there may be a risk of collision on the optimal path. Further research is needed to find routes that can avoid collisions without too much deviating from the optimal path.

PS9 Development of bidirectional communications using ultrasonic waves

Yudai Tsuchiya and Kazuya Okamoto
(National Institute of Technology, Wakayama College, Japan)

In recent years, what is required as a substitute for radio waves in a space where radio waves can't be communicated, such as in a nuclear power plant. Ultrasonic waves, visible light, invisible light, and the like can be cited as the wireless communication without radio waves. Among them, the development and research of applications relating to communication using ultrasonic waves are currently being actively carried out in particular. However, ultrasonic communication does not have standards that exist in radio communication until now. In this research, we aim to develop a one - to - two - way bidirectional communication method using ultrasonic and communication standards.

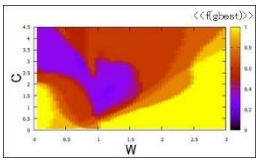
PS10 A study on power superposition isolation amplifier by 1 transformer system

Shouya Ikeda and Kazuya Okamoto
(National Institute of Technology, Wakayama College, Japan)

Isolation amplifiers have three applications of detection of different reference potential signals, prevention of the introduction of common mode noise, and securing of safety, and play an important role in the field of FA, power generation equipment, and the like. In this research, we aim to make it better from the viewpoint of price, size and reliability than conventional isolation amp. The isolation amplifier communicates between the input section circuit and the output section circuit with a signal transformer and a power supply transformer. Therefore, by superimposing power, it is possible to realize power transmission and signal transmission with one transformer. This method eliminates the need for a communication isolating device, and can realize the object of this research.

PS11 Hybrid model of linked and unlinked random PSO models

Makiko Izumi and Toshiya Iwai
(Nihon University, Japan)



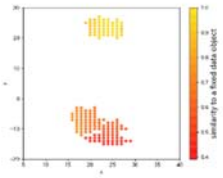
The unlinked random PSO model represented by the construction method shows the velocity anisotropy of the particle caused by the implementation method of random multiplicative parameters. On the other hand, another implementation method, the linked random method, is known to reduce the velocity anisotropy. First, we numerically analyze the parameter dependence of both the linked and unlinked random PSO models and find that the linked random PSO model shows the high global search ability. Thus, the hybrid model of the linked and unlinked random PSO models is proposed by use of our numerical analysis of parameter dependence for both models. As a result, the hybrid model has the high search ability for both sigmoidal and multimodal functions, especially rotated functions. Therefore, it is found that the local search ability and the global search ability are well balanced in the hybrid model.

January 24 (Thursday), 12:00–13:00

PS12 Topology preservation in discrete data swarm clustering

Koutaro Yoshida and Toshiya Iwai
(Nihon University, Japan)

The self-organizing map (SOM) is a useful algorithm for data clustering. Especially, the topology of data items in the high-dimensional feature vector space is preserved in the low-dimensional map space. The data swarm clustering (DSC) model is also a useful algorithm for data clustering and quickly forms clusters with few mistakes. However, it is difficult to evaluate the ability of the topology preservation for the DSC model, because data points clustered by the DSC model converge on almost a point. Thus, the discrete DSC model is proposed by extending the DSC model. As a result, it is found that the discrete DSC model has the ability to preserve the topology of data items in the projection to the map space, although it is not complete.



PS13 Robust Torque Control Algorithm of Induction Motor using MRAC

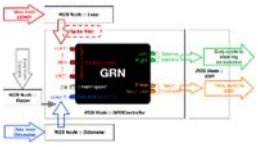
Jeongyun Cheong
(Polytech College, Republic of Korea)

The method of controlling the motor by applying the vector control algorithm of the induction motor does not continuously estimate the rotor time constant(Tr) sensitive to the temperature change. The vector control of the induction motor is because the rotor and stator of the motor in the narrow casting are gradually influenced by the temperature and change the torque characteristics. In order to prevent the deterioration of the vector control performance, it is necessary to control the torque control algorithm, which continuously estimates the rotor time constant(Tr) among the various energies of the motor. In this paper, we discuss the need for robust torque control algorithms for induction motors. Using the Model Reference Adaptive Control(MRAC) that continuously estimates the rotor time constant(Tr) enables robust torque control and improves output torque characteristics that change with time.

PS14 From virtual car to cognitive physical robot: a simple transposition of a Gene Regulatory Network based controller

Stéphane Sanchez[1], Sylvain Cussat-Blanc[1], Jean Disset[1], Yves Duthen[1], and Marc Yvon[2]
([1]University of Toulouse - IRIT - CNRS - UMR5505, France)
([2]IBM Europe, Human Centric Innovation Center, France)

Transferring learned behaviors from simulated environments to real robotics systems is still a challenge. In this paper, we present a solution in which a gene regulatory network (GRN) drives both a virtual and a physical robot. We firstly show how well a GRN-based controller, evolved to drive a simulated racing car in a video game, can be transferred, with minor adjust-ments, in a physical robot without further adaptation nor learning. We then connect this robot to a Visual Recognition service and perform a simple stop and go experience based on post sign detection and alteration of GRN inputs.



January 24 (Thursday), 12:00–13:00

PS15 A parametric study of short-term heart rate variability analysis for mental stress estimation

Kousuke Ono and Nan Bu
(National Institute of Technology, Kumamoto College, Japan)

Short-term heart rate variability (HRV) analysis methods have been proposed in order to improve the time resolution of stress evaluation. This paper conducts a parametric study to verify estimation performance of ten evaluation indices. Stress estimation is achieved with a sliding window with two parameters, i.e. the window length and the overlap. Mental stress experiments were used to collect HRV data for relaxation and mental stressed situations of twelve healthy subjects. Two traditional time domain measures, i.e., the mean R-R interval and the root mean square of successive differences between normal heartbeats (RMSSD), are used for evaluation. On the other hand, eight stress metrics based Poincare plot of HRV are investigated. Based on the experimental results, it has been found that variation can be recognized in all ten stress evaluation indices. In addition, comparisons between every two conjunctive test sessions (relaxation and stress) have been investigated with significant difference of t-test. It has been found that for very short-term HRV data (e.g. 20 s) the traditional time domain indices show better results. When the windows length increases, part of the Poincare indices outperforms the time domain indices.

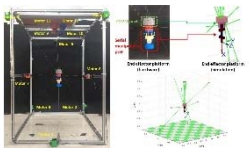
PS16 Towards continuous mental stress estimation in driving a powered wheelchair

Ryo Nishiyama, Nan Bu, and Hirofumi Ohtsuka
(National Institute of Technology, Kumamoto College, Japan)

This paper aims to achieve stress evaluation of a user when he/she is riding on a powered wheelchair. The level of stress (especially mental one) is considered relating to riding comfort and this information is important for wheelchair design and control system development. During wheelchair riding, however, a stress-inducing episode may be temporary and changes dynamically. Traditional heart rate variability (HRV) analysis methods are not appropriate for such cases. A short-term HRV analysis based on Poincare plot and a distance index is applied in this study. In addition, higher time resolution is realized using a sliding window method. Wheelchair riding experiments were conducted with different conditions and electrocardiography (ECG) data were acquired. From the experimental results, stress estimation can be made even with 5 s resolution. In addition, comparison of stress levels between different conditions has been used to verify the proposed method.

PS17 Introduction to Hybrid type cable-driven parallel manipulator system

Seockki Lee, Hyunseok Shin, Sunhyuk Back, and Hyunhwan Jeong
(Korea university, Republic of Korea)



In this paper, we introduce a new hybrid cable-driven parallel manipulator system that combines a serial manipulator and a parallel manipulator. The proposed system has all the advantages of a serial and parallel cable drive manipulator system. Therefore, the proposed system has a wide range of directional(orientation) ranges as well as a wide range of positional movements. The design and modeling of the proposed hybrid type cable-driven manipulation system are presented. We verify the validity and feasibility of the proposed hybrid system through the numerical simulations and a simple experimentation using a prototype system.

January 24 (Thursday), 12:00–13:00

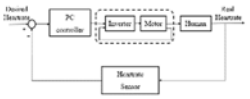
PS18 Applicability of Programmed Artificial Insemination (pAI) for evaluating Japanese Cattle Production using Bayesian Network Model (BNM)

Takuya Yoshihara[1], Iqbal Ahmed[2], Osamu Fukuda[1], Hiroshi Okumura[1], Kenji Endo[3], Naoki Takenouchi[4], Hideo Matsuda[5], Tadayuki Yamanouchi[5], Junki Egashira[6], and Kenichi Yamashita[7]
([1]Saga University, Japan) ([2]University of Chittagong, Bangladesh)
([3]Morinaga rakunou Co., Ltd., Japan) ([4]NARO, Japan)
([5]NLBC, Japan) ([6]Saga Livestock Research Laboratory, Japan)
([7]AIST, Japan)

Recently, the conception rate of Japanese cattle has declined although livestock farmers and veterinarians tries to use the artificial insemination regularly. The main reasons for declining conception rate are the poor evaluation of the productivity of cattle and overlook their estrus signs on time. To address these issues, the breeders execute the Programmed artificial insemination (pAI). However, applying pAI to all the cattle need huge labor and cost. Therefore, the research tries to estimate the applicability of pAI based on the analysis of various indexes from cattle using Bayesian Network Model (BNM). The proposed method can select the cattle that is applicable for pAI. Additionally, several models are created from the different number of measured indexes. Finally, the paper revealed that the applicability of pAI can be evaluated even though the number of measured indices are very few.

PS19 Robust control simulation of heart rate for cardiac rehabilitation using treadmill exercise

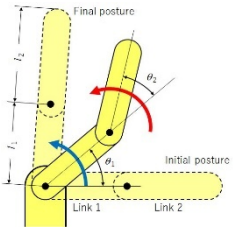
Hyun Hee Kim and Min Cheol Lee
(Pusan National University, Republic of Korea)



Cardiac rehabilitation with treadmill is widely used in heart disease medical centers in developed countries including Korea because it significantly reduces the prevalence of heart disease and that is effective in treating mild and severe patients. For the automation of cardiac rehabilitation exercise, dynamic model of patient heart rate according to treadmill speed has been proposed several times in developed countries where heart rehabilitation studies are active. The heart rate model of the human body differs from person to person because it is greatly influenced by various factors such as age, weight, health condition, and heart disease severity. However, existing studies on human heart rate modeling do not reflect these individual differences. In this paper, we introduce a method of estimating the heart rate model by using only the exercise that can be easily performed before the treadmill cardiac rehabilitation by using the signal compression meth-od. In the experiment, the heart rate model was estimated as a 2-order transfer function closest to the equivalent impulse response. Based on the estimated model, we simulated in MATLAB using sliding mode control (SMCSPO), which is a robust controller for system nonlinearity, parameter uncertainty and disturbance.

PS20 Trajectory Planning of Saving Energy for Robot using the Genetic Algorithm with Assistant Chromosomes

Yoshio Yokose
(National Institute of Technology, Kure College, Japan)



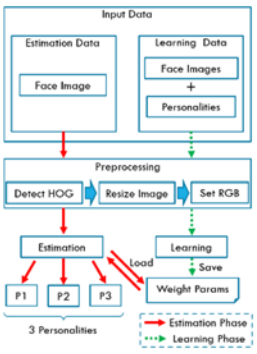
Energy saving trajectory planning is one of the fundamental fossil fuel and global warming problems. Many trajectories planning for robot manipulators are determined by prioritizing operational efficiencies, such as the operating time and controllability efficiencies. However, these trajectory planning might not even consider the energy consumption. The study focuses on the energy consumption problem, discussing the application of the genetic algorithm (GA) to solve the energy consumption minimization problem for a robot manipulator having nonlinear joint friction. Although the GA is a search heuristic, routinely used to generate useful solutions for the search and optimization problem, it still requires much calculation time. In this study, we propose a combination of a gradient method and the GA to achieve the best optimum solution since a gradient method can be used for early local optimum solution. A search for chromosomes is proposed for the validity of the proposed method.

January 24 (Thursday), 12:00–13:00

PS21 Estimating Personality from Face Images

Masaya Tanaka, Nguyen Hoang Son, Yu Takahata, Tetsuo Tanaka, and Kazunori Matsumoto
(Kanagawa Institute of Technology, Japan)

We in this study develop a method to automatically estimate a person's personality from his/her face image. Each person has a different personality, and the personality determines suitability and preference for various kind of things. Thus knowing a person's personality is useful in many practical areas. Personality tests based on questionnaire are common ways to determine the one's personality, which are often time consuming and troublesome works for the users. It is thus practically important to provide an automatic method for the tasks. In this study, we based on the well-known Synthetic Personality Inventory test in Japan, which is called SPI, assume a personality is defined from four different viewpoints, each of them is further subdivided into traits. A personality in SPI is defined a tuple of values of these items, and then our goal becomes to decide the tuple values for a given face image. We collect personality values for about one hundred different persons with their face images, and augment the images by about two thousands using several image augmentation methods. A machine learning method based on the neural network is applied to the augmented images with personality traits. We in this paper show the details and results of the experiments. The applicability and possibility of the method are discussed in the final chapter.



PS22 Emergence of cooperative and altruistic behavior in SOM-based agents

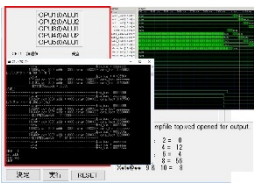
Nobuhito Manome[1, 2], Shuji Shinohara[2], Kouta Suzuki[1], Kosuke Tomonaga[1, 2], and Shunji Mitsuyoshi[2]
([1]SoftBank Robotics Corp., Japan)
([2]The University of Tokyo, Japan)

When humans perform a task in a group, they sometimes change their behavior by observing the behavior of others, in addition to the feedback of their own behavior. In this paper, we proposed an agent that autonomously changes its behavior while observing the behavior of others using a self-organizing map (SOM). In addition, a multi-agent simulation using the proposed agent was performed on a cleanup problem consisting of a chain of tasks of picking up and discarding garbage routinely carried out by humans. The results confirmed that cooperative and altruistic behavior emerged, despite the agents conducting tasks with the only purpose of discarding as much garbage as possible themselves.

PS23 A proposition of a processor system and a design method for secure IoT system without OS

Hideo Araki, Sintaro Hashimoto, and Sigeru Omatu
(Osaka Institute of Technology, Japan)

Many microcomputer systems are commonly used due to the spread of the IoT system. These IoT systems are connected to a network, record data in a server such as a cloud, and control a control device connected to a microcomputer by a command from a server. Many of the IoT systems are built for specific purposes, and few run new application programs while the system is running. Therefore, we thought that by restricting the application, it is possible to limit the essential functions of the OS or to build the system without the OS. For this purpose, we propose a processor that operates on FPGA, which is hard to analyze hardware and can customize it as necessary. In particular, we propose a new processor that can execute intermediate representation obtained from a program written in script language. Thus, it is possible to efficiently construct a microcomputer system without knowledge of hardware. In this paper, we report the microcomputer system and its design method.



January 24 (Thursday), 12:00–13:00

PS24 Case Study of Human-Robot Cooperation on Construction Sites

Seungyeol Lee and Sungwoo Chang
(DGIST, Republic of Korea)

The human-robot cooperative system can cope with various and untypical constructing environment through the real-time interacting with a human, robot and constructing environment simultaneously. The physical power of a robot system helps a human to handle heavy construction materials with relatively scaled-down load. Also, a human can feel and response the force reflected from robot end effecter acting with working environment. This paper presents the case study regarding the application of the proposed human-robot cooperation technology for construction robot through field tests on construction sites.

PS25 Study on the Eddy Current Loss Reduction of the Magnetic Gear

Sungwoo Chang and Seungyeol Lee
(DGIST, Republic of Korea)

A variety of magnetic gears have been proposed [1]. The magnetic gears have advantages such as low mechanical loss and maintenance-free operation that are not observed in mechanical gears. However, the transmission efficiency when the input rotation speed is high tends to be low due to the eddy current loss, which is dominant in the pole pieces. This paper proposes a new stator shape which can reduce the eddy current loss. The effectiveness is verified using 3-D finite element analysis.

