ABSTRACTS

Plenary Speech 1 (Room G)

January 20 (Wednesday), 11:10-12:00

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

What happened at the Darpa Robotics Challenge

Jun Ho Oh
(Professor of Mechanical Engineering, KAIST
Director of Humanoid Robot Research Center (Hubo Lab), Korea)

Jungho Lee
(CEO of Rainbow Robotics Inc., Korea)

The DARPA Robotics Challenge, which was motivated by nuclear disaster at Fukushima, Japan, in 2011, consisted of increasingly demanding two competitions, DRC trail and DRC final, over two years. The goal was to accelerate progress in robotics for humans and mitigate the impacts of natural or man-made disasters. The DRC Finals competition challenged participating robotics teams and their robots to complete a difficult course of eight tasks relevant to disaster response, among them driving alone, walking through rubble, tripping circuit breakers, turning valves and climbing stairs.

25 teams from worldwide participated in this demanding challenges but only three of them completed the mission in the specified time limit, one hour. Even the first place winner, team KAIST, took 44 minutes to complete. Many teams struggled a lot in operating their robots. Most of the robot experienced real ‘disastrous’ situation as falling down before entering the disaster scene or during the tasks. Some of them were from mechanical failure, the others were from operator’s mistakes or from bipedal walking difficulties, etc.

Prof. Jun Ho Oh will review the DRC final process and discuss about what the difficulties were, what happened and what we learned from the challenge. He will also explain some details and winning strategy about the robot ‘DRC Hubo’.

"This is the end of the DARPA Robotics Challenge but only the beginning of a future in which robots can work alongside people to reduce the toll of disasters," -Arati Prabhakar, DARPA Director –

Biography:

Prof. Jun Ho Oh received his B.S. and M.S. degree from Yonsei University, Seoul, Korea in 1977 and 1979, respectively. After short working at Korea Atomic Energy Research Institute as a researcher from 1979 to 1981, he received Ph.D. degree in mechanical engineering in the field of automatic control at U.C., Berkeley in 1985. He is now a distinguished professor of mechanical engineering and the director of Humanoid robot research center (Hubo Lab) at Korea Advanced Institute of Science and Technology (KAIST).

He performed many industry and government research projects in motion control, sensors, microprocessor applications, and robotics, etc. He is especially interested in mechatronics and system integration. In the recently ten years, he completed unique humanoid robot series KHR-1, KHR-2, Hubo and Hubo 2. And he also developed Albert Hubo and Hubo FX-1. Recently, he leaded team KAIST and won Darpa Robot Challenge final as first place at Pomona, Ca, USA in 2015. He is currently studying to improve the performance of humanoid robot for faster and more stable walking, robust robot system integration and light weight design, etc. He is a member of ASME and IEEE. And he also is the member of the National Academy of Engineering of Korea.

Dr. Jungho Lee received his B.S. and M.S. degree from Kookmin University, Seoul, Korea in 2000 and 2002, respectively. And also he received Ph.D. degree in mechanical engineering in the field of robotics at Korea Advanced Institute of Science and Technology (KAIST). He and Prof. Jun Ho Oh established Rainbow Robotics Inc. in 2011 for commercializing humanoid robot platform, HUBO and he is CEO of the company since 2013.

He performed many industrial and government projects in robotics field, especially He is interested in mechatronics, system integration and real-time operating system for robots. He is a leading member of team KAIST and won DARPA Robot Challenge final as first place at Pomona, Ca, USA in 2015.

Plenary Speech 2 (Room G)

January 21 (Thursday), 11:00-11:50

Chair: Hiroshi Tanaka (Tohoku Medical Megabank Organization, Tohoku University, Japan)

Artificial Life Approach to Eco-Evo-Devo based on the Evolution of Virtual Creatures

Takaya Arita
(Graduate School of Information Science, Nagoya University, Japan)

Evolutionary developmental biology, "evo-devo", emerged to integrate evolution and development in the 1980s, in which evolution is conceptualized as heritable changes in development. Recently the field is moving to a new synthesis: ecological evolutionary developmental biology, "eco-evo-devo". We believe that artificial life approach will provide new insights in the field and also the robotics field by the constructive methodology. This talk will explore the potential of such an artificial life approach based on the evolution of virtual creatures by presenting our ongoing studies with three models: 1) Metamorphosis model,2) Exaptation model, and 3) Prey-predator model.