January 24 (Thursday), 13:00–14:15

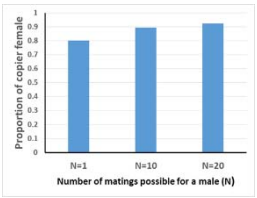
Room A

GS1 Agent-based modelling

Chair: Takayasu Fuchida (Kagoshima University, Japan)

GS1-1 A Model of Mate-Choice Copying Focusing on Mating Systems

Kosuke Ozeki, Atsuko Mutoh, Yutaro Ikai, Koichi Moriyama, and Nobuhiro Inuzuka
(Nagoya Institute of Technology, Japan)



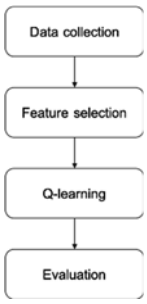
We simulated mate-choice copying (MCC) behavior using an agent-based model consisting of the imported MCC gene and female preferences as influenced by other individuals' mate choices as meme. Only those agents having the MCC gene can imitate the mate choice of other females. Imitation of mate choice implies that a female imitates the gene trait of a male who is the most popular with her preference meme in our proposed model. Experimental results revealed a relationship between the spread of the MCC genes and mating systems; a similar tendency has been observed among real animals. Furthermore, we discussed the reason why MCC behavior is not well suited to monogamous species.

January 24 (Thursday), 13:00–14:15

GS1-2 An Action and Direction Design of Q-learning for RoboCup 2D Soccer Simulation

Waranyoo Kiatjindarat and Chatklaw Jareanpon
(Mahasarakham University, Thailand)

The main objective of the RoboCup 2D soccer simulation league is the number of each team scoring. Mostly, the penalty area is usually the area for scoring in the RoboCup 2D soccer simulation, but this area is very difficult to dribble or pass the ball into. This paper proposed the long shooting using Q-learning algorithm of each agent, which uses action and direction for shooting decision. The methodology is divided into 4 processes: 1) Data collection, 2) Future selection, 3) Q- learning algorithms, and 4) Evaluation. The data set is collected from [10], which has 246 situations. It is separated into 2 sets, which are the training situation and test situation. The training situation has 196 situations and test situation has 50 situations, which both can long shoot but does not happen. The result of this paper is 28%, which increase the chance of the scoring and all shooting direct into the goal.



GS1-3 The Effects of Individual and Social Learning on the evolution in a Co-creative Fitness Landscape

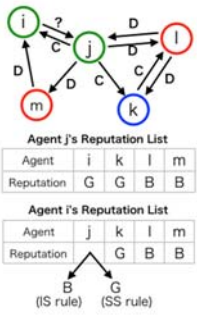
Hiroto Yonenoh, Reiji Suzuki, and Takaya Arita
(Nagoya University, Japan)

The effects of learning have been regarded as important factors of the evolutionary process of human linguistic abilities. In this study, with computer simulations, we examine the effects of individual and social learning on the evolution in a co-creative fitness landscape where both cognitive (e.g., hierarchical structures of language) and communicative (e.g., intention sharing) aspects of language abilities are essential. Our simulation results imply that collaboration between individual and social learning facilitates the adaptive evolution, which means that both individual and social learning can play roles of enhancing lifetime fitness on such a complex fitness landscape arising from co-creative communications.

GS1-4 The evolution of cooperation based both on indirect reciprocity and spatial locality in continuous space

Huanxin Chen, Reiji Suzuki, and Takaya Arita
(Nagoya University, Japan)

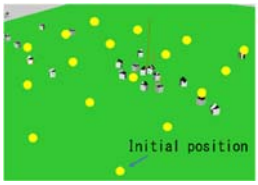
How cooperation evolves despite its disadvantage to local selfishness has been a challenging theme for many years. Indirect reciprocity and spatial locality are two of the major mechanisms having been proposed for this contradiction. However, there are only a few studies about their interaction. We considered an agent-based model in a two-dimensional continuous space where both the game-based interaction and the transmission of agents' reputation occur based on the Euclidean distance between agents. Agents have one of these three strategies as gene: Always defect, always cooperate or discriminate based on the recipient's reputation. We found that without mobility, firstly, as the spatial locality gets weaker, the cooperation rate drops. Secondly, for cooperation to evolve from an all-defector environment, the cluster of discriminators is necessary. Moreover, we added mobility to agents and found that if the movement duration is long enough, a higher cooperation rate is promoted.



January 24 (Thursday), 13:00–14:15

GS1-5 A 3D simulation framework based on body-controller coevolution of virtual creatures for investigating the origin of acoustic interactions

Ryohei Seki, Yoshiyuki Omomo, Naoaki Chiba, Reiji Suzuki, and Takaya Arita
(Nagoya University, Japan)



We discuss the origin of acoustic communication by investigating the hypothesis that acoustical communication in terrestrial animals started as noises that are contingent with breathing or gestures associated with predation or feeding. For this purpose, we design and implement an evolutionary simulation framework using ODE (Open Dynamics Engine) In the framework, sounds are inevitably generated by behaviors of virtual creatures in a 3D physically simulated environment, which are perceived by and possibly affect the other creatures. We conducted preliminary experiments to see whether the morphology and behavior of virtual creatures that make use of sounds can evolve or not in two simple conditions. We observed the emergence of virtual creatures that can find and approach a sound source, making sounds with a constant periodicity. We also observed the emergence of an aggregation behavior that make use of sounds emitted by their locomotion behavior.

January 24 (Thursday), 13:00–14:15

Room B

OS1 Biocolor imaging and its practical and clinical applications

Chair: Norimichi Tsumura (Chiba University, Japan)
Co-Chair: Masahiro Nishibori (International University of Health and Welfare, Japan)

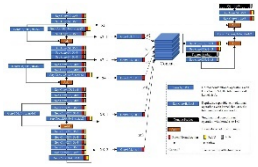
OS1-1 Invited talk: Tongue Image Analysis for Healthcare

Toshiya Nakaguchi and Takao Namiki
(Chiba University, Japan)

Tongue diagnosis is a non-invasive diagnosis and is traditionally one of the most important tools for physicians who practice Kampo (traditional Japanese) medicine. It is expected for monitoring health condition, early detection of serious diseases and preventive medicine. Therefore we have proposed a tongue imaging system named TIAS (Tongue Image Analyzing System) which quantitatively and stably records the tongue color, shape, wetness and so on. In this talk, we introduce the past researches related to tongue diagnosis using TIAS.

OS1-2 Tongue proposal network for RGB sublingual vein segmentation with multi-network augmentation

Tingxiao Yang, Yuichiro Yoshimura, Akira Morita, Takao Namiki, and Toshiya Nakaguchi
(Chiba University, Japan)



The tongue is one of the most sensitive organs of the human body. The changes in the tongue indicate the changes of the human state. One of the features of the tongue can be used to inspect the blood circulation of human is sublingual vein. In this research, the tongue-proposal network was designed to automatically segment sublingual veins for the future diagnosis. The extracted pyramid feature maps will be processed for tongue and vein segmentation. The predicted tongue segmentation result will be utilized as attention mask for vein segmentation to improve the speed of convergence and segmentation accuracy. Tongue segmentation and vein segmentation were joint-trained in one single architecture end-to-end. The raw RGB input images were taken from TIAS, which is the dedicated tongue analysis system with a spherical shell and integrated shooting camera. By using the TIAS system, the distortion from background and shooting environment will be reduced and more stable. The initially small dataset was manually annotated. To break the limit on the size of the annotated dataset, the multiple trained networks with …

January 24 (Thursday), 13:00–14:15

OS1-3 Multi-tap CMOS image sensors and multi-aperture cameras for biomedical imaging

Keiichiro Kagawa[1], Jun Tanida[2], Keita Yasutomi[1], and Shoji Kawahito[1]
([1]Shizuoka University, Japan)
([2]Osaka University, Japan)

Applications of multi-tap CMOS image sensors using lateral electric field charge modulators (LEFMs) and a compact multi-aperture camera based on a thin observation module by bound optics (TOMBO) to biomedical imaging is shown. The multi-tap CMOS image sensor is combined with synchronized illuminations to perform time division multiplexed imaging. Coded shutter is also effective to implement functional exposure. A multi-spectral camera based on TOMBO is shown.

OS1-4 Relationship analysis between sexual attractiveness and heart rate variability in observing portrait and self-introduction movie

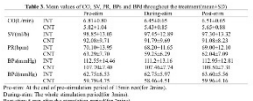
Natsuki Ikisawa[1], Ryota Mitsuhashi[1], Shoji Yamamoto[2], and Norimichi Tsumura[1]
([1]Chiba University, Japan)
([2]Tokyo Metropolitan College of Industrial Technology, Japan)

In this paper, we investigate the heart rate variability (HRV) on sexual attractiveness while the subjects are observing the portraits and self-introduction movies of opposite sex. The indicators of HRV such like Low-Frequency (LF) and High-Frequency (HF) are computed from R to R intervals of heartbeat waveform this heartbeat waveform is expected to be obtained from the slight change of skin color captured by digital camera. We also demonstrate the time-varying transition of HRV parameters induced from the contents of self-introduction movies. As the results, we found the higher evaluation score of attractiveness are proportional to the transition of LF/HF. The value of LF/HF is increased when subjects observe the high evaluated female on attractiveness.

OS1-5 The effect of different types of acupuncture manipulations on shoulder pain and cardiovascular circulation dynamics

Hongyang Li[1], Norio Tomita[1], Mako Iwahashi[2], Kanji Kawasaki[1], Akiko Shirai[2], and Keiko Ogawa[1,2]
([1]Kanazawa University, Japan)
([2]Kanazawa University Hospital, Japan)

This study is to compare the effect of Contact needle therapy (CNT) and Insert needle therapy (INT) on cardiovascular dynamics and Visual analogue scale (VAS) in patients with shoulder pain. A total of 11 patients (9 females, 2 males, average age 32.27) were recruited and divided into two groups (CNT group and INT group). The treatment was once a week and for 4 weeks. Changes of cardiovascular circulation dynamics were detected at baseline, during treatment and after treatment. Pain was assessed before and after acupuncture therapy. There was significant difference on VAS within each group. There was not significant difference between the two groups on CO, SV, BPs, BPd and VAS, and had significant difference on PR (P<0.05). PR significantly decreased in both group, the rate of decrease was significantly higher in CNT group than that in INT group.



January 24 (Thursday), 13:00–14:00

Room C

GS6 Complexity

Chair: Ken Naitoh (Waseda University, Japan)

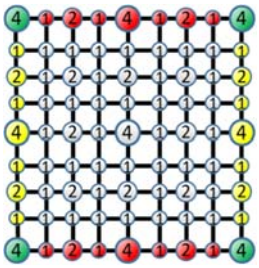
GS6-1 A Simple and Smaller-state Implementation of Generation Algorithm for Exponential Sequences on Cellular Automata

Naoki Kamikawa and Hiroshi Umeo
(Osaka Electro-Communication University, Japan)

A model of cellular automata (CA) is considered to be a well-studied non-linear model of complex systems in which an infinite one-dimensional array of finite state machines (cells) updates itself in a synchronous manner according to a uniform local rule. A sequence generation problem on the CAs has been studied and many scholars proposed real-time sequence generation algorithms for a variety of non-regular sequences such as prime, Fibonacci, and $\{2^n|n = 1, 2, 3, ... \}$ sequences etc. In this paper, we present that sequence $\{ k^n|n=1, 2, 3, ... \}$ can be generated in real-time by a k-state CA when $k \geq 3$, and give a mathematical proof of the correctness of the implementation. The algorithm improved the previous design in Kamikawa and Umeo (2018) in the number of states of the finite state automaton, considerably.

GS6-2 Characteristics of fractal cellular automata constructed from linear rules

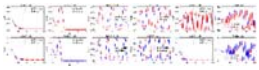
Yoshihiko Kayama
(BAIKA Women's University, Japan)



Cellular automata (CAs) have played a significant role in the study of complex systems. Recently, the recursive estimation of neighbors (REN) algorithm was proposed to extend a CA rule with a unit rule radius to rules with larger radii. This framework enables the construction of non-uniform CAs comprising cells that follow different CA rules. A non-uniform CA, referred to as fractal CA (F-CA), which comprises fractally arranged cells, inherits certain characteristics of basic CAs, including pattern replicability and time-reversibility of linear rules. In this paper, F-CAs based on linear rules, particularly the elementary CA #90 and #150, and lifelike CA B1357S1357 and B1357S02468 are investigated. Cells in the F-CAs of #90 and B1357S1357 are separated into groups by their rule radius and each group has an independent lifetime. The explicitly constructed inverse rule of F-CA of #150 is more complex than that of F-CA. A large degree of freedom to obtain time-reversible CAs can be applied to the construction of a self-contained encryption system.

GS6-3 Adversarial Imitation Learning of Bird Song Modeled with Recurrent Neural Network

Seiya Yamazaki, Hiroyuki Iizuka, and Masahito Yamamoto
(Hokkaido University, Japan)



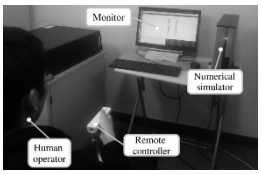
It is known that the birds that have the grammars generating complex songs are advantageous for survivability, and learn how to sing a song from each other. From these facts, we have a hypothesis that the adversarial imitation learning plays a major role in the developing complex songs and in the emergence of grammar. Previously, we modeled adversarial imitation learning using a simple feedforward neural network. The generated bird song time series are complicated gradually and evolve to chaos through the learning. However, the generated time series cannot be grammatical structures. In this paper, we expand our previous model using a recurrent neural network to use historical information that exists in the grammar. At the beginning, the generated time series converge to a fixed point, but gradually become periodic and the frequency of it increases as the progress of the learning. Finally, the generated time series evolves to like chaos.

January 24 (Thursday), 13:00–14:00

GS6-4 Dynamic stability analysis on human controller model in cooperation with human operator

Yoshikazu Yamanaka[1], Shigeki Matsumoto[2], and Katsutoshi Yoshida[1]
([1]Utsunomiya University, Japan)
([2]Intelligent Vision & Image Systems Inc, Japan)

We investigate the cooperative behavior between our previously proposed human controller model (HCM) and a human operator. In our previous study, we constructed our HCM by which the behavior of human's individual balancing control can be accurately reproduced. In this study, we examine how accurately our HCM reproduce the dynamic stability of human behavior in a cooperative balancing task performed by a pair of our HCM and a human operator. The largest Lyapunov exponents (LLEs) of their balancing errors are estimated. Then, the ratios of the LLE values for our HCM to those for the human operator are calculated. The resulting ratios are compared with those obtained by a conventional controller. This comparison indicates that the dynamic stabilities of the human operators are more accurately reproduced by our HCM than the conventional controller.



January 24 (Thursday), 13:00–14:15

Room D

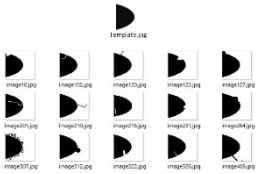
OS6 Intelligence and Robotics

Chair: Maki K. Habib (The American University in Cairo, Egypt)
Co-Chair: Fusaomi Nagata (Sanyo-Onoda City University, Japan)

OS6-1 Binary Classification Method Using Deep Convolutional Neural Network, Support Vector Machine and Template Matching Techniques

Fusaomi Nagata[1], Kenta Tokuno[1], Kazuki Mitarai[1], Akimasa Otsuka[1], Takeshi Ikeda[1], Hiroaki Ochi[1], Keigo Watanabe[2], and Maki K. Habib[3]
([1]Sanyo-Onoda City University, Japan)
([2]Okayama University, Japan)
([3]The American University in Cairo, Egypt)

In this paper, a binary classification method using convolutional neural network (CNN), support vector machine (SVM) and template matching techniques is introduced. Firstly, an application of deep CNN (DCNN) for visual inspection is developed and is trained using a large number of images to inspect undesirable defects such as crack, burr, protrusion, chipping, spot and fracture phenomena which appear in the manufacturing process of resin molded articles. Then, the trained DCNN named sssNet and well-known Alexnet are respectively incorporated with two SVMs to classify sample images with high recognition rate into accept as OK or reject as NG categories, in which compressed feature obtained from the DCNNs are used as input for the SVMs. The performance of the two types of SVMs with the DCNNs are compared and evaluated through training and classification experiments. Finally, a template matching technique is further applied to extract important target areas from original training and test images. This will be able to enhance the reliability and accuracy for binary classification.

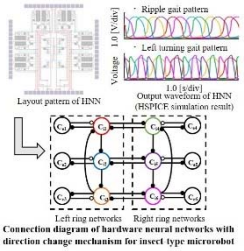


January 24 (Thursday), 13:00–14:15

OS6-2 Development of Hardware Neural Networks with Direction Change Mechanism for Insect-Type Microrobot

Masaya Ohara, Mika Kurosawa, Takuro Sasaki, Taisuke Tanaka, Satoshi Kawamura, Yuichiro Hayakawa, Daisuke Noguchi, Minami Kaneko, Fumio Uchikoba, and Ken Saito
(Nihon University, Japan)

This paper describes the hardware neural networks (HNN) which can change the direction of the insect-type microrobot. Firstly, we investigated the relationship between the oscillation period and the synaptic weight of excitatory-inhibitory neuron pair model which is the constituting of the HNN. The synaptic weight can vary by adjusting the synaptic weight controlling voltage. The oscillation period of the excitatory-inhibitory neuron pair model can change from 2.0 s to 0.5 s by varying the synaptic weight controlling voltage. Secondly, we developed the HNN which has direction change mechanism. The direction of the robot can change by switching the oscillation period as half cycle of left side legs or right side legs. As a result, the HNN can switch between ripple gait pattern, right turning gait pattern, and left turning gait pattern by switching only two synaptic weight controlling voltage.

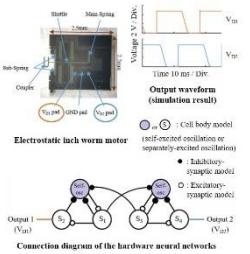


Connection diagram of hardware neural networks with direction change mechanism for insect type microrobot

OS6-3 Development of Hardware Neural Networks Generating Driving Waveform for Electrostatic Actuator

Takuro Sasaki, Mika Kurosawa, Masaya Ohara, and Ken Saito
(Nihon University, Japan)

The authors are studying to control the locomotion of the microrobot system using hardware neural networks (HNN). In previous research, a waveform generator was used to drive the electrostatic actuators of the microrobot. If the driving circuit could construct using HNN, the controlling circuit and the driving circuit could integrate into a single chip. In this paper, the authors will propose the driving circuit using HNN. The HNN consists of two self-oscillating cell body models, six separately-excited cell body models, four excitatory-synaptic models, and six inhibitory-synaptic models. The single self-oscillating cell body model outputs the electrical oscillated square waveform as 3 MHz of frequency. The proposal HNN generates a large delay without using large capacitors. As a result, the proposal HNN can generate the driving waveform of electrostatic actuators with variable frequency. The frequency of the driving waveform could vary from 50 to 100 Hz.



Connection diagram of the hardware neural networks

OS6-4 Smart Manufacturing and Intelligent Robotics: The Evolution of Industry 4.0

Maki K. Habib[1] and Fusaomi Nagata[2]
([1]The American University in Cairo, Egypt)
([2]Sanyo-Onoda City University, Japan)

Large number of elements and facilities comprising production, manufacturing and other industrial systems have been and continue to be interfaced and integrated with the Internet communication technologies and supporting by software development to lay down the steps necessary to develop smart manufacturing, smart factories and smart value chains and smart products of the future industry. This paper under the umbrella of “Smart Manufacturing and Intelligent Robotics” aims to introduce the importance, the concept and the evolution of Industry 4.0 and the history behind it. In addition, the paper highlight the key components of Industry 4.0 and the driving and enabling technologies supporting its advancements, along with its extended benefits and opportunities to the smart manufacturing and intelligent robotics. In addition, the paper discusses the requirements for successful applications in the new ear of digitization and smart manufacturing and highlights the design principles of industry 4.0 and the research challenges facing its development and concludes the future research requirements.

January 24 (Thursday), 13:00–14:15

OS6-5 Family support robot grapping daily necessities - Learn surface features of object using Growing Neural Gas -

Zepei Wu[1], Yuichiro Toda[2], and Naoyuki Kubota[1]
([1]Tokyo Metropolitan University, Japan)
([2]Okayama University, Japan)

In this paper, we propose a method to quickly grasp the shape of daily necessities and determine the best grip position by constructing the topological structure from the 3D point cloud data. We first utilize the growing neural gas, one of the unsupervised learning methods to generate a topological structure of objects through 3D point cloud data. Next, the proposed method extracts the required feature values from the generated topological structure for shape recognition and then perform hierarchical segmentation using the region growing algorithm. Finally, we apply the Principle Component Analysis (PCA) algorithm to determine the grabbing coordinates and proceed the grab operation.

January 24 (Thursday), 13:00–14:00

Room E

OS9 Machine Learning Applications to Movement Detections

Chair: Kiyota Hashimoto (Prince of Songkla University, Thailand)

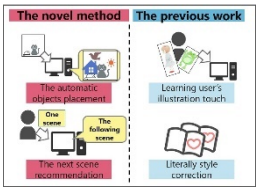
OS9-1 A segment discrete firefly algorithm for combinatorial optimization problems

Tatsuhisa Watanabe, Jordan Henrio, and Tomoharu Nakashima
(Osaka Prefecture University, Japan)

This work focuses on a Discrete Firefly Algorithm (DFA) which is a nature-inspired and swarm-based algorithm. DFA is a discrete version of its original algorithm mimicking the social behavior of fireflies. A firefly explores the solution space by being attracted to the other fireflies. The firefly of DFA represents a solution in a discrete space. Although the original firefly algorithm has been studied by several researchers as with the other metaheuristics, there is a lack of investigation of a discrete version of firefly algorithm. This paper proposes to restrict movements of fireflies. This makes fireflies explore the solution space more effectively. To verify the performance of our approach, we conduct several experiments on two vehicle routing problems.

OS9-2 The automatic objects placement for a picture book by machine learning

Saya Fujino[1], Naoki Mori[1], María Navarro Cáceres[2],
Sara Rodríguez González[2], and Juan Manuel Corchado[2]
([1]Osaka Prefecture University, Japan)
([2]BISITE Digital Innovation Hub, University of Salamanca, Spain)



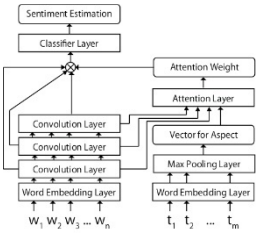
Understanding human emotion and "Kansei" is a key issue in the field of artificial intelligence and has attracted a lot of interest among the scientific community. In this work, Deep learning is used to create a picture book based on human emotions, the authors propose an intelligent system for this purpose, called Interactive digital picture book system 103K. In this study, the authors proposed a novel feature vector for the 103K system, in order to automatically place objects on the pages of a picture book. Then the author made a picture book by 103K system and showed the example pages of the picture book.

January 24 (Thursday), 13:00–14:00

OS9-3 Aspect-based Sentiment Analysis with Convolutional Neural Network

Hidekazu Yanagimoto
(Osaka Prefecture University, Japan)

Aspect-based sentiment analysis is one of sentiment analysis tasks and determines a different sentiment polarity based on aspects from the same sentence. Usual sentiment analysis determines whole sentiment polarity from a sentence or a document. In this paper, we develop an aspect-based sentiment analysis with a convolutional neural network. After applying a convolutional neural network, we can get a sequence of word vectors which denotes a sentence as a sequence of vectors. To extract a feature vector from the sequence focused on an aspect, we employ an attention mechanism in natural language processing. In experiments, we use SemEval2014 datasets to discuss the performance of the proposed method. Especially, we employ two datasets which consist of laptop computer reviews and restaurant reviews. For both of reviews, we achieved over 60% accuracy in this experiment.



OS9-4 Sentiment classification of Burmese news using variable-length n-gram words with distributive word representation similarity

Myat Lay Phyu and Kiyota Hashimoto
(Prince of Songkla University, Thailand)

The scope of the research is the languages without word boundaries in written text, specifically Burmese. The methodology consists of two proposals, a character-based variable-length n-gram word model and a word grouping method with word similarities calculated with distributive word representation models. The proposed method is compared with Conditional Random Field (CRF) baseline approach, which is also proposed newly in this thesis, and achieved almost the same result as the CRF-based word segmentation with a small size of supervised data. The proposed method is also validated with a larger size of data using Amazon product reviews. Thus, the proposed methods in this thesis provide an effective and efficient way for less resourced language processing without focusing on language specific characteristics.

January 24 (Thursday), 13:00–14:00

Room F

OS11 Robot Control and Signal Processing 2

Chair: TBA (TBA, Japan)

OS11-1 Realization of Multi-Legged Crawler Mechanism Capable of Navigation with Steady Locomotion Pose

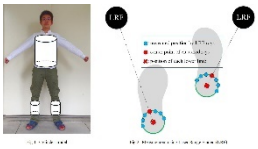
Shu Takaira and Geunho Lee
(University of Miyazaki, Japan)

This paper presents practical design and hardware implementation issues of an adaptable crawler mechanism for a mobile robot, enabling it to maintaining its constant desired pose when roving. For this purpose, a novel multi-legged adaptable crawler (MLAC) prototype is proposed by utilizing a spring and a rack-and-pinion unit. More specifically, the MLAC prototype allows changing of the crawler configuration in order to adapt to a local surface topology. When the MLAC prototype is mounted under the mobile robot, even though the robot might encounter ascending/descending slopes and thresholds, the mechanism allows it to preserve its locomotive pose continuously. The design and performance of the MLAC prototype is explained in detail, and its effectiveness is verified through experiments in our laboratory environments.

January 24 (Thursday), 13:00–14:00

OS11-2 Generation of 3D Ambulatory Model for Distance-Based Robotic Walker Interface

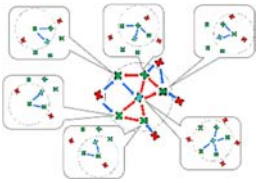
Soichiro Nakao, Geunho Lee, Yuki Fujio, and Shu Takaira
(University of Miyazaki, Japan)



Robotic walkers and assist robots that assist walking use a walking recognition method using sensors and cameras to recognize walking of user. However, depending on the method, there are problems such as low convenience and problems of protection of privacy. In this research, we propose a new walking recognition method to recognize walking based only on distance data of lower limbs and torso, and try to solve these problems. Furthermore, we performed comparative experiment of walking motion measured by motion capture and measured by the method of this research, and verified the effectiveness of the recognition method. As a result of the verification, it was confirmed that the walking recognition method is effective.

OS11-3 Communicative Interaction Scheme of Mobile Robot Swarms

Soe Soe Hlaing, Shu Takaira, and Geunho Lee
(University of Miyazaki, Japan)



The self-organization problem for mobile robotic sensors are creating wireless ad hoc networks while adapting to topological changes. The challenge is how to exploit locally communicative interactions with minimal conditions such as locality and implicit coordination. Each sensor node organizes and updates its partially connected network through selecting specific neighboring nodes with higher connectivity. The most important features of the proposed system includes self-organization, topological adaption, and self-healing, enabling self-organization of mobile sensor networks in an efficient way. With the advances of mobile network-enabled sensors, great attention has been paid to increase sensor network applications. Many studies employing large-scale mobile sensors have been reported in fields of networking and swarm robotics.

OS11-4 Monitoring System Based on Active RFID Tags for Acquiring Ecological Data of Individual Pigs

Geunho Lee, Kazuki Koroki, Takashi Yoshiura, Atsushi Ishimoto, Shinsuke Sakamoto, and Seiji Ieiri
(University of Miyazaki, Japan)

In this paper, we introduce an IoT-based livestock monitoring system for a large herd of pigs. To observe the behaviors of the pigs in their pigpen, this paper tackles what kind of a sensor will be used and how to collect biological data for the pigs toward the application to a large pig farm. As a solution approach, our study proposes a monitoring system that uses the microwave field intensity transmitted from IC tags attached to individual pigs, enabling the system to obtain the biological data such as dwell time at feeding or resting areas, amount of movement, and so on. The implementation of the monitoring system are explained in detail, and its effectiveness and usability are verified through experiments.

January 24 (Thursday), 15:35–16:35

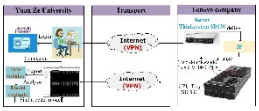
Room A

GS2 Artificial intelligence

Chair: Jiann-Shing Shieh (Yuan Ze University, Taiwan)

GS2-1 Applying CNN model for time-frequency analysis of EEG to assess the depth of anesthesia based on BIS value

Yu-Po Huang[1], Jerry Chen[1], Shou-Zen Fan[2], Maysam F. Abbod[3],
Jiann-Shing Shieh[1], and Yu-Chen Kung[4]
([1]Yuan Ze University, Taiwan)
([2]National Taiwan University, Taiwan)
([3]Brunel University London, United Kingdom)
([4]Lenovo Global Technology Ltd, Taiwan)



In this study, time-frequency analysis of continuous wavelet transforms (CWT) is used to process the different frequency bands of EEG signals. The Bi-Spectral (BIS) index and signal quality indicator (SQI) are recorded using a commercial machine. BIS is classified as Anesthetic Light (BIS: ≤100 and ≥60, SQI: ≥50), Anesthetic OK (BIS: <60 and ≥60, SQI: ≥50), Anesthetic Deep (BIS: <40 and ≥0, SQI: ≥50), and Noise (SQI: <50). This study is applied CNN to extract features of time-frequency domain images to train the model. As a result, the CNN model predicts the accuracy of individual categories of Anesthetic light is 69%, Anesthetic Ok is 75%, Anesthetic Deep is 73%, and Noise is 50%. The overall accuracy of the model is 72.36%. Although the accuracy is not high at the moment, it will be improved by nonlinear way to process EEG data to train the CNN model in the future.

GS2-2 Implementation of convolutional neural network for classification of daily human activities

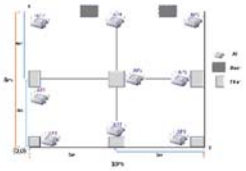
Tsige Tadesse Alemayoh, Jae Hoon Lee, and Shingo Okamoto
(Ehime University, Japan)

A novel method for classifying and identifying human activities in real-time is needed in healthcare and human-machine interaction fields. In this paper, a multi-channel motion data collected from a smartphone are structured in a new way and converted to a virtual image. An iOS application software was developed for recording and streaming real-time data. The time series data of an accelerometer and gyroscope motion sensors are structured into 15x60 virtual image. Similarly, their respective amplitudes of 1 dimensional DFT (Discrete Fourier Transformation) are organized into 15x60 image format. The resultant data was given to the designed CNN (Convolutional Neural Network) for classification. Both data structuring methods were analyzed and compared yet the time series data structuring showed a better result and attained an accuracy of 99.3%. For further verification, the model was tested for real-time activity recognition and achieved an excellent result.

January 24 (Thursday), 15:35–16:35

GS2-3 Wifi Localization using machine learning techniques

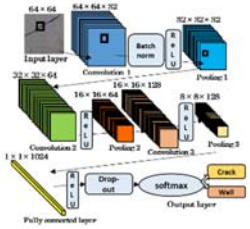
Sukh Sagar Subedi, Ashish Adhikari, and Hironori Hiraishi
(Ashikaga University, Japan)



In this research we used Wi-Fi localization using SVM (Support Vector Machine) and Deep Learning to analyze the better data. We collected our own data by installing 9 access points. In row there was 3 AP and in column there was 3 AP. In row each AP has 4meter distance and in column each AP has 5meter distance. which means in row there is 8meter distance and in column 10meter distance. In the case of SVM, we got the best accuracy of 83.3% in 3 meter distance data. After SVM analysis we also tried the deep learning process to analyze the data. We tried few types of neural network combinations and got the best result in 3 layers' combination. We were able to get almost 100% result in 3 meter. We also tried in 2 and 1 meter distances. We got above 95% and 70% accuracy rate simultaneously.

GS2-4 Deep Learning-based Crack Detection Algorithm for Infrastructure Inspection Task

Naoya Kubota, Jae Hoon Lee, and Shingo Okamoto
(Ehime University, Japan)



In this paper, as a solution for an effective inspection task which can be embedded in a drone, deep learning-based algorithm was designed. It consists of two main modules of recognizing surrounding environment and finding cracks. Firstly, the algorithm estimates the position near a building by utilizing ORB-SLAM and a RGB-D camera, where a 3D map is generated with the help of RGB and depth images simultaneously. Furthermore, the proposed CNN detects cracked parts by calculating their probabilities based on big data. Thus the algorithm was trained by cracked and general wall images of 6,000 datasets for that. In addition, when the recognized results meet the criteria, feature points including the RGB image parts having cracks are colored and displayed in the 3D map. Finally, trained model outputted over 90 percent of test accuracy. The effect of embedding a drone was also investigated through experimental results.