Biography:

Prof. Takaya Arita received his B.E., M.E. and Ph.D. degrees from the University of Tokyo in 1983, 1985 and 1988. He was a research associate and then an assistant professor at Nagoya Institute of Technology, and a visiting researcher at University of California, Los Angeles. Since 2003, he has been a professor in the graduate school of information science at Nagoya University. His research interests are in the area of artificial life, in particular in the following fields: evolution of language, evolution of cooperation, interaction between evolution and learning, and swarm intelligence. He is the author of several books on artificial life.

January 20 (Wednesday), 09:00–10:30

Room A

OS9 Intuitive Human-System Interaction

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

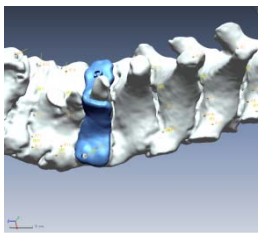
OS9-1 Experimental study on realistic sensation in tele-communication with ultra-resolution video by multiple cameras on tiled display wall

Yasuo Ebara
(Osaka University, Japan)

In tele-communication over the Internet, the space sharing by displaying of wide-area and high-quality video is effective in order to realize the high-realistic sensation. However, the effective solution has not been still proposed even though the ordinary presence and the realistic sensation in real environment have been insufficient in commonly-used tele-communication system. In existing studies, we have constructed the tele-communication environment to display an ultra-resolution video on tiled display wall by multi-transmitting each video which captured by multiple cameras. On the other hands, the need for objective and quantitative evaluation on realistic sensation that participants feels in tele-communication has been increasing. In this paper, we have conducted experimental study by subjective evaluation to analyze the effectiveness of realistic sensation for participants in this environment. From experimental results, we have found that this environment has a strong tendency to give higher realistic sensation for estimators through tele-communication.

OS9-2 A pre-operative plan assistance system of surgical instruments and metal plates for disease of bone

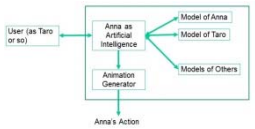
Akio Doi[1], Hiroki Takahashi[1], Toru Kato[1], Taro Mawatari[2], and Sadafumi Ichinohe[3]
([1]Iwate Prefectural University, Japan)
([2]Hamanomachi Hospital, Japan)
([3]Iwate Medical University, Japan)



To efficiently provide surgical instruments and metal plates for treating disease of bone, such as fractures, a 3D-based pre-operative planning system was developed. Our system was used to manufacture tailor-made surgical instruments and metal plates for providing optimal surgery and care. The 3D information of human bone structure was generated by using CT scans. The CAD (Computer Aided Design) systems were used in designing the instruments and plates. In order to verify the shapes and application of them, we utilize computer analysis in the CAD system. The manufactured tailor-made bone plate was used to treat the fractures and the bone deformity of dogs, and observed the post-operative recovery.

OS9-3 Computer simulation of human-robot interaction in natural language

Rojanee Khummongkol and Masao Yokota
(Fukuoka Institute of Technology, Japan)



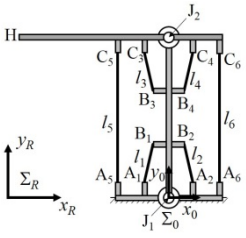
Human-robot interaction in natural (or human) language is simulated as intelligent management of English conversation between a humanoid robot and several kinds of people on imagination. The robot is destined to help a disabled old man by comprehending his intention through dialogue and its final response to his intention is animated graphically. When the robot finds any problem in every situation in helping him, it tries to solve such a problem by employing its knowledge and the information acquired by inquiry to the people. This is an application of integrative multimedia understanding based on intermediate knowledge representation in Lmd, the formal language proposed in Mental Image Directed Semantic Theory.