January 24 (Thursday), 15:35–17:05

Room B

GS4 Biomedical imaging

Chair: Kazuhiko Goto (Hakata Medical Technical College, Japan)

GS4-1 Segmentation of Spine Region in CT Images using 3D Edge Detection and 3D Region Growing Technique

Guanghua Fu[1,4], Huimin Lu[1], Guangxu Li[2], Hyoungseop Kim[1], Seiichi Murakami[3], Midori Ueno[3], Takashi Terasawa[3], Xinglong Zhu[4], and Takatoshi Aoki[3]
([1]Kyushu Institute of Technology, Japan)
([2]Tianjin Polytechnic University, China)
([3]University of Occupational & Environment Health, Japan)
([4]Yangzhou University, China)

Recently, bone metastasis is considered as one of the life-threatening diseases that cause death. Early diagnosis plays an important role in the treatment of radiation therapy for bone metastasis. It is necessary to segment the spine region based on three-dimensional image processing technique. This paper presents a hybrid automatic 3D segmentation based on edge detection and region growing algorithms. The proposed method solves the problem of edge blurring in traditional regional growing algorithm. We have successfully applied this method to 3D segmentation of the spine region obtained from CT scans of 3D datasets of 10 patients. Intersection over union (IoU) is used to compare the results of segmentation with the manual segmentation results. The proposed method has an average accuracy of 85.36%. The computational cost of each data set is greatly reduced.

January 24 (Thursday), 15:35–17:05

GS4-2 Characteristics of brain activity under combination of optic flow and binocular disparity stimulus by using LORETA analysis for visual evoked potentials

Kazuhiko Goto[1], Takenao Sugi[2], Takuro Ikeda[3], Takao Yamasaki[4],
Shozo Tobimatsu[4], and Yoshinobu Goto[3]
([1]Hakata Medical Technical College, Japan)
([2]Saga University, Japan)
([3]International University of Health and Welfare, Japan)
([4]Kyushu University, Japan)

Visual evoked potentials (VEPs) are the electrical responses from the brain concerned with visual information processing. The signal source of VEP components is assessed by using the topography of VEP amplitude. However, the evaluation of the influence on two visual information interaction for the signal source in the human brain has difficulties due to the overlapping of both components in the time domain. In this study, the evaluation of the interaction between the signal source of optic flow and that of binocular disparity stimulus was done by use of the waveform subtraction method and low-resolution electromagnetic tomography (LORETA). Usefulness of the proposed method was investigated by comparing the current density map of original waveform and subtracted waveform. The proposed method will be effective for evaluating the interaction between two visual information process.

GS4-3 Blur restoration of confocal microscopy with depth and horizontal dependent PSF

Yuichi Morioka[1], Katsufumi Inoue[1], Michifumi Yoshioka[1], Masaru Teranishi[2], and Takashi Murayama[3]
([1]Osaka Prefecture University, Japan)
([2]Hiroshima Institute of Technology, Japan)
([3]Juntendo University, Japan)

In recent years, chemical and medical fields disclosed a lot of facts regarding cell components and their functions. Accordingly, there is an increasing demand to further deepen the knowledge of the cells. In particular, the confocal microscopy has been used as a technique for observing alive cells. However, due to the refractive index difference between the cells and surrounding materials, spherical aberration and so far, the observed image is defocused, and becomes degraded. For restoration of the defocused image, Point-Spread-Function estimation is required. Several restoration methods have been proposed to reduce microscopy image degradations. The major one is a Richardson Lucy method. It has a problem to takes a long time for restoring an image. To solve this problem, we propose iteration method with dividing into cell and background region.

GS4-4 Hybrid-structured nanofibers supported chemoprotective gene therapy enhances chemotherapy tolerance and efficacy in malignant glioma rats

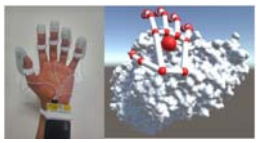
Yuan-Yun Tseng[1], Ying-Chun Chen[2], and Shih-Jung Liu[2]
([1]Taipei Medical University, Taiwan)
([2]Chang Gung University, Taiwan)

We exploited hybrid-structured poly[(D,L)-lactide-co-glycolide] nanofibers that offer the sequential and sustainable release of O6-BG and two alkylators (carmustine and temozolomide). Nanofibers were surgically implanted into the cerebral cavity of pathogen-free rats and F98 glioma-bearing rats. The release curves of loaded drugs were quantified. The treatment results were compared with the rats treated with intraperitoneal injection of O6-BG combined with surgical implantation of carmustine wafer and oral temozolomide. The drugs loaded nanofibers displayed a sequential drug release behavior with the elution of high drug concentrations of O6-BG in the early phase, followed by high concentrations of two alkylators. All pharmaceuticals levels were high for over 14 weeks. Tumor growth was slower and the mean survival time was significantly extended in the nanofibers-treated group. Biodegradable nanofibers can promote therapeutic efficacy and prevent toxic systemic effects.

January 24 (Thursday), 15:35–17:05

GS4-5 Haptic Rendering Applied to Hand Tracking 3D User Interface for a Molecular Modeling Environment

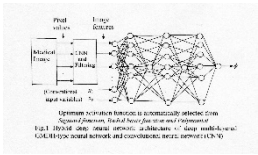
Arif Pramudwiatmoko[1,2], Satoru Tsutoh[3], Gregory Gutmann[1], Yutaka Ueno[4], and Akihiko Konagaya[1]
([1]Tokyo Institute of Technology, Japan)
([2]Universitas Teknologi Yogyakarta, Indonesia)
([3]Fuji Xerox Co., Ltd., Japan)
([4]National Institute of Advanced Industrial Science and Technology, Japan)



In order to provide a real time 3D user interface with comprehensive modeling environment for the molecular models, we have implemented haptic rendering facility to the hand tracking user interface. The system handles molecular objects in a virtual reality environment with a hand tracking user interface provided by Leap Motion controller. We introduced small fingertip pinching and vibration devices attached on each finger to give haptic display when manipulating objects that interact with the control hands. Based on software development studies using existing 3D graphics toolkit, CHAI3D and Unity, the hardware interface was developed with reasonable modeling performance for small molecular objects with limited numbers of atoms. The haptic device successfully provided grasping feel of the molecular model. For large scale molecular systems, we also started our own scene graphics software using high performance graphics library DirectX. The haptic interface and our implementation results with different graphics libraries are discussed.

GS4-6 Medical image recognition of brain regions using deep multi-layered GMDH-type neural network and convolutional neural network

Shoichiro Takao[1], Sayaka Kondo[2], Junji Ueno[1], and Tadashi Kondo[1]
([1]Tokushima University, Japan)
([2]Tokushima Medical Informatics Laboratory, Japan)



In this study, the hybrid deep neural network of the deep multi-layered Group Method of Data Handling (GMDH)-type neural network and convolutional neural network (CNN) is applied to medical image recognition of the brain regions. The deep GMDH-type neural network can automatically organize the deep neural network architectures using the revised heuristic self-organization method. This method is a type of the evolutionary computation. In the deep GMDH-type neural networks, the structural parameters which are number of hidden layers, type of the activation functions of neurons and useful input variables, are automatically selected to fit the complexity of the nonlinear systems using the prediction error criterion defined as Akaike's Information Criterion (AIC) or Prediction Sum of Squares (PSS). The hybrid neural network algorithm is applied to the medical image recognition of the brain regions and the recognition results are compared with those of the conventional three-layered sigmoid function neural networks.

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Room D

OS5 Deep Learning Approaches to Textual Information

Chair: Kiyota Hashimoto (Prince of Songkla University, Thailand)

OS5-1 Novel deep learning method for understanding Japanese comics

Ryo Iwasaki[1], Koichi Sato[1], Miki Ueno[2], Naoki Mori[1], and Makoto Okada[1]
([1]Osaka Prefecture University, Japan)
([2]Toyohashi University of Technology, Japan)

Comic computing is a branch of computing dealing with comics in engineering. In this field, multimodal data with natural languages and pictures are used. Although tasks such as comic frame recognition in comic computing are performed using image processing techniques, artificial intelligence focuses on pictures in comics rather than the comic content to solve these tasks. To make models understand the contents in comics, we should deal with natural languages in comics in the form of character words. We used a dataset which was suitable for analyzing comic contents and set up two tasks for the analysis of Japanese comics. One was sentimental analysis and the other was variety analysis. We demonstrated and analyzed the results to determine the feasibility of computers understanding comics.

OS5-2 A Method of Title Generation Using Attention Model with Gated Convolutional Neural Network for Japanese News Articles

Hiroki Teranishi, Makoto Okada, and Naoki Mori
(Osaka Prefecture University, Japan)

In this research, we propose a title generation model incorporating Gated Convolutional Neural Network (GCNN) into an Attention model. By incorporating GCNN, we made it possible to obtain words feature between n-gram. In our model, we obtain the feature vectors of n-gram by applying the input words to the GCNN and apply the attention to this vectors in the decoder. Vectors are convoluted in n-gram, Attention applies different weights to the words depending on the context even though the same word. It is useful if a word has many meanings, like Japanese. We conducted an experiment of title generation use Japanese news articles and evaluated by ROUGE value whether the word feature of n-gram is obtained. We confirmed the increase of the ROUGE score compared with the previous method.

OS5-3 Attentive Visualization in Neural Image Caption Generation

Maaki Shozu and Hidekazu Yanagimoto
(Osaka Prefecture University, Japan)

Caption Generation is one of fundamental tasks combining computer vision and natural language processing. To achieve this goal, the system has to understand an image and transform the understanding to text. In multimodal learning, neural networks are employed to implement a system because the neural networks are trained in end-to-end fashion. In this paper, we proposed a caption generation system combining a CNN-based object detection system and a language model with a recurrent neural network. Especially, a vector which is sent from the object detection system to the language model is generated using an attention mechanism. The attention mechanism helps us to understand how the system can generate a caption based on a part of the image. In the experiments, we evaluate the performance of the proposed system and discuss the effects of the attention mechanism in the image caption.

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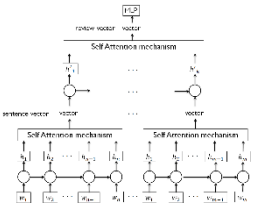
OS5-4 An Estimation Method of Situations of Reviewers Using Deep Neural Network

Kazuto Nomura, Makoto Okada, and Naoki Mori
(Osaka Prefecture University, Japan)

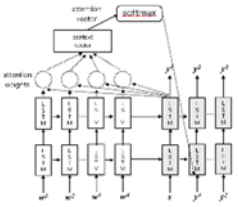
We propose a method to estimate the attributes of situations of reviewers using Deep Neural Network (DNN). There are many customer reviews about products and services on the internet. The customer reviews are useful for users. However, the number of reviews has become enormous and it has been difficult to find the appropriate reviews. Therefore, a method to estimate the appropriate reviews will bring large benefits to the users. In this paper, we propose a method to estimate the appropriate reviews. Our target data is customer reviews in the travel information site. We compared the results of proposed method with general methods. We investigated effectiveness of the proposed method by experimental results and discuss the results and future works.



OS5-5 Code Generation with Sequence to Sequence Model

Moe Yoshimasu and Hidekazu Yanagimoto
(Osaka Prefecture University, Japan)

In software development, a system is developed based on specifications written with a natural language. The final product depends on programmer's skill which denotes how to translate specification to implementation. One of challenging tasks is to generate a programming code from the specification directly. In this paper, we propose a neural network based program generator which includes a recurrent neural network and an attention mechanism. We generate a Python code from pseudocode written in English and analyze code generation errors.



January 24 (Thursday), 15:35–17:20

Room E

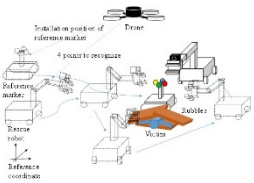
OS13 Robotics with Intelligence and/or Informatics 2

Chair: Tetsuya Kinugasa (Okayama University of Science, Japan)
Co-Chair: Mamoru Minami (Okayama University, Japan)

OS13-1 3-D object shape recognitions for stacked rubble withdrawal works performed by rescue robots

Toshifumi Fujii, Masatoshi Hatano, Harunao Koizumi, and Akira Tokita
(Nihon University, Japan)

In this research, we aim to develop a method to recognize three dimensional shape of stacked rubbles each by each for rubble withdrawal rescue robots. Shapes, masses, states of stacked rubbles and so on are various and unknown at the disaster area. Then, grasping positions on rubbles and ways of withdrawal works have to be considered for not breaking down the stacked rubbles and falling them down on victims. Thus, it is necessary to analyze stacked rubble individually and to identify their shapes and center of gravity positions. For such problems, we propose the 3-D environmental recognition system with the Kinect sensor as a RGB-D sensor and the 3-D reference marker. Moreover, we also propose the extraction method of rubbles using the SSD (Single Shot Multi Box Detector) of the AI (Artificial Intelligence).



January 24 (Thursday), 15:35–17:20

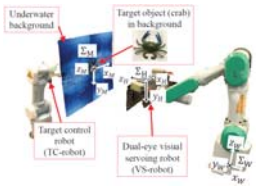
OS13-2 Development and gait analysis of lightweight and small myriapod robot with denser leg based on passive dynamics

Naoki Miyamoto[1], Tetsuya Kinugasa[1], Koichi Osuka[2], Ryota Hayashi[1], and Koji Yoshida[1]
([1]Okayama University of Science, Japan)
([2]Osaka University, JST CREST, Japan)

This study aims at developing anther prototype of myriapod robot, i-CentiPot 03, with denser legs, which achieves significant mobility against unpredictable environment via passive dynamics. In the previous i-CentiPot series, because the space between the consecutive legs was wide, the torso contacted the ground and the legs slipped, which resulted unnatural locomotion. Therefore, we develop anther prototype of i-CentiPot with denser legs, conduct some experiments under various conditions, and evaluate its mobility. Denser leg provided shorter distance between the leg contact areas, which suppressed that the bottom of the torso segments scuffed the ground. The slippage ratio was reduced to 60% of the previous prototype, i-CentiPot 02. Small slippage ratio occurred natural locomotion of the myriapod robot.

OS13-3 Visual servoing to arbitrary target with photo-model-based recognition method

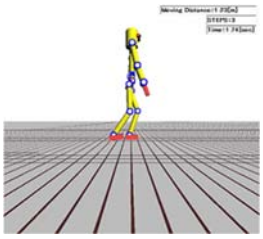
Hongzhi Tian, Yejun Kou, and Mamoru Minami
(Okayama University, Japan)



Visual servoing is one of the methods to control robots. By incorporating visual information obtained from the installed vision sensor into the feedback loop, it is desirable for the robot to be able to operate in a changing environment or an unknown environment. For visual servo systems, the authors proposed a photo-model-based recognition method for processing an arbitrary object with a still picture. In the previous work, a flat shape clothes handling robotic system has been proposed to handle deformable and unique clothes. In this paper, we extend the photo-model-based robot handling system (pick and place) to a real-time pose tracking system. And the recognition method is used for attitude tracking of different objects of dynamic pictures. Furthermore, to verify the ability to track with the photo-model-based recognition method. The authors design some frequency response experiments with arbitrary aquatic creature toys to keep the relative pose between a sea animal and hand-eye. The results of visual servoing experiments show that the proposed identification method is feasible, flexible and effective.

OS13-4 Ice Skating Motion Using Feedforward Control System by Model of Humanoid Robot

Zeyi Zhang, Daiji Izawa, Xiang Li, Takayuki Matsuno, and Mamoru Minami
(Okayama University, Japan)



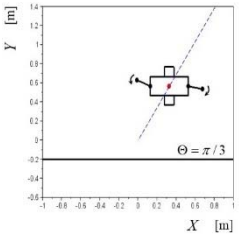
The research of humanoid is widely discussed whether by simulations or real machines. To bipedal walking, inverted pendulum has been used frequently for making a stable controller that enables researchers to realize stable gait through well known control strategy. In our research, a model of humanoid robot including slipping, bumping, surface-contacting and point contacting of foot is discussed, and its dynamical equation is derived by Newton-Euler method. Our research purpose aims to create a control system by utilize slip and stop slip using the model. In this paper, the ice skating, which is a kind of typical utilize slip motion will be discussed. And a new feed-forward control method was prepared for realize this motion. Also some discussion from the viewpoint of step cycle and slipping distance during the ice skating motion will be introduced.

January 24 (Thursday), 15:35–17:20

OS13-5 Mobile robot utilizing rotational movements of the arms - Control of moving direction and reduction of collision impact -

Ryota Hayashi[1], Yuki Tanaka[1], Yasuyuki Setoyama[2], Tetsuya Kinugasa[1], and Koji Yoshida[1]
([1]Okayama University of Science, Japan)
([2]National Institute of Technology, Kagoshima College, Japan)

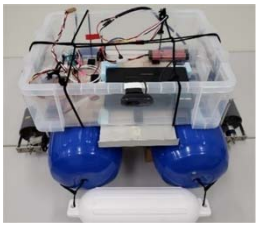
In this paper, we consider a mobile robot which can start to move by utilizing rotational movements of the two arms. We investigate a simulation model of the robot which moves in a planar space where there are no friction and no gravity. This robot has a special device that can fix the body to a platform constructed on a certain wall or floor. While the body is fixed to the platform, the robot can store the kinetic energy by rotating of the arms. When the body is unfixed from the platform, the robot starts to move along the kinetic momentum of the center of mass. We propose a scheme to control the moving direction of the robot after the body is unfixed from the platform. Furthermore, we consider the reduction capability of the robot against the impact of collision with a platform at destination.