January 20 (Wednesday), 09:00–10:30

OS9-4 An experimental study on effect of biarticular muscles in an antagonistically actuated robot arm

Tetsuya Morizono[1], Kenji Tahara[2], and Hitoshi Kino[1]
([1]Fukuoka Institute of Technology, Japan)
([2]Kyushu University, Japan)

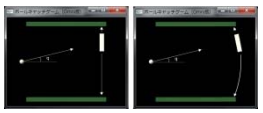
This paper experimentally investigates effect of biarticular muscles in PTP control of an antagonistically actuated robot arm. Three typical combinations of muscular forces are considered as experimental conditions, and performances of those conditions are compared each other through simulation examples. The simulation results show that a particular condition gives very similar settling times of control to those of the case where the robot is controlled without biarticular muscles (with monoarticular muscles only). No significant difference is found in the time among the other two conditions. This observation suggests possibility that biarticular muscles can play a major role in PTP control of the robot under an assumption.



OS9-5 A preliminary study on learning effect in a contact positioning task in a virtual environment

Raita Miyaji, Yusuke Tomonari, and Tetsuya Morizono
(Fukuoka Institute of Technology, Japan)

This paper deals with investigation of learning effect in a contact positioning task in which precise position control is required only at the moment of contact. The task considered in this paper is catching a ball by a paddle in a virtual environment. In the task, planar two dimensional movement is given to the ball, and two kinds of paddle movement are related to operation of a haptic device as experimental conditions. The experiment under attendance of several operators yielded three observations on absolute position errors at the moment of contact between the ball and the paddle, and those observations suggest existence of learning effect obtained through long-term experience of operation.



OS9-6 The Trial Operation of the Motion Capture to Trace Female Divers in the Underwater and the Trial Production of the Motion Viewer for Developing the Virtual Diving Experience Learning System

Yasushi Hosokawa[1], Daiki Urata[1], Akio Doi[2], Toyoo Takata[2], and Yoshihiko Abe[2]
([1]National Institute of Technology, Hachinohe College, Japan)
([2]Iwate Prefectural University, Japan)

For the first time in the world, we developed the virtual diving experience learning system of “Ama” who are Japanese traditional female fishing divers. This system simulates diving of “Ama” in a virtual space using the diving interface by accelerometer and gyroscope. This interface detects the diving motion and it outputs movement for virtual space. Diving motion is hand motion of breaststroke on standing. It became a possible that a learner performs a diving motion intuitively. However, in this system, a learner cannot learn how to move the hand or arm of Ama, or the body in detail. From this, we tried the development of the system which can reproduce an operation of actual diving of Ama in the virtual human body in a virtual space. Then, we performed underwater motion capture of Ama. Next, we created the virtual human body of Ama. And we made motion viewer as an experiment using the data of movement, and reproduced motion of actual Ama.

January 20 (Wednesday), 09:00–10:30

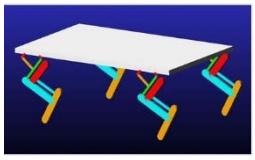
Room B

GS11 Mobile robots

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

GS11-1 Multi-body dynamics simulation and gait pattern analysis of a bio-inspired quadruped robot for unstructured terrains using adaptive stroke length

D Vishal and P V Manivannan
(Indian Institute of Technology Madras, Chennai, India)



This paper presents the Finite Element Analysis, MBD simulation and gait pattern analysis of a bio-inspired quadruped robot. A novel power transmission mechanism with varying gear train assembly has been designed for generating different gait structures, for unstructured terrain. The adjustable length of the lower link aids in improving the stability of the robot (or) make the robot to travel longer distances within a stipulated time. Multibody Dynamics simulation (MBD) has been performed using MSC/ADAMS for torque, speed, energy and force analysis. The novel mechanism designed was able to successfully negotiate unstructured obstacles of different heights and these results have been presented in the paper which proves a direct relationship between stroke length, lift-off distance and gear center distance. The experimental setup of the robot limb has been fabricated initially with a scaled down acrylic model and then extended to a full scale aluminum structure model.

GS11-2 Control of self-organizing robots with switching role: Multi columns formation moving

Yuta Ueda, Kenji Sawada, and Seiichi Shin
(The University of Electro-Communications, Japan)

Self-organizing robots cooperate with each other and achieve complicated order. An example of self-organizing robot is Kilo-bot, which moves via vibration motors and communicates with other Kilobots via infrared communication. Typical formation control methods of self-organizing robots are based on leader-follower systems in which their role is fixed. This study proposes a new formation control method based on switching role. Each robot has two roles: Marker and Mover. Furthermore, each robot has their priority among robots which depends on their own ID. In the proposed method, transmitting and receiving their ID and role information via infrared communication, each robot switches their role and decides their action. This paper veri-fies the usability of the proposed method by realizing more complicated formation control than that realized in the previous research of the current authors. We implement two simple functions to robots and perform a type of formation moving: multi-columned formation moving inspired by an English nursery rhyme “London Bridge is falling down”.

GS11-3 Development of remotely operated unmanned boat with long-range Wi-Fi

Kyohei Takahata[1], Etsuro Shimizu[1], Ayako Umeda[1], Tsuyoshi Oode[1],
Toshio Tsuchiya[2], and Yoshihiko Tamura[2]
([1]Tokyo University of Marine Science and Technology, Japan)
([2]Japan Agency for Marine-Earth Science and Technology, Japan)

Remotely monitored and operated unmanned vessels are effective for the working environment improvement of vessel crew, the solution of crew shortage, and the efficiency of marine survey. However, the development of unmanned vessels is delayed. One of factors is the communication problem. A bit rate of the current maritime communication using the satellite communication is about several hundred kbps from vessels. Therefore, this bit rate is insufficient for remote monitoring and operation. In order to solve this problem, a use of a long-range Wi-Fi communication is proposed. In this paper, the unmanned system capable of remote monitoring and operation with long-range Wi-Fi is developed and examined at Tokyo bay.

January 20 (Wednesday), 09:00–10:30

GS11-4 Robot localization and map construction using sensor data (Withdrawal)

Yekaterina Polichshuk
(Vladimirovna, Kazakhstan)

GS11-5 HMRP: Heat map based path planning for multiple mobile service robots in dynamic environments (Withdrawal)

Abhijeet Ravankar, Ankit Ravankar, Yukinori Kobayashi, and Takanori Emaru
(Hokkaido University, Japan)

GS11-6 Improvement of GPS performance using SNR information analysis

Jong-woo An, Yun-Ki Kim, Jin-Ho Kim, Yo-Seop Hwang, and Jang-Myung Lee
(Busan national university, Korea)

In general, GPS signal, structure, these errors geometric error occurs, the degree is severe enough low-cost GPS.Of course using a GPS or RTK system, it is possible to know the position accuracy location estimates.But, such as these systems have the disadvantage that high cost and need to reference stations station for adjust the position.Recently, intelligent robot industry which is mobile function equipped to provide more convenient services to users is expanding.In order to provide move convenient and accurate service to users, the process. In the activation of intelligent robot industry, many costly for the exact position estimation of the robot, it becomes an obstacle. In this paper, traceback the GPS receiver location by using the pseudo distance between the satellite ephemeris and satellite receiver. We will progress the pre study to obtain precise position by using the SNR value obtained by the estimated value.

Room C

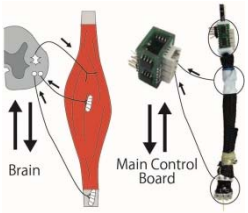
GS12 Neural networks & Intelligent control

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

GS12-1 Development of an embedded sensor system as pneumatic artificial muscle proprioceptors

Hirofumi Shin, Hajime Saitoh, Takahiko Kawakami, Satoshi Yamanishi, Shuhei Ikemoto, and Koh Hoseda
(Osaka University, Japan)