OS13-6 Target detection with SSD and navigation control for autonomous USVs transporting repair parts of bridge piers

Kanta Nemoto, Masatoshi Hatano, and Kenpin Ri
(Nihon University, Japan)

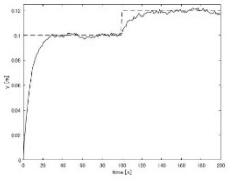
Japan is the maritime nation and there are many port facilities. Those port facilities are damaged by the seawater through the long years. Explorations and repairs of bridge piers in ports are accomplished by divers in general. However, environments around the target areas are dangerous because of waves and accident by deterioration of piers. Therefore, our final goal of the research is to develop an autonomous USV instead the divers. In this research, constructed USV transporting repair material of bridge piers is shown and the target detection method with the SSD is proposed. Accuracy of the object detection and a navigation result are discussed.



OS13-7 A Consideration of Smart Strong Stability Systems Based on PID Control

Akira Yanou
(Kawasaki University of Medical Welfare, Japan)

Smart strong stability system is one of the safe control systems, whose open-loop and closed-loop gains are designed to be 1. In the steady state, the smart strong stability system becomes a quasi-open-loop system. In other words, the feedback signal becomes almost zero in the steady state. Therefore, even if the accident that the feedback signal becomes zero occurs, the smart strong stability system can keep the safety. Although the proposed system was derived by generalized minimum variance control (GMVC) in the previous researches, this paper explores the derivation of the proposed system through PID control.



January 24 (Thursday), 15:35–17:20

Room F

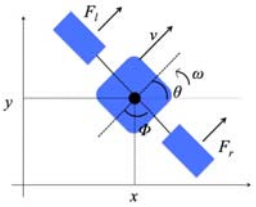
OS14 System Sensing and Its Applications

Chair: Hirotoshi Asano (Kagawa University, Japan)
Co-Chair: Tota Mizuno (The University of Electro-Communications, Japan)

OS14-1 Control of Fish type Balloon Robot using time-state control form

Hiroki Miyamae and Masafumi Uchida
(The University of Electro-Communications, Japan)

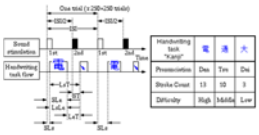
A fish type balloon robot (FBR) is a biomimetic robot that introduced a twisting motion and a pectoral fin motion of fish to an airship robot. FBR is intended for indoor using, and it is required for automatic control. However, FBR is a nonholonomic system, and it is considered difficult to control. In this study, we propose to apply a control using time-state control form, which is one of control of nonholonomic systems, to FBR and construct a control system. We measured the propulsion force of the pectoral fin which is required to apply the control. From the measurement results, we derived the output pattern of the propulsion velocity and the turning angular velocity of FBR, and conducted a simulation to investigate the operational characteristics of the FBR. Because of investigations, we examined the controllable range of FBR.



OS14-2 Evaluation of task difficulty based on fluctuation characteristics in writing task

Keisuke Tanaka, Ken Arai, and Masafumi Uchida
(The University of Electro-Communications, Japan)

De-trended fluctuation analysis (DFA) is an effective method to analyze the physiological signals. If the time series of the handwriting time element had self-similarity, it implied that this time series did not have a fixed timescale. However, some previous studies have reported the crossover phenomenon associated with a change in the short- and long-range self-similarity features during the DFA process. In this study, we focused on the self-similarity modality of each timescale and proposed a new scaling index as a parameter for evaluating the local self-similarity on the time scale. Moreover, we investigated the relationship between the proposed scaling index values and the differences in the difficulty levels for writing three Kanji characters by hand. Because of investigations, we considered the differences of coping strategies for the local tasks constituting synchronous handwriting tasks.



OS14-3 Body Turning Feature Measurement for Liner Walking Locomotion Interface

Ryota Sakashita and Hisaya Tanaka
(Kogakuin University, Japan)

In this research, we have developed a new locomotion interface (LI) that uses the inertial information of a body for direction change input. This LI uses a treadmill to minimize the space to be used. In addition, we aim to develop LI that allows pseudo-left/right turning movement on virtual environment (VE) space in a treadmill where the subjects can only walk straight ahead based on the rotation information of a shoulder. The system using virtual reality analyzed the degree of sickness, which is being considered herein, through a simulator sickness questionnaire. Result shows that we can freely walk in the VE when the gaze direction matches with the moving direction. Before and after this experiment, subject 1's SSQ score increased from 0 to 4. Subject 2's SSQ score increased from 2 to 8. This system allows walking in VE, but both subjects felt simulator sickness.

January 24 (Thursday), 15:35–17:20

OS14-4 Estimation of stress structure on daily life behavior using psychophysiological information

Masahiro Seo, Kosuke Oiwa, and Akio Nozawa
(Aoyama Gakuin University, Japan)

The objective of this study was an estimation of stress structure considering detailed behavior of spare capacity. In the experiments, multitasking simulated an actual daily life behavior was performed, and the experiments were conducted three conditions to change the mental fatigue of secondary task. In this study, mathematical model for estimating psychological index from physiological and performance indices was constructed, in order to reveal the relationship between stress structure and impression during multitasking. As the result, the measured value of psychological indices was higher than that of estimat-ed value obtained from the model in the case that fatigue of secondary task was low. On the other hand, the measured value was lower than that of estimated value in the case that fatigue of secondary task was high. It was suggested that fatigue of secondary task could be absorbed into spare capacity, and ability absorption of fatigue could be limited.

OS14-5 Analysis of relationships between mechanism of variations in blood pressure and facial skin temperature distribution

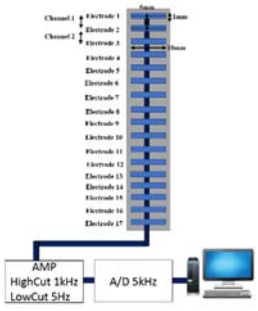
Narushi Nakane, Kosuke Oiwa, and Akio Nozawa
(Aoyama Gakuin University, Japan)

The aim of this study is to construct a technique for measuring blood pressure (BP) with noncontact measurements. In our study, relationships between variations in BP of cardiac-dominant and facial skin temperature distribution were evaluated using independent component analysis and multiple regression analysis. Mechanisms of variation in BP are roughly classified into cardiac-dominant and vascular-dominant, and evaluation of relationships between both of mechanisms in BP and facial skin temperature distributions are essential. The objective of this study is to analyze relationships between mechanisms of variations in BP, which is cardiac-dominant and vascular-dominant, and facial skin temperature distributions. Two tests caused cardiac-dominant and vascular-dominant were conducted, and compared with feature quantities of facial skin temperature. As the result, distributions of common feature quantities related to both mechanisms were extracted from nasal region, and distributions of feature quantities in other facial regions were different between both mechanisms.

OS14-6 A study of analyzing Conducting waves using multi-channel surface EMG

Marzieh Aliabadi Farahani, Hiroki Yamada, Kota Akehi, Kazuyuki Mito, Tota Mizuno, and Naoaki Itakura
(The University of Electro-Communications, Japan)

Abstract: By individually examining the characteristics of conducting waves in multichannel surface electromyogram (EMG) signals, there is a possibility to understand the mobilization mechanism of muscle contraction. It is important to consider the potential obtained from the surface electromyogram (EMG) signal conducted from a large number of moving units in the muscle, as well as the interference potential due to the conducting action potential. The main purpose of this research paper is to find the exact characteristics of conducting waves close to an end-plate using the antiphase conduction method. To evaluate the position of the end-plate, every conducting wave will be investigated by multi-channel surface EMG, and the formation process for the conducting waves will be analyzed. Keywords: Muscle, neuromuscular junction, MFCV, Surface EMG, motor unit,



January 24 (Thursday), 15:35–17:20

OS14-7 Effects of color LED exposure on drowsiness

Shusuke Otake[1], Tota Mizuno[2], and Hirotoshi Asano[1]
([1]Kagawa University, Japan)
([2]The University of Electro-Communications, Japan)

Much research has evaluated effects of color light on drowsiness. However, the results are different. We guess that the problem affected by two effects. One is circadian rhythm. Intrinsically photosensitive retinal ganglion cell in retina directly projects light stimulus on suprachiasmatic nucleus which is central circadian rhythm. ipRGC is the largest spectral sensitivity at 479nm. Thus, blue light lets arousal level high. Another is psychological effects by color. Cone cell and rod cell in retina affected vision. In particular, color information connects with memory and affect judgement of value. Blue and red impress calmly and actively, respectively. Blue light accelerates the relaxation process. Thus, blue light lets arousal level low. This research assessed influence on both psychological effects by color and circadian rhythm.

January 25 (Friday), 09:00–10:00

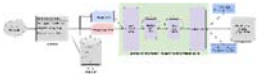
Room A

OS2 Bio-inspired theory and applications (1)

Chair: Kunihito Yamamori (University of Miyazaki, Japan)

OS2-1 Sentence classification method using recurrent neural network structure

Mitsuhiro Komuro and Yuji Sato
(Hosei University, Japan)



In this paper, we consider a sentence classification method using recurrent neural networks to classify whether the sentence is positive or negative. We also consider a flexible conversational system, in order to make the system understand the sentence nuance. We propose a model with a structure of a recurrent neural network (RNN) in which the hidden layer is multi-layered. In the experiment, the precision is evaluated by changing the hyperparameters such as learning rate, a hidden layer type called “Cell”, the number of neurons used in the hidden layers, and the number of hidden layers in proposed neural networks, in order to see how they affect the accuracy of neural networks. From the experimental results, we confirmed that by having specific hyperparameters and neurons, such as 3 hidden layers, 32 cells per hidden layer, learning rate 1e-6 using gated recurrent unit cells, the validation data reached an accuracy of 84.0% at the end of the specified hyperparameters and training steps.

OS2-2 Heterogeneous Crossovers for Constrained Multi-Objective Continuous Optimization

Wataru Hiruma and Yuji Sato
(Hosei University, Japan)

This paper proposes a method to utilize multiple crossovers to deal with directive mating using effective impossible solution to approximate Pareto-front more accurately in solving the constrained multi objective optimization problem. We focus on Two-Stage Non-dominated Sorting and Directed Mating algorithm to solve the Constrained Multi-Objective Optimization Problems. The crossovers used in this study are the Simulated Binary Crossover which is a wide area search and good at solving problems with strong correlation between objective function and variable and Polynomial Mean-Centric Crossover which is a local search and superior to solve problems with weak correlation between objective function and variable. In the experiment, we will switch the crossover method for a fixed generation targeting the search TNK, switching the crossovers for each constant generation, switching the number of generations and the order of crossover I changed it. In conclusion, SBX assists the search of PMCX.

OS2-3 High-speed image classification on convolution neural network with variance

Yasuhisa Nagano, Kentaro Inoue, Masaru Aikawa, and Kunihito Yamamori
(University of Miyazaki, Japan)

In recent years, neural network models such as deep learning gives us a probability to apply them for real world problems. In image classification, convolution neural network (CNN) and ensemble learning are popular and give us high classification accuracy. However ensemble learning has a problem, increasing of the learning time. In this paper, to overcome this problem, we propose CNN-based image classification method using variance. We evaluate the proposed method using CIFAR-10 dataset. The results showed that classification accuracy in our proposed method was improved, and classification speed was three times faster compared with CNN with ensemble learning using three identification machines.

January 25 (Friday), 09:00–10:00

OS2-4 Hierarchical policy gradient method with the combination of reinforcement and auxiliary learning

Masaya Yoshida, Kentaro Inoue, Masaru Aikawa, and Kunihito Yamamori
(University of Miyazaki, Japan)

In this paper, we aim to improve learning efficiency of reinforcement learning by hierarchical combination of Proximal Policy Optimization (PPO) and auxiliary tasks. PPO is a method to stabilize learning. Auxiliary tasks are used in UNsupervised REinforcement and Auxiliary Learning (UNREAL) which is a kind of policy gradient method based on Asynchronous Advantage Actor-Critic (A3C) for high-speed learning convergence. We aim to improve learning efficiency by combining these two methods. We compare our method with previous methods using two benchmark tasks 'Hopper' and 'HumanoidStandup' in 'Gym' provided by OpenAI. Experimental results showed that the proposed method achieved better performance than that by PPO.

January 25 (Friday), 09:00–10:30

Room B

OS4 Biomimetic Machines and Robots

Chair: Keigo Watanabe (Okayama University, Japan)

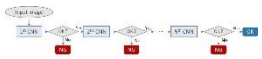
OS4-1 Experimental verification of the designed algorithm for swarming behavior

Akimasa Otsuka, Hikaru Tanaka, Yuki Baba, and Fusaomi Nagata
(Sanyo-Onoda City University, Japan)

Natural beings can get higher intelligence behaviors by swarming in spite of its simplicities of individuals. Therefore, imitating that will be effective in developing an efficient swarming robots system. Many studies also treated swarming robotics topic, and many methods were presented. However, the studied of swarm robotics are mainly classified in two category based on the aims. One is to acquire a superior function than individual function by swarming. Another is to investigate an emergence mechanism of the superior function. The latter one is interesting because a design method of an algorithm for individual robots can be established if the mechanism is revealed. In this paper, the algorithm is evaluated through experiments using actual mobile robots. The optimized algorithm is implemented into all robots. Ten robots and a leader are used for the experiments. Comparison of simulation results and the experimental results is reported.

OS4-2 Design Tool of Convolutional Neural Network (CNN) - Design of Cascade-Type CNN and Its Application to Defect Detection -

Kenta Tokuno[1], Fusaomi Nagata[1], Akimasa Otuka[1], Keigo Watanabe[2], and Maki K. Habib[3]
([1]Sanyo-Onoda City University, Japan)
([2]Okayama University, Japan)
([3]The American University in Cairo, Egypt)



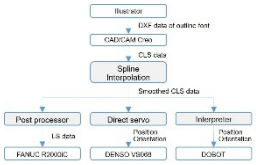
In this decade, convolutional neural network called CNN has been attracting attention due to its high ability of image recognition and other applications. In this paper, a design and training tool for convolutional neural network is developed. The tool requires no knowledge and experience about C++ or Python. As a test trial, a multi-class CNN is designed using the tool to detect defects such as crack, burr, protrusion, chipping and spot which occurs in the manufacturing process of resin molded articles. The multi-class CNN is trained with a large number of training images of each category. Then, a cascade-type CNN consisting of multiple binary-class CNNs is proposed to classify target test images into OK category or NG one including the defects such as crack, burr, protrusion, chipping and spot. A metrics using the miss-classification rate is applied in order to compare the performances of the conventional multi-class CNN and the proposed cascade-type CNN.

January 25 (Friday), 09:00–10:30

OS4-3 CAD/CAM Interfaces for Articulated-Type Robots

Shintaro Suzuki[1], Fusaomi Nagata[1], Takamasa Kusano[2], and Keigo Watanabe[3]
([1]Sanyo-Onoda City University, Japan)
([2]SOLIC Co., Ltd., Japan)
([3]Okayama University, Japan)

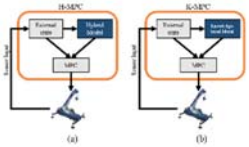
In this study, CAD/CAM interfaces are proposed for articulated-type robots. They are an educational robot called DOBOT and an industrial robot called VS068. Two types of robot operating environments that can be used without conventional teaching process are presented. In the case of the DOBOT, paths called CLS (Cutter Location Source) data are interpretively converted into robot language codes line by line and are given to the robot controller through its API functions. Also, in the case of the VS068, position and orientation vectors calculated from the CLS data are given to the robot controller every sampling time through API functions provided by ORiN middleware. Due to the proposed systems, attractive outline fonts can be easily drawn and engraved without teaching tasks. The usefulness and validity of the proposed systems are evaluated through design, drawing and engraving experiments.