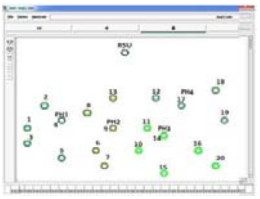
Spinal reflexes are greatly contributing to deal with fast physical interactions without waiting for commands of higher level control systems in motor control.Therefore, to realize humanlike motions of musculoskeletal robots, it is necessary to mimic not only humanlike musculoskeletal systems but also nerve systems bearing spinal reflexes. To this end, sensors that measure and encode body movements similar with proprioceptors of humans will be required as the starting point of spinal reflexes. In this study, we develop artificial muscle proprioceptors to reproduce spinal reflexes of musculoskeletal robots by a biomimetic approach. In particular, we focus on musculoskeletal robots driven by pneumatic artificial muscles and design an artificial muscle spindle and an artificial golgi tendon organ which are integrated with a pneumatic artificial muscle. As the implementations of these sensors, a compact local measuring system consisting of a microcomputer and amplifiers is developed to easily install and organize the sensors.



January 20 (Wednesday), 09:00–10:30

GS12-2 Simplified node decomposition and platoon head selection: a novel algorithm for node decomposition in vehicular adhoc networks (vanet)

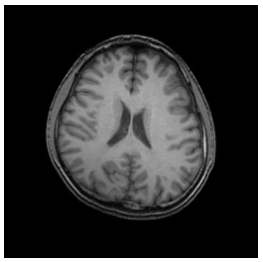
R.Prakash and P.V.Manivannan
(Indian Institute of Technology Madras, Chennai, India)



This paper presents a novel Simplified Node decomposition and Platoon (SNAP) head selection cluster based routing algorithm for Vehicular Ad hoc Networks (VANET) Communication. The algorithm partition's the given network into platoons (clusters) based on coverage range of wireless node. It uses SPSS statistical software tool for platoon decomposition and also to determine the platoon head (PH). The number of iterations required for selection of PH is found to be minimum, irrespective of the number of network nodes. The platoon is controlled by its platoon head (PH) and the data transfer happens locally between the platoon nodes and its head. The platoon head alone communicates with the road side unit (RSU) and avoids multiple data link between the individual nodes of platoon to RSU. The performance of SNAP algorithm has been verified using NS-2 network simulator and found to increase the transmission speed and overall efficiency of network.

GS12-3 Deep feedback GMDH-type neural network and its application to medical image analysis of MRI brain images

Tadashi Kondo, Junji Ueno, and Shoichiro Takao
(Tokushima University, Japan)



The deep feedback Group Method of Data Handling (GMDH)-type neural network is applied to the medical image analysis of MRI brain images. In this algorithm, the complexity of the neural network is increased gradually using the feedback loop calculations and the deep neural network architecture is automatically organized so as to fit the complexity of the medical images using the prediction error criterion defined as Akaike's Information Criterion (AIC) or Prediction Sum of Squares (PSS). The recognition results show that the deep feedback GMDH-type neural network algorithm is useful for the medical image analysis of MRI brain images because the optimum neural network architectures fitting the complexity of the medical images are automatically organized.

GS12-4 Medical image analysis of abdominal X-ray CT images by deep multi-layered GMDH-type neural network

Tadashi Kondo, Junji Ueno, and Shoichiro Takao
(Tokushima University, Japan)

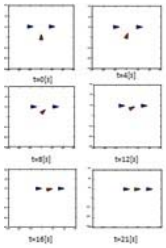
In this study, a deep multi-layered Group Method of Data Handling (GMDH)-type neural network is applied to the medical image analysis of the abdominal X-ray CT images. The deep neural network architectures which has many hidden layers are automatically organized using the deep multi-layered GMDH-type neural network algorithm so as to minimize the prediction error criterion defined as Akaike's Information criterion (AIC) or Prediction Sum of Squares (PSS). The characteristics of the medical images are very complex and therefore the deep neural network architectures are very useful for the medical image diagnosis and medical image recognition. In this study, it is shown that this deep multi-layered GMDH-type neural network is useful for the medical image analysis of abdominal X-ray CT images.

January 20 (Wednesday), 09:00–10:30

GS12-5 A control law for vehicle merging inspired by dragonfly's behavior

Kei Yamaguchi[1], Naoyuki Sakuraba[2], and Kazuyuki Ito[1]
([1]Hosei University, Japan)
([2]Tokyo Electric Power Company, Japan)

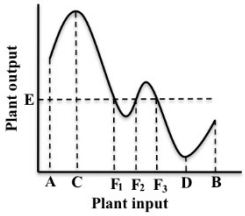
Insects can behave adaptively in the complex real world in spite of the limited size of their small brains. They reduce computational costs of their brain by utilizing various properties of the real world, and their intelligent behaviors are realized through simple strategies. The behavior of a dragonfly when chasing a prey is an example of these strategies. In this study, we focus on the task of vehicle merging and we applied the dragonfly's strategies to control the vehicle. We propose a simple control law inspired by the strategies of dragonflies, and we conducted simulations to demonstrate the effectiveness of the proposed control law.



GS12-6 Remarks on folding behavior and plant Jacobian of neural network direct controller for its stability

Takayuki Yamada
(Ibaraki University, Japan)

Simulation results of our previous papers show a neural network direct controller performs well by the use of folding behavior. This paper presents an analytical approach for the questions related to the folding behavior. The intermediate value theorem answers these questions. There is the suitable plant input for any plant output although the plant is nonlinear. The same sign of the plant Jacobian can be selected for any plant output. We can use the same sign of the neural network parameter η although the plant is nonlinear. This paper also presents how we tune the neural network parameter η based on the above analytical approach. The approach of this paper deals with the static continuous nonlinear plant. However, I believe that it is helpful to understand the neural network performance for the dynamical plant. This paper also presents future works based on this analytical approach.



Room D

OS20 Visualing Information: machine learning approaches

Chair: Kiyota Hashimoto (Prince of Songkla University, Thailand)
Co-Chair: Sachio Hirokawa (Kyushu University, Japan)

OS20-1 Optimizing team strategies for corner-kick situations in RoboCup soccer 2D simulation

Thomas Henn[1], Jordan Henrio[2], Tomoharu Nakashima[2], and Satoshi Mifune[2]
([1]Ecole Internationale des Sciences du Traitement de l'Information, France)
([2]Osaka Prefecture University, Japan)

In the domain of the Soccer simulation 2D league of the RoboCup appropriate player positioning against the opponent team formation is an important factor of soccer team performance. In this work we propose to use a meta-heuristic algorithm called the Firefly Algorithm to optimize player positioning. We used sequential Bayesian estimation as well as parallelization to reduce the necessary number of time-consuming simulated soccer matches. As a first trial of our system, we optimized the corner-kick formation. Preliminary results in optimizing the corner-kick formation are not advantageous over the previous handmade formation due to the difficulty in tuning the meta-heuristic algorithm parameters. However, it is also shown that the proposed system is effective in handling a high load of simulations over the span of weeks and therefore is promising to be usable to optimize player positioning.

January 20 (Wednesday), 09:00–10:30

OS20-2 Evaluation of Integrity of WordNet by Combining Word Similarity and Random Forest

Takuya Hirao[1], Nao Wariishi[1], Kiyota Hashimoto[2], Takahiko Suzuki[1], and Sachio Hirokawa[1]
([1]Kyushu University, Japan)
([2]Prince of Songkla University, Thailand)

The Japanese WordNet contains erroneous synonyms. We have been exploiting the detection of the erroneous synonyms in the Japanese WordNet. In a previous study, it is shown that the combination of word2vec and decision tree is promising in distinguishing synonyms and related words from unrelated words. In this paper, we introduce an error detection method based on the combination of word2vec, WordNet structure and Random Forest. We discuss current results and possible improvement.

OS20-3 Steep Increase Trigger of Citation

Tetsuya Nakatoh[1], Hayato Nakanishi[1], Toshiro Minami[2], Kiyota Hashimoto[3], and Sachio Hirokawa[1]
([1]Kyushu University, Japan)
([2]Kyushu Institution of Information Sciences, Japan)
([3]Prince of Songkla University, Thailand)

In scientific research, the literature search is essential activity. For this purpose, it is important for us to choose good articles efficiently from the database of scientific articles. However, the number of articles being published is enormous therefore we cannot read or evaluate all articles. The citation count of an article is convenient measure for objective evaluation. We regard the article which have many citation count as of great value. The present paper is an experiment of hypothesis that the article of which citation count increases steeply has importance. We confirmed that the steep increase trigger of the citation count is an article which cite the article. One article with steep increase was chosen as experiment in field of “bibliometrics”.