OS4-4 A knowledge-based deep hybrid model for model-based reinforcement learning

Maimaitimin Maierdan, Mizuki Kihara, and Soichiro Fukamachi
(Advanced Technology Research Center, TADANO Ltd., Japan)

A Model-based Reinforcement Learning (MBRL) has a strong advantage of being sample efficient. A well-designed objective model enables MBRL to understand complex processes by predicting future states. In most of the critical-system applications, an objective model designing depends on direct theoretical knowledge about the system. However, it is difficult to have a full understanding of the non-linear properties of the system in most of the situations. In this paper, a deep hybrid model of a rotary crane is proposed. It combines a knowledge-based model of a crane with a deep neural model that is aimed to estimate random dynamics of the crane. As the result, the deep hybrid model is able to represent the non-linear properties which cannot be expressed in our pure dynamic model. In this paper we compared the performance of these two models: a pure knowledge-based model and the deep hybrid model. Our experiments show that the deep hybrid model is better at approximating the non-linearity of a real crane system than a knowledge-based model.



OS4-5 Development of a foldable personal mobility vehicle usable on Japanese public roads

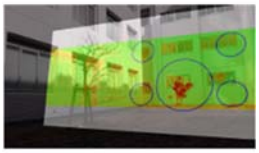
Takanori Sakata, Isaku Nagai, and Keigo Watanabe
(Okayama University, Japan)

A new transportation system, in which personal mobility vehicles (PMVs) and public transports such as railroads and buses are combined, attracts attention from the viewpoint of environmental load. Some PMVs including Segway have been developed up to now. However, the use of existing PMVs on Japanese public roads is generally prohibited because of Road Traffic Act. Therefore, a foldable PMV which aims to be used on Japanese public roads is consequently developed in this research. Specifications of our PMV such as body dimensions and maximum running speed are designed to comply with the standards of “walking aid vehicle with an electric motor and so on” in the Road Traffic Law Enforcement Regulations. Therefore, our PMV on Japanese public roads is permitted like senior cars and electric wheelchairs. Moreover, by folding up the PMV, the user can easily carry it into a public transport.

January 25 (Friday), 09:00–10:30

OS4-6 Distortion and coordinate correction in NDVI visualization system using spectral camera

Shogo Nonaka[1], Masaya Osafune[1], Seishi Ninomiya[2], and Wei GUO[2]
([1]National Institute of Technology, Tsuyama College, Japan)
([2]The University of Tokyo, Japan)



In agriculture and industrial fields, spectral cameras are used for sensing because they can acquire invisible information by wavelength analysis. Relatively light processing normalization difference vegetation index among which (NDVI) is widely used. However, complicated analysis is required for enormous amount of information. Thus, it has disadvantages from the viewpoint of immediacy of information. Also, due to this characteristic, there is a problem that distortion of coordinate information easily occurs in information imaging, and calibration is required. In this paper, we study the interpolation of spectral information and the extension method to RGB camera environment, in constructing visualization system by AR technology of the spectrum information. We propose a method using five feature point scanning areas for expansion. We verify the effectiveness of the system constructed by visualization experiment.

January 25 (Friday), 09:00–10:15

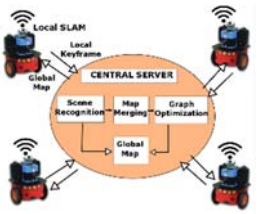
Room C

GS17 Mobile robots

Chair: Masato Ishikawa (Osaka University, Japan)

GS17-1 Real-time Visual Graph-Based Navigation for Multi-Robot System

Ankit A. Ravankar[1], Abhijeet Ravankar[2], Yukinori Kobayashi[1], and Takanori Emaru[1]
([1]Hokkaido University, Japan)
([2]Kitami Institute of Technology, Japan)



A key component to realize autonomous robot navigation is precise localization of the robot and accurate mapping of the environment. This is mainly achieved by making the model of the environment using sensors and keeping track of the robot's position in the given map. The combined task is called as the SLAM problem in robotics. An important issue in robot mapping is to maintain the overall consistency of the map. In this paper, we present a multi-robot SLAM system that utilizes visual pose graph information for mapping and navigation. Our system can accurately map large areas by distributing the mapping process to multiple robots and outputs the merged global map. Each robot in the system communicates to a central server, sending local pose and keyframe information obtained from different sensors. The information is merged whenever a visual overlap is detected and optimizes the local pose graph to a consistent global map.

GS17-2 Development of an autonomous control system for object gripping by mobile manipulator based on image processing

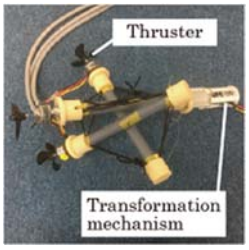
Yoshitaka Sato[1], Yoshitaka Matsuda[1], Takenao Sugi[1], Satoru Goto[1], and Naruto Egashira[2]
([1]Saga University, Japan)
([2]National Institute of Technology, Kurume College, Japan)

In this research, an autonomous control system of mobile manipulator for object gripping is constructed by using image information. The system mainly consists of manipulator, mobile unit, USB camera and control PC. An object to be gripped is recognized from the camera image by image processing based on HSV representation, and autonomous control of the mobile manipulator is performed based on the camera image information. First, the mobile manipulator is manipulated by manual control of the operator until the object is included in the camera image. Then, it operates autonomously by image processing results to grip the object. The effectiveness of the control system developed in this research is verified through experimental results.

January 25 (Friday), 09:00–10:15

GS17-3 A transforming mechanism for an underwater robot with a deformable tensegrity structure

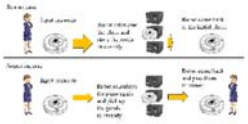
Mizuho Shibata[1] and Norimitsu Sakagami[2]
([1]Kindai University, Japan)
([2]Tokai University, Japan)



Underwater robots for inspecting underwater structures such as breakwaters, pipes and quay walls also requires the movability not only for long distances but also for rotate during the inspection. To solve the problem, we have proposed a portable lightweight underwater robot whose performance to translate and rotate is variable by altering its shape. The shape is composed of a three-strut tensegrity structure, which three pipes connected with rubber strings. Especially, this manuscript describes a transformation mechanism for an underwater robot with a tensegrity structure. The transformation mechanism is composed of a winding unit which includes a planetary gear. We show that the transformation mechanism has the self-locking feature by selecting a high gear ratio of the winding unit. We also evaluate the fluid characteristics of the robot with the transforming mechanism through several experiments in a circulating water tank to investigate the effect of attaching the transformation mechanism.

GS17-4 On system design of safe storage with mobile robots

Mitsuharu Matsumoto
(The University of Electro-Communications, Japan)



This study reports an approach for safe storage using robot technology and its prototype design. Although many researchers study the security in the internet and data science, the safety of the real objects have not been studied very much. Cash box is a typical approach to store the property in trust. However, even if the cash box is used, the thief can steal the cash box including the property in trust. This is because the storage place and the property in trust are at the same location. This study aims to use robots to achieve more secure physical storage. In recent years, many robots for interacting humans have actively been studied and could be found in both public space and private space. This paper studies the approach to store the property in trust using the robot, and show prototypes to show the scenario.

GS17-5 Observer-Based Predictive Pinning Control for Consensus of Multi-Agent Systems

Koichi Kobayashi
(Hokkaido University, Japan)

In this paper, based on the policy of model predictive control, a method of predictive pinning control is proposed for the consensus problem of multi-agent systems. Pinning control is a method that the external control input is added to some agents (pinning nodes), e.g., leaders. By the external control input, consensus to a certain target value (not the average of the initial states) and faster consensus are achieved. In the proposed method, the external control input is calculated by the controller node connected to only pinning nodes. The controller node collects only the states of pinning nodes. Since the states of all agents are required in calculation of the external control input, an observer is introduced, where the states of pinning nodes are regarded as measured outputs.

January 25 (Friday), 09:00–10:00

Room D

GS23 Sensor and multi-sensor data fusion

Chair: Akira Yamawaki (Kyushu Institute of Technology, Japan)

GS23-1 The 3-D environmental map synthesized from camera images and laser scanning data

Ryuhei Yamada and Yuichi Yaguchi
(The University of Aizu, Japan)

The 3-D environmental map around the mobile robot such as rover and multicopter is necessary for the autonomous navigation. We have studied the method to construct the 3-D map synthesized from camera images and the laser scanning points. This map will have high resolution and color based on the image in addition to wide and accurate range given from the LIDAR data. We could construct the 3-D synthesized map consisting of the LIDAR point cloud which have RGB values in 360° horizontal range. The color information is provided by projection of the LIDAR point data on a camera image taken by simultaneous measurement with the LIDAR, and the parameters required for the projection are determined by the data matching for the calibration board measured by both sensors. We found that application of multiple boards is effective for the projection with good accuracy.

GS23-2 Implementation of a single device measuring two biological signals by using dynamic analog circuit reconfiguration

Tetsuya Suematsu and Akira Yamawaki
(Kyushu Institute of Technology, Japan)

A device supporting analog circuit reconfiguration can be applied to many kinds of products with a uniformed hardware platform. But, the dynamic reconfiguration of analog circuit has some problems. For example, the method to efficiently use the analog circuit dynamic reconfiguration for many kinds of application isn't well known and so on. We have focused on the health care field to investigate the applications which the analog circuit reconfiguration can be efficiently applied. We have confirmed that each of them can be realized individually on the PSoC microcontroller supporting analog circuit dynamic reconfiguration. However, we haven't confirmed whether a single device can measure the different biological signals device by using the technique or not. In this paper, we confirm whether PSoC can measure the signals while changing the two biological signals measurement circuits in a time division fashion. And the time changing circuits indicates an influence over the measurement time.

GS23-3 Development of a motion imitation system for a humanoid robot using sound localization and dialog

Nozomi Ihara, Hideaki Itoh, Hisao Fukumoto, and Hiroshi Wakuya
(Saga University, Japan)

Humanoid robots are important because it is easy for them to replace human beings in various work environments. We have been developing an imitation learning system for humanoids to learn new skills. This is a system in which a humanoid robot learns motions by measuring movements of a human teacher. However, the measurement part of our system had some limitations. First, our previous system could not measure the movement of the human teacher when there were other people in the measurement area of the Kinect sensor. Second, in our previous system, the human teacher had to press a key on a keyboard to start the measurement. To overcome these limitations, we have made two improvements to our system by using sound localization and speech dialog. By experiments we demonstrate how our system works. Future work includes improving the accuracy of the sound localization.

January 25 (Friday), 09:00–10:00

GS23-4 Design of Sound Recognition Function for Autonomous Surface Vehicle

Takumi Nishina, Etsuro Shimizu, Ayako Umeda, and Tsuyoshi Ode
(Tokyo university of marine science and technology, Japan)

Recently, the self-driving system for automobiles and the driving support system have been actively developed. In the shipping industry, the research related to autonomous and remotely controlled ships has been carried out to reduce seafarer's work load, support the seafarer’s shortage, decrease the operational cost and improve the working environment. The current remote control system is almost constructed by only using video image and not using sound information. In this paper, we propose what kind of systems, communication methods, protocols should be used, and which voice should be acquired in order to perform plural voice and video image transmission for remotely controlled ships.

January 25 (Friday), 09:00–10:15

Room E

GS25 Tele-operation

Chair: Shinichi Sagara (Kyushu Institute of Technology, Japan)

GS25-1 Evaluation of visual image for remotely controlled ship

Ai Hoshino, Ayako Umeda, Takumi Nishina, Hidemasa Kimura, Katsuya Hakozaki,
Tsuyoshi Ode, and Etsuro Shimizu
(Tokyo University of Marine Science and Technology, Japan)

In recent years, automation technology for navigation support is widely accepted not only in the automotive industry but also in the maritime industry. Particularly the research related to autonomous and remotely controlled ships has become the major topic in the maritime field. At Tokyo University of Marine Science and Technology (TUMSAT), the research for the operation of remotely controlled ships has been started since 2015.In this paper, we report the results of experiments on the image evaluation method required for the remote-control system using wireless communication. The remote-control system is required to install sensors that replace seafarers' visual, hearing and other means in manned ship. The camera image is a substitutable method for the seafarer's vision and is thought to be one of the most necessary information for the operator of the land station who carries out remote ship maneuvering.

GS25-2 Advanced control system for dexterous dual-arm robot motion

Keita Nakamura, Kenta Tohashi, Hikaru Harasawa, and Jun Ogawa
(The University of Aizu, Japan)

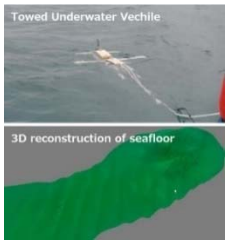
An operator for teleoperation robot generally controls the robot by seeing the image from the camera which is attached to the robot to obtain the state of the robot. However, it is very difficult for the operator to obtain information for the robot because its camera can obtain only information within the angle of view. Moreover, this method requires algorithms and hardware that realize communication band securing and highly efficient compression with low delay. On the other hand, multiple robot arms with camera enable to be efficient work and observation from various viewpoints. However, this method has a problem that interference between arms. Therefore, in this study, we propose an assistance system for operator of teleoperation robot through cooperation between real space and virtual space. By using this system, it is possible for the novice to turn the valve with dual-arm robot after practicing for an hour.

January 25 (Friday), 09:00–10:15

GS25-3 Preliminary experiment of a small towed underwater vehicle for high-speed and wide area data acquisition

Norimitsu Sakagami[1], Fumiaki Takemura[2], and Satoru Takahashi[3]
([1]Tokai University, Japan)
([2]National Institute of Technology, Okinawa College, Japan)
([3]Kagawa University, Japan)

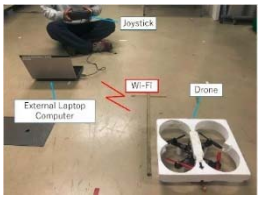
This paper proposes a small towed underwater vehicle to acquire image data at a high speed and in a wide range. 3D seafloor maps are useful for academic and practical understanding for geography, archaeology, biology, civil engineering, etc. To acquire image data, we use a small towed underwater vehicle which is faster than ROVs and AUVs. We engage in research on 1) the development and control of a small towed vehicle with wings, 2) the development and experiment of a multi-camera system, and 3) the development of an image processing algorithm to build 3D maps from the acquired images. In this paper, we focus on the development of the towed vehicle and the multi-camera system.



GS25-4 Development of Drone Control System Using Raspberry Pi and Commercial Drone Controller

Kodai Nohara, Jae Hoon Lee, and Shingo Okamoto
(Ehime University, Japan)

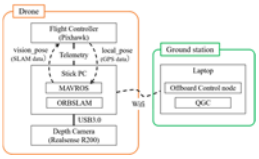
In this paper, a new control system for a drone was developed by incorporating a Raspberry Pi and a commercial flight controller. Recently, a drone has been considered as a prospective device for wide applications because it shows high mobility and quick approachability by moving through free space in the air. Even though there are many commercially available drones in the market, on account of restrictions on extending their control systems, flexibility is lacking for carrying out autonomous control and inspection task with sensors such as cameras. To solve this problem, a new appropriate drone control system and a hardware setup are proposed. Besides, the practicability of the developed drone system was confirmed through experiments.



GS25-5 Position control of a drone to fly near the wall using 3D map information and ROS

Shinya Kawabata, Jae Hoon Lee, and Shingo Okamoto
(Ehime University, Japan)

This paper presents a position control system for a drone to fly for inspection task near artificial constructions where stable position information by GPS cannot be obtained. As the main part, a recognition system using depth camera and SLAM (Simultaneous Localization and Mapping) algorithm is implemented to recognize the surrounding environment and estimate the location of the drone. The system provides the position and attitude information of the drone as well as 3D map of feature points estimated from two input data, RGB images and depth images obtained from depth camera. In order to confirm the robustness of position estimation and mapping capability about sudden and random motions, flight experiments were also conducted by manual operation in indoor environment. Then, a position control system based on position and attitude informations obtained from the proposed method was developed.



January 25 (Friday), 10:45–11:45

Room A

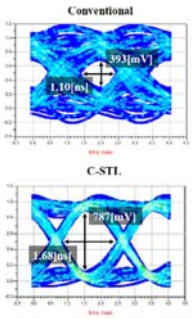
OS3 Bio-inspired theory and applications (2)

Chair: Kunihito Yamamori (University of Miyazaki, Japan)

OS3-1 Evolutionary design methodology for waveform shaping in GHz transmission line

Yuya Hoshino[1], Shumpei Matsuoka[1], Tetsuya Odaira[1], Takashi Matsumoto[1],
Ikuo Yoshihara[2], and Moritoshi Yasunaga[1]
([1]University of Tsukuba, Japan)
([2]University of Miyazaki, Japan)

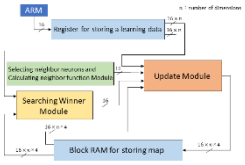
Signal integrity (SI) degradation is one of the serious problem in printed circuit boards (PCBs) operating in GHz frequency. To solve this problem, we propose a novel trace structure and its design methodology. In the proposition, capacitors are connected to a trace so that impedance mismatching points are created intentionally, which actually cause reflections of the propagating digital signal and degrade the SI. However, the reflected waves are superposed onto the signal to cancel the distortion to improve the SI degradation. Capacitors are embedded inside of the PCBs using the built-in component technology. Genetic algorithm is used to solve the combinational explosion problem in the capacitance design. As a result, we obtained the improvement of eye-pattern: the height is about 2 times higher, and the width is about 1.5 times wider than those in the conventional trace structure. These results demonstrate the effectiveness of our proposition.