OS20-4 Analysis of the diachronic relations of adjective antonym pairs in wine tasting notes

Brendan Flanagan[1], Carita Paradis[2], Kiyota Hashimoto[3], and Sachio Hirokawa[1]
([1]Kyushu University, Japan)
([2]Lund University, Sweden)
([3]Prince of Songkla University, Thailand)

Antonymic adjectives in discourse can be used to express opposing properties of a meaning dimension. An example of this can be found in wine tasting notes, where the characteristics of the wine are described using a number of different dimensions. In this paper, we examine the change in use patterns over time of antonym pairs in wine tasting notes. We examine the change in the use of thick and thin by analyzing words that co-occur in the same tasting note as thick or thin and generate visualizations for diachronic analysis.

January 20 (Wednesday), 09:00–10:30

OS20-5 Generation and Evaluation of Quizzes from Manyo-Shu and Kokin-Waka-Shu

Hitoshi Inoue[1], Hiroto Nakae[1], Kazuhisa Noguchi[2], Kiyota Hashimoto[3], Akira Aiba[4], Sachio Hirokawa[1]
([1]Kyushu University, Japan)
([2]Kyushu Institute of Technology, Japan)
([3]Prince of Songkla University, Thailand)
([4]Shibaura Institute of Technology, Japan)

Training exercises are indispensable to settlement of knowledge gained through learning. It is a hard task to prepare a large number of quizzes, particularly when the difficulty levels are required for each quiz. When there are a great deal of problem pools, and there are results of the learner who took an examination by those, it is possible to evaluate degree of difficulty of each problem. But degree of difficulty of newly added problems cannot be understood beforehand. The present paper applies the machine learning method SVM (support vector machine) to construct a model that distinguishes positive document and negative document, given a training data. We use the the predicted score of a document for the difficulty estimation. We use this model to solve a quiz which asks if a poetry belongs to Manyo-Shu or to Kokin-Waka-Shu, both of which are the two famous anthologies of Japanese poetry (waka) dating from 8 century.

Room E

GS7 Data mining

Chair: Nobuyasu Ito (The University of Tokyo, Japan)

GS7-1 Detecting Thai stock anomaly using visualization and news sentiment classification

Apinan Chattupan and Ponrudee Netisopakul
(King Mongkut's Institute of Technology Ladkrabang, Thailand)

Thai investors follow the stock news to gain information for investment. However, one obstacle for processing the information is that there is no collection of business news corpus and lexicon. There are two main objectives for this research. First, to verify that there is a real relationship between Thai stock news and stock price and volume changes using graph visualization and hypothesis testing. Second, to classify Thai stock news into the positive, neutral or negative news, based on text words. An over one-year collection of Thai stock news from a broker are classified. The best correctness rate obtained from decision tree model is 75.8%.

GS7-2 Research of guidance support system for physically handicapped person in the station

Kei Takeuchi and Hiroyuki Nishiyama
(Tokyo University of Science, Japan)

Japan has become a super-aging society. Year after year the number of senior citizens has increased, and the proportion of physically handicapped persons among them is increasing. Handicapped persons live with difficulty in the activities of daily living, such as walking or writing over a long period of time. Barrier-free of the station is defined a new index. As a result, 40% of stations are required to be barrier-free. We conducted a survey regarding barrier-free stations for physically handicapped persons and found that about 60% of people would suffer in changing to barrier-free stations. Therefore, the purpose of this study is to construct a navigation system that takes into account the barrier-free locations within the station by using a smartphone. This study focuses on indoor location estimation. The experiment environment of the present study is the JR Ueno Station and the data is based on the radio-wave strength of the wireless LAN in the station yard. We propose a method to estimate the indoor location using machine learning. In particular, in the results that we have studied, there is a wireless LAN 59 of the wireless LAN in the station yard.The data collected with the radio signal intensity of the 39 of the wireless LAN to the training data. Training data to teach an estimated position as the basic statistic characteristic of the radio signal intensity of every five seconds for each base station. As a result, the position estimation that we have proposed was 48% accurate. In this study we determine six points to treat as one area. Therefore, Ueno Station was divided into five areas. As a result of learning from data for the five divided areas, the estimation accuracy was 88%. Indoor locations can't be estimated accurately, but we found that our approach can estimate at a point in proximity