OS3-2 Design and performance evaluation of a self-organizing map implemented on a Zynq FPGA

Yuuki Kawahara[1], Hiroto Komatsu[1], Takumu Shimada[1], Noriyuki Utagawa[2], Chitose Kuroda[2],
Ikuo Yoshihara[3], and Moritoshi Yasunaga[1]
([1]University of Tsukuba, Japan)
([2]Technical Research Institute, Sato Kogyo Co.,Ltd, Japan)
([3]University of Miyazaki, Japan)

In recent years, computational models of neural networks are widely used in the analysis of big data. In the neural network algorithms, self-organizing map (SOM) has been well used for the applications that need to visualize the learning results because the SOM can map the topological structure of complex data distribution onto a 2-dimensional space of neurons. However, SOM has a problem that the learning time increases as the map size and input data increase because it requires many repetitive calculations in its learning process. In order to accelerate the learning speed of the SOM, we implemented the SOM onto a Zynq FPGA, and achieved the learning speed that was 18.52 times faster than the entire software processing with Intel Core i7 3.70GHz under the map size of 60 × 60 neurons. In this paper, we describe the design and evaluation results of the proposed SOM hardware.



January 25 (Friday), 10:45–11:45

OS3-3 A Degradable Network-on-Chips Router for the Improvement of Fault-Tolerant Routing Performance

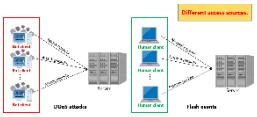
Yota Kurokawa, Toshihiro Katsuta, and Masaru Fukushi
(Yamaguchi University, Japan)

Network-on-Chip provides high computation performance for wide range of applications such as robotics and artificial intelligence. This paper deals with the issue of improving the fault-tolerant routing performance to realize high performance NoCs. The major drawbacks of the conventional fault-tolerant routing methods are low node utilization efficacy and high communication latency. To solve these problems, we propose a new NoC router architecture which enables to logically reconstruct faulty input buffers. In contrast to most conventional methods which regard routers with partially faulty input buffers as faulty, the proposed method regards them as fault-free routers with degraded input buffers. Simulation results obtained by a cycle accurate custom simulator show that the proposed method reduces the number of faulty and unused nodes and improve communication latency by up to 84% and 87%, respectively, compared with the conventional methods.

OS3-4 A bot detection method focused on HTTP request transmission behavior of clients

Ryusei Fuji[1], Shotaro Usuzaki[1], Kentaro Aburada[1], Hisaaki Yamaba[1], Tetsuro Katayama[1],
Mirang Park[2], and Naonobu Okazaki[1]
([1]University of Miyazaki, Japan)
([2]Kanagawa Institute of Technology, Japan)

Distributed denial of service (DDoS) attacks cause serious disruption to web servers; therefore, attack detection is important. In recent years, the emergence of a new phenomenon called flash events, which are spikes in network traffic from legitimate users has been seen frequently. Flash events are often recognized as DDoS attacks by mistake because of their large amount of traffic and numerous clients. However, we need to react to them in a different way, we must identify the factors of them. In this paper, we propose a bot detection system that focuses on the HTTP request transmission behavior of clients to identify increases in traffic and clients. In an evaluation experiment, we evaluated the detection accuracy using datasets of a flash event and a DDoS attack.



January 25 (Friday), 10:45–12:00

Room B

GS12 Identification and Estimation

Chair: Kenji Sawada (The University of Electro-Communications, Japan)

GS12-1 Pig Separation System and Extraction of a Pig Image Using Periodic Pattern Projection

Khin Dagon Win[1], Hsu Lai Wai[1], Kumiko Yoshida[2], and Kikuhito Kawasue[1]
([1]University of Miyazaki, Japan)
([2]Koyo Machinery Works Co., Ltd., Japan)

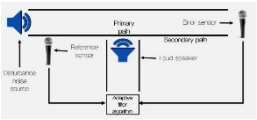
Recently, automatic pig sorting system has been applied to reduce the manual works. This system sorts pigs on considering the weight of pig. The work of pig farms are very hard and the environment of the farm is bad. Therefore, robust and easy system is required to use for the practical use in pig farms. In this paper, the weight estimation method of pig using computer vision has been developed. To enable the robust measurement on the sorting system, a laser projection with periodic pattern is used. The system detects the 3D pig information and the information can be used for the weight estimation. The advantage of our weight estimation method based on computer vision is to extract the clear image of pig that is not influenced by the environment. In this paper, the robust extraction process and the effects are introduced. The experimental results show the stability of the proposed system for a practical use in the pig farms.


Experimental Setup for Sorting System

January 25 (Friday), 10:45–12:00

GS12-2 A filtered-x VSS-SSAF active noise cancellation algorithm robust to impulsive noise

Taesu Park, Juman Song, and PooGyeon Park
(Pohang University of Science and Technology, Republic of Korea)



This paper proposes an algorithm that actively controls the noise using a variable step-size normalized subband adaptive filter (VSS-NSAF) algorithm by minimizing the mean square deviation (MSD). In the ANC environment, it is important to deal with the impulsive noise. From this point of view, this paper apply the sign algorithm. Generally, when updating the coefficients of an adaptive filter, it updates based on an error signal and an input signal, However, the algorithm applied in this paper updates the coefficients of the adaptive filter based on the sign of the error signal and the input signal. The proposed algorithm is robust to impulsive noise and is suitable for active noise cancellation. The proposed algorithm is not only robust to impulsive noise, but also enhances filter performance in terms of convergence speed and steady state error.

GS12-3 Identification of single degree-of-freedom fluctuation model of human bicycle balance

Keishi Sato, Yoshikazu Yamanaka, and Katsutoshi Yoshida
(Utsunomiya University, Japan)

In this study, we proposed a new fluctuation model that precisely reproduces the probability density functions (PDFs) of the human bicycle balance motions. For this purpose, first, we measured the time series of the roll angular displacement and velocity of the human bicycle balance motions and constructed the PDFs of them. Then, using these PDFs as the teacher data, we identified the model parameters by means of particle swarm optimization (PSO) to minimize squared residuals (SRs) between the human's PDFs from the participants and the simulated PDFs from the model. The resulting model qualities with respect to the roll angular displacement and velocity were both over 99%, meaning that the simulated PDFs were in close agreement with the participant's PDFs. The above result leads to the conclusion that our proposed model can provide a precise single degree-of-freedom fluctuation model of the human bicycle balance motions.

GS12-4 Evaluation of Muscle Coordination in Lower Extremities during Pedaling Exercise

Takuhiro Sato, Riki Kurematsu, Shota Shigetome, Taiki Matsumoto, and Tatsushi Tokuyasu
(Fukuoka Institute of Technology, Japan)

In competitive cycling, coordinated muscle activity between the lower extremities is key for high-efficiency pedaling when cyclists use clipless pedals which fix their pedals to their shoes via cleats. Few studies have focused on the muscle coordination of both legs, which contributes to pedaling skill that reduces muscle fatigue. Thus, the mechanism of muscle coordination between the legs during pedaling has not yet been clarified. In this study, we investigated the synergistic muscle activity pattern of both the left and right legs by measuring both surface electromyography and crank rotation angle during pedaling exercise. The results confirmed that the left and right leg muscles had asymmetrical muscle synergy patterns during pedaling. We considered the spatio-temporal component of muscle synergy formed by both legs to be the evaluation criteria explaining how the left and right legs coordinate for effective pedaling with clipless pedals.

January 25 (Friday), 10:45–12:00

GS12-5 Automatic generation of pseudo flyer images to construct learning dataset and its application for extracting character string region based on machine learning

Tomoko Tateyama, Ken Orimoto, and Shimpei Matsumoto
(Hiroshima Institute of Technology, Japan)

“Tame map” is a novel digital event flyer system, which revitalize regional activities based on IoT technology. However, many images on the system has much characters which has different font features, such as size, shape and line, it is hard to obtain effective information by OCR, so that the information is organized by manually. In previous study, we proposed a string automatically identification method though separating background area and other area, that each area is as a similar region respectively, based on machine learning. Though, this method has been an effective as a text area classification based on the division of the background and other areas in the event image with a simple background, but as the background becomes complicated, the method has occurred the accuracy of string recognition decreases. To propose a robust separation method from the flyer image to the background and other areas, we propose automatic generation of pseudo flyer images to label between character region and other areas, respectively.

January 25 (Friday), 10:45–11:45

Room C

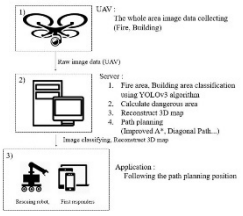
OS8 Learning and Control

Chair: Hee-Hyol Lee (Waseda University, Japan)

OS8-1 Diagonal Path Planning for Rescuing Robot and First Responders

Shin Nyeong Heo, Shengyu Lu, Shi Guo, and Hee-Hyol Lee
(Waseda University, Japan)

A key point of reducing injury rates for the first responder is making smaller time to reach people in a dangerous area. Researchers decided to apply rescuing robot and devices with first responders for dangerous area searching and avoiding an obstacle. Unmanned aerial vehicle(UAV) also start to use for disaster management. Therefore, path planning for rescuing robot and first responders are needed during dangerous area searching using UAV. In here, path planning algorithms for rescuing robot and first responders are important and it is better to use different algorithms depends on the environment. A D* lite algorithm is suitable in partially known terrain and an A* algorithm is suitable in known terrain. However, both the node-based optimal algorithm has slow path calculation time and it should be solved in an urgent situation. For these reasons, a new Diagonal Path planning algorithm is developed in this paper. The main idea of diagonal path planning is using diagonal node instead of the surrounded node from current node selection steps. However, it occurs zig-zag path problems. A solution, which called bounded curvature, solves the zig-zag problems. The bounded curvature used a Quaternion rotation and Lerp (linear interpolation) and animated smooth line instead of a zig-zag line.

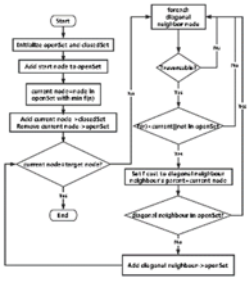


January 25 (Friday), 10:45–11:45

OS8-2 Different Bounded Curvature Methods for Diagonal Path Planning

Shi Guo, Shin Nyeong Heo, and Hee-Hyol Lee
(Waseda University, Japan)

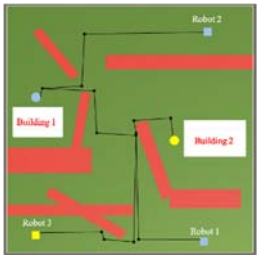
Abstract: Path planning algorithms are largely divided sample based and node-based algorithms. There are different advantages to hardware and software. The node-based algorithm is more adaptable to changeable software. Therefore, we need to develop the node-based algorithm for lower hardware specification and fast searching. The A* algorithm is a representative node-based algorithm on the known terrain. This paper proposes a diagonal A* path planning for reducing a calculation time better than an A* algorithm. The diagonal A* algorithm only thinks about the 4 diagonal nodes around the current node, not all 8 neighbor nodes around the current node for reducing calculation time. However, there are some zig-zag problems happened in the diagonal A* algorithm. We applied Bounded curvature methods for solving the zig-zag problems happened in the diagonal A* path planning and smoothing original paths. The bounded curvature methods are LERP with quaternions, SLERP with quaternions and Bezier curves.



OS8-3 Optimal Path Planning using Heap Optimization and Least Turn for Multiple Rescue Robots

Shengyu Lu, Shin Nyeong Heo, Shi Guo, and Hee-Hyol Lee
(Waseda University, Japan)

Mobile robots have been widely used in various fields such as logistic system, industrial system, and rescue operations. This paper is aimed at finding the optimal path for multiple rescue robots. In order to find the optimal path, the energy consumption and the path calculation time are taken into account. A rotation penalty is added to the A* algorithm cost function to reduce the turning points along the path to save energy and the heap optimization is adopted to shorten the path calculation time for multiple rescue robots. The proposed algorithm is simulated using Unity 3D. According to the simulation results, the proposed least turn A* with heap optimization successfully computes path with fewer turning points and the path calculation time is greatly reduced.



OS8-4 Weight Initialization on Neural Network for Faster Convergence in Neuro PID Controller

Akilesh Sai Theertham and Hee-Hyol Lee
(Waseda University, Japan)

Neuro PID Controllers, a deep learning controller, and a lot of artificial intelligence based have been used as controllers in recent times in the control system. Neuro PID controller, in particular, is widely used in control field in recent times for the characteristic changes in the plant. The faster convergence in Neuro PID Controller is needed during the characteristic changes to obtain faster settling time after each characteristic change. Weight initialization is one of the most important prerequisites for faster convergence in the Neural network. Various weight initialization techniques have been proven to be effective in faster convergence on Neural network. However, the effect of initialization was not examined in the Neuro PID controller. Investigation of weight initialization techniques such as Gaussian initialization, Uniform initialization, HE initialization and XAVIER initialization in Neuro PID controller is needed. The typical plant contains a combination of First-order lag element, Second order lag element, Integrator element and Dead time element. Suitable weight initialization method in Neuro PID Controller is needed during characteristic changes in their combination for lesser settling time.

January 25 (Friday), 10:45–12:00

Room D

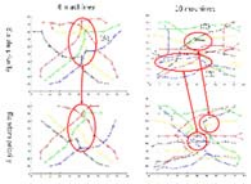
GS18 Motion planning and navigation

Chair: Ankit Ravankar (Hokkaido University, Japan)

GS18-1 Waypoint Correction Method for Collision Avoidance with Artificial Potential Method on Random Priority

Kyota Tamagawa and Yuichi Yaguchi
(University of Aizu, Japan)

This paper proposes a waypoint correction method for collision avoidance with the artificial potential method. To establish the multi-robot navigation system which includes the mix of different systems, the navigation system needs to plan paths with avoiding the collisions of each robot. Robots will move the high autonomy system which includes the waypoint navigation, but this navigation method is difficult to avoid collisions than entire path planning. For the waypoint-based path planning, we proposed the novel waypoint correction method using the artificial potential method with random priority. We also proposed speeding up algorithm for this method with k-nearest neighbor and Delaunay triangulation. From the result, our method is effective for the many robot navigation with collision avoidance.



GS18-2 Dynamic feedback control of nonholonomic cross-chained systems using transverse function approach

Tatsuro Aoki, Masato Ishikawa, and Yuki Minami
(Osaka University, Japan)

Nonholonomic cross-chained system is a mathematical model of a class of nonlinear systems, with a peculiar structure of nonlinear controllability characterized by second-order Lie bracket. The systems exhibit interesting behavior under various periodic controls, however, it is difficult to design a feedback controller, due to Brockett's theorem. Then, we design a dynamic feedback controller to the cross-chained system, by following the transverse function approach. First, we render the state space as a Lie group, so that the vector-fields would be left-invariant. Second, we introduce oscillators, which correspond to augmented state variables of the dynamic controller to be designed. Then we design a transverse function, which map a virtual target in the actual state space, then it turns to be possible to asymptotically stabilize the virtual-tracking problem using conventional continuous state feedback. Finally, we applied this approach to a spherical rolling robot.

GS18-3 HMRP: Heat Map based Robot Path Planner for Safe Navigation in Human Centric Environments

Abhijeet Ravankar[1], Ankit A. Ravankar[2], Yohei Hoshino[1], and Yukinori Kobayashi[2]
([1]Kitami Institute of Technology, Japan)
([2]Hokkaido University, Japan)

Safe navigation is important for mobile robots and many collision avoidance algorithms have been proposed. However, path planning based on these algorithms is done only on the knowledge of static obstacles, which is a serious limitation. To overcome this limitation, this paper presents a novel `HMRP (Heat Map Based Robot Path Planner)' for service robots. HMRP uses fixed external cameras to generate a heat map of different passages and tracks the net influx of people, in different times. This data is maintained in a database, and the paths are classified into hot or cold regions. This enables a robot to estimate the probability of crowd in different passages of the map and plan a relatively free path. We demonstrate the effectiveness of HMRP by comparing it with traditional techniques in actual environments. The proposed HMRP increases the safety of robot navigation by lowering the probability of collision.

January 25 (Friday), 10:45–12:00

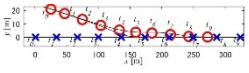
GS18-4 Analysis of motion characteristics during cylindrical knob rotation operation by index finger and thumb

Jumpei Yonezawa, Toru Tsumugiwa, and Ryuichi Yokogawa
(Doshisha University, Japan)

The purpose of the research presented in this paper was to analyze motion characteristics of the upper limb during rotation of the cylindrical knob. In this experiment, the positions of the shoulder, the elbow, and the fingertip of the index finger were measured to describe the posture of the upper limb during rotation operation. Two cylindrical knobs with diameters of 30 mm and 50 mm were tested with and without fixing the elbow. In order to investigate whether there is an influence on the upper limb the, the elbows were fixed and the same operation was performed. The displacement of the shoulder was observed independently. The displacement of the elbow and the fingertip of the index finger were observed regularly in conjunction with each other.

GS18-5 Merging trajectory generation method using real-time optimization with enhanced robustness against sensor noise

Wenjing Cao[1], Masakazu Mukai[2], and Taketoshi Kawabe[3]
([1]Sophia University, Japan)
([2]Kogakuin University, Japan)
([3]Kyushu University, Japan)



To reduce drivers' mental load and traffic congestion caused by merging maneuver, a merging trajectory generation method aiming for practical automatic driving was proposed in a past research by the authors. In this paper, the robustness of the merging trajectory generation method against sensor noises that contaminate the state variables is enhanced. The robustness was enabled by adding dummy optimization variables that relax the constraints of variables expressed by equations and barrier functions. The stage costs composed by these introduced variables were designed to generate safe and smooth merging maneuver. Effectiveness of the proposed method for a typical case was observed in the simulation results. To check if the proposed method works well under different initial conditions, 116 initial conditions were generated randomly. The proposed method solved all the cases of merging problem, while the conventional method failed in 80% of the cases.

January 25 (Friday), 10:45–11:45

Room E

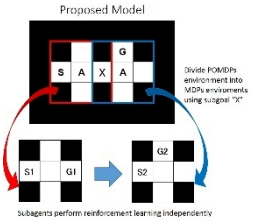
GS24 Swarm intelligence

Chair: Takaya Arita (Nagoya University, Japan)

GS24-1 Swarm-Based Subgoal Emergence for Reinforcement Learning under the POMDPs

Kohei Suzuki and Shohei Kato
(Nagoya Institute of Technology, Japan)

Perceptual aliasing is one of the major problems in applying reinforcement learning to the real world. Perceptual aliasing occurs in the POMDPs environment, where agents cannot observe states correctly, which makes reinforcement learning unsuccessful. HQ-learning is cited as a solution to perceptual aliasing. HQ-learning solves perceptual aliasing by using subgoals and subagent. The subgoals are determined by HQ-values, which are values of subgoals. However, HQ-learning takes time to learn appropriate subgoals in large environments. In this paper, we propose reinforment learning methods introducing swarm intelligence. The proposed method divides a POMDPs environment into MDPs environments using subgoals as with HQ-learning. In proposed method, subgoal candidates is generated, which makes search space of subgoal small in the proposed method. In addition, the proposed method introduces swarm intelligence in order to shorten learning time. We also report the effectiveness of our method by some experiments with mazes.



GS24-2 Control method for underwater swarm -Visible light nonlinear synchronization-

Taichi Ito, Junichiro Tahara, Masakazu Koike, and Feifei Zhang
(Tokyo University of Marine Science and Technology, Japan)

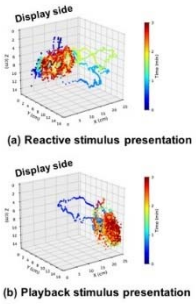
This paper describes control method for underwater swarm using nonlinear synchronization. We study underwater swarm to apply to marine resource exploration. This has important and difficult problem. There is the change in electronic circuit characteristics because of high water pressure. We considered nonlinear synchronizing systems as effective because they can be synchronized even if system time constants differ. Nonlinear synchronization is a phenomenon that is often found in fireflies. Firefly has different flashing period for each individual. However, when they come to a group, they emit light synchronously. We developed a visible light communication device using this nonlinear synchronization system. We experimented in both air and water. The results confirmed that they are synchronized even if time constant difference exists between them. Next, we used nonlinear synchronization for swarm control method. The swarm robots synchronize velocity vectors by nonlinear synchronization. We achieved group behavior of swarms in simulation and experiment.

January 25 (Friday), 10:45–11:45

GS24-3 Establishing Mutual Interaction between Artificial and Real Medaka

Yosuke Nakamoto, Hiroyuki Iizuka, and Masahito Yamamoto
(Hokkaido University, Japan)

Interacting with other individuals is important for many animals. There are many researches that present the visual stimulus to animals to investigate the social interaction. However, most of those researches use the simple video playback as the stimulus, and the mutual interaction between the individuals is not established. In this paper, we investigated if the mutual interaction between a real life, medaka, and an artificial medaka can be established. To achieve this objective, we built the experimental environment where the artificial medaka can react to the movement of the medaka which was captured by a camera. As the experimental results, the medaka was more attracted to the artificial medaka when it can react to the real medaka movements than one displayed as the playback, i.e. non-reactive artificial medaka. We showed that the mutual interaction can be established under our environment, and the mutuality contributed to attract the medaka.



Spatial distribution of real medaka.

GS24-4 Weighted dynamic time warping and its optimization by firefly algorithm

Tomoharu Nakashima
(Osaka Prefecture University, Japan)

In the computational experiments, we apply the firefly algorithm to obtain the optimal weight vector of the w-DTW for a real world problem. As the real world problem, the prediction task is employed where the amount of the rice crop yield of the year is predicted from the precipitation amount per month. The experimental results reveal the important months of the year in the context of the rice crop yield prediction.

January 23 (Wednesday), 13:00–14:00

Room B

ISBC OS3 Genome, Food Preference, Environmental Factors, and Prognostic Medication

Chair: Soichi Ogishima (Tohoku University, Japan)

ISBC OS3-1 Whole genome association study based on the questionnaire data for examining the relation among genome, food preference and environmental factors

Kazuro Shimokawa and Hiroshi Tanaka
(Tohoku University, Japan)

Various factors would be relate to the behavioral pattern of the food preferences.
In some cases, it is likely to be formed with the growth environment, and others could be decided by the genetic background such as sense of tastes and the constitutions.
It is known to relate with the genome about some of articles of taste such as alcohol in the dining habit.
We expanded the range of the investigation, to the nutrient intakes such as salinities and glucidics, based on the questionnaire data.
These customs might become factors related to the disease, in the long run.
We used 10,000 or more questionnaire data of healthy people collected in the Cohort Study of Tohoku Medical Megabank Project.
We investigated the relation between the food preference and the single nucleotide polymorphism, and also tried to explain these relation from the side of metabolism and epidemiology.

ISBC OS3-2 Prognostic medication: toward further validation of the model and new drug

Tsubasa Takizawa, Keisuke Suzuk, Remi Konagaya, and Ken Naitoh
(Waseda University, Japan)

Six nonlinear ordinary-differential equations, i.e., the bio-standard network theory, model the basic interaction between molecular/cell groups on a time axis, and simulate the number of vigorous cells during an organisms' lifespan. By utilizing this theory, we found calculation results which agreed fairly well with real medical history data for two individual cases and are currently collecting additional real medical history data with permission from the Ethics Review Committee of Waseda University. In addition, we are able to delay getting illness by controlling an increase of the density of molecular group replicating DNA just before getting illness. This illness prevention process is found in real medical care such as RNA polymerase inhibitor used to treat influenza.

January 23 (Wednesday), 14:45–15:45

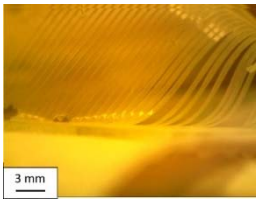
Room B

ISBC OS1 Complexity

Chair: Ken Naitoh (Waseda University, Japan)

ISBC OS1-1 Fundamental Study of the Microfabrication Method of Thin-film Material for Bio-MEMS

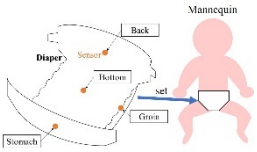
Takashi Ohya[1], Tetsutaro Kikuchi[2], Daisuke Sasaki[2], Tatsuya Shimizu[2], Katsuhisa Matsuura[2], Kenjiro Fukuda[3], Takao Someya[3], and Shinjiro Umezu[1]
([1]Waseda University, Japan)
([2]Tokyo Women's Medical University, Japan)
([3]RIKEN Thins-film device laboratory and Center for Emergent Mater Science, Japan)



The needs of biomedical microelectromechanical systems (Bio-MEMS) are getting stronger with an increase in public health awareness. In these bio-MEMS, ongoing health care monitoring system such as wearable electronics has attracted great attention. An important thing for high accuracy monitoring with these wearable electronics is degree of attachment and flexibility. In this study, we have conducted a basic research to process parylene film for changing mechanical property such as flexibility. For performing this micromachining, we used a plasma etching method and photolithography masks because the fine micro machining by using shadow mask was difficult. As a result, the parylene film that has the same micro structure as the photomask could be obtained.

ISBC OS1-2 Body temperature measurement of baby utilizing MEMS sensor sheet

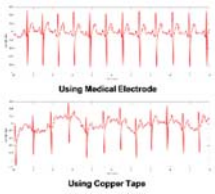
Hayato Ogawa and Shinjiro Umezu
(Waseda University, Japan)



In this study, we aimed to demonstrate that temperature above 38 ℃ can be screened as fever by using a simple temperature monitoring device for children nursery. A small temperature sensor was installed in diapers usually worn by children to investigate temperature responsiveness. From the results it was shown that detection is possible when the device is placed on the back or groin area, although flexibility is required for the device when put on the back since high pressure will be applied. We also investigated the effect of urination on temperature change. Sensing was not disturbed by urination, so it was confirmed that the temperature sensor can be mounted on a diaper.

ISBC OS1-3 Evaluation of electrode material for vital monitoring that is non-invasive to everyday life

Tsubasa Sui[1], Toshinori Fujie[2], Kayo Hirose[3], and Shinjiro Umezu[1]
([1]Waseda University, Japan)
([2]Tokyo Institute of Technology, Japan)
([3]Tokyo Metropolitan Institute of Gerontology, Japan)



In Japan, about 20% of people die of cardiac-based diseases. It is common to get medical examination in Japan. However, some cardiac diseases are paroxysmal, these paroxysmal diseases are not always can be found by medical examination. In order to discover a paroxysmal heart disease, it requires to be performed a long-term monitoring. However, the monitoring is difficult to carry out restrictive vital monitoring such as attaching a sensor to a person who is estimated healthy by medical examination. Therefore, we considered that long-term monitoring would be possible if it was non-invasive to daily life, and selected electrodes using relatively easy-to-obtain material suitable for noninvasive monitoring for daily behavior.

January 23 (Wednesday), 14:45–15:45

ISBC OS1-4 Injection system of liquid fuel including biomass solid particles

Yoshinari Wake, Yohei Naridomi, and Ken Naitoh
(Waseda University, Japan)

In our laboratory, we have been focusing on yeast and used it for overcoming environmental problems in recent years. In case that we use solid yeast mixed with liquid fuel, there are two problems: (1) difficulty of producing nanoscale particles of yeast due to grinding and (2) durability of fuel injector. Here, we conduct a durability test of fuel injector by spraying the liquid including nanoscale particles made by carbon different from yeast. We have done the durability test corresponding to car driving by using fuel injector filled with nano-carbon aqueous dispersion, which showed that the injector has no problem for driving of 1,000 km.

January 23 (Wednesday), 16:00–17:00

Room B

ISBC OS2 Complexity

Chair: Ken Naitoh (Waseda University, Japan)

ISBC OS2-1 Machine Learning as a Robust Index of the Difficulty of Mathematical Problems

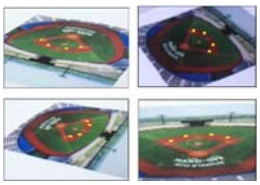
Yuto Toida[1] and Toru Ohira[1,2]
([1]Nagoya University, Japan)
([2]Mathematical Science Team, RIKEN Center for Advanced Intelligence Project, Japan)

Recent developments have enabled us to employ machine learning techniques for a wide range of research. We investigated the robust classification of mathematical problems by its difficulty using simple Deep Neural Net (DNN) models. We applied a DNN model to learn a simple binary addition and the Mackey-Glass equation, which gave us results with good precisions. On the other hand, learning for the next ((n+2)-th) Collatz-Kakutani minimal cycle length from odd number n and the associated cycle length with the same DNN model, showed us no sensible predictions. We view that this result is caused by the fundamental difficulty of the problems: the pattern of the length of the Collatz-Kakutani minimal cycle is harder to learn than that of the simple binary additions. This indicates that the levels of difficulties associated with mathematical problems may be measured by learning performances of the DNN models.

ISBC OS2-2 AR system supporting baseball game watching using SFM technology

Hideo Miyachi and Yuki Iinuma
(Tokyo City University, Japan)

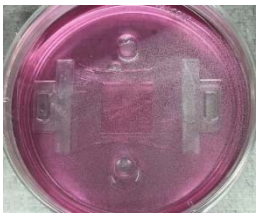
The fielding position in baseball game is delicately adjusted every pitching. The adjustment is decided by a number of factors such as current inning, out counts, scores, runners, batter's skills and pitcher's pitching course and type. Observing such adjustment is one element of enjoyment of baseball game watching. So, we have started to develop an AR system supporting baseball game watching which informs changes of the fielding position. To obtain an image for AR marker, first, a 3D model with texture is generated from multiple images taken from audience seats by using SFM (Structure From Motion) technology. Then, to acquire an ortho image as the AR marker, the model is rendered from the upward direction. As a result of the evaluation test using the AR marker, it was learned that the ortho-image created by the proposed method worked as an AR marker as well as the true ortho-image.



January 23 (Wednesday), 16:00–17:00

ISBC OS2-3 Fundamental study for measuring contractile force of cardiomyocytes by using ultraflexible film

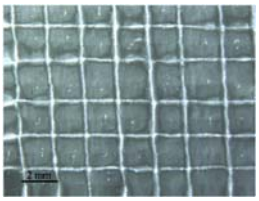
Haruki Ohtomo[1,2], Takashi Ohya[1,2], Tetsutaro Kikuchi[2], Daisuke Sasaki[2], Tatsuya Shimizu[2], Katsuhisa Matsuura[2], Kenjiro Fukuda[3], Takao Someya[3], and Shinjiro Umezu[1]
([1]Waseda University, Japan)
([2]Tokyo Women's Medical University, Japan)
([3]RIKEN, Japan)



In recent years, studies of a biohybrid devices combining living tissues with artificial structures are prosperous. These researches are expected to be applied to devices that support and extend the function of the human body. This study aimed to construct a bioactuator using human iPS cell-derived cardiomyocytes that have autonomous beat with a biocompatible, highly flexible parylene film. Parylene was deposited on a glass to be a thickness of 500 nm to produce an ultraflexible film. In order to grasp basic characteristics of the contraction of iPS cell-derived cardiomyocytes adhered to the ultraflexible film, the contractile force caused by the autonomous beat of human iPS cell-derived cardiomyocytes that are adhered to this film was measured.

ISBC OS2-4 Fabrication of gellan gum gel fibers by printing on the gelatin gel.

Ryu-ichiro Tanaka[1], Katsuhisa Sakaguchi[1], Tatsuya Shimizu[2], and Shinjiro Umezu[1]
([1]Waseda University, Japan)
([2]Tokyo Women's Medical University, Japan)



In this research, we describe a method for fabricating gellan gum gel fibers using gelatin gel. A low concentration gellan gum solution reacts with a trace amount of cation to gel. It is notable that gellan gum gel in which adhesive protein is modified due to cell adhesion can be applied as a scaffold of cells for fabricating three-dimensional tissues. Although it is possible to fabricate complex three-dimensional structures by bioprinting, it is difficult to fabricating gellan gum gel by printing like alginate gel. Therefore, in this study, we showed that it is possible to print gellan gum gel by printing gellan gum ink on gelatin gel containing cation. Since gellan gum ink turn into gel with a slight cation, it can be gelled on gelatin gel with low cytotoxicity. We investigated the fundamental characteristics of gelatin gel gel fibers preparation method using gelatin gel.