January 20 (Wednesday), 09:00–10:30

GS7-3 Aspect evaluation by using overall rating and category information of reviews (Withdrawal)

Hatsuho Sakai and Ryosuke Saga
(Osaka Prefecture University, Japan)

GS7-4 A study of integrity of the name space for open data

Tadanori Hisanaga, Takayasu Fuchida, Chong Guo, and Takashi Ishii
(Kagoshima University, Japan)

In recent years, the use of big data and open data is promoted, a number of organizations are working to take advantage of open data, including national and local governments. In addition, IPA has been promoted the development of Infrastructure for Multi-layer Interoperability (IMI) [1], the use of open data and big data in Japanese is drawing an attention. However, in the use of the method of the present situation of open data, the applications are biased to a specific purpose and some original URIs[2] are used as namespace and they does not reach to take advantage of the wide variety of data yet. In this study, by converting the number of unique namespaces that are used at present into the common namespace, we propose a unified method of utilizing a variety of open data. Also we develop an application using HTML5 in order to introduce an actual utilizing of the specific open data.

GS7-5 Emotional Estimation and Automatic Construction of Emotional Corpus by Naive Bays (Withdrawal)

Ryuichi Matoba and Yusaku Funane
(National Institute of Technology, Toyama college, Japan)

GS7-6 Respiratory Diseases Retrieval System

Weenawadee Muangon
(Silpakorn University, Thailand)

Respiratory disease descriptions are always stored in free text which content is hard to understand. A symptom of respiratory diseases can be noticed by the patient or doctor such as sinusitis, conjunctiva and cough. These symptoms might be used to describe multiple respiratory, often the diagnosis confused that lead to carelessness, the patients are not aware to treat. In this research, we proposed an information retrieval model to detect possible respiratory diseases related to queried symptom. The model analyzes the structure index and the appropriately weight to make the precision to the retrieval system. Experimentally, we have some formal tests set that cover all of respiratory diseases to study the performance of the system. The result of this research shows that acceptable precision value in retrieving respiratory diseases is about 60 percent in mean average precision.

January 20 (Wednesday), 13:00–14:30

Room A

OS13 New trends in text processing

Chair: Kiyota Hashimoto (Prince of Songkla University, Thailand)
Co-Chair: Sachio Hirokawa (Kyushu University, Japan)

OS13-1 An Investigation of Effectiveness of a Method to Collect Synonyms in the Recipe using Word2Vec.

Kenta Itani[1], Makoto Okada[1], and Kiyota Hashimoto[2]
([1]Osaka Prefecture University, Japan)
([2]Prince of Songkla University, Thailand)

In order to use the big amount of the data efficiently, arranging and classifying the data is important. It is necessary to classify words so as to classify the data automatically and correctly. Therefore, we have investigated effectiveness of a method to collect synonyms in the recipe data using “word2vec”. “Word2vec” is a tool that can take a text corpus as input and produces the distributed representations of words as output. Distributed representations of between words and synonyms may well be similar. Also, the recipe data is provided by cooking website named “cookpad”. In this paper, we report this effectiveness and problem revealed by comparative experiments with “word2vec”.

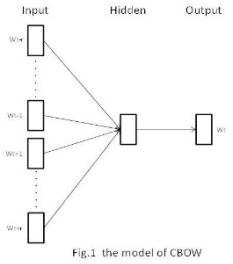
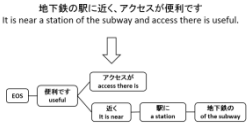


Fig.1 the model of CBOW

OS13-2 A Method to Estimate Evaluations of Specific Targets in the Travelers' Reviews

Kosuke Kawabata[1], Makoto Okada[1], and Kiyota Hashimoto[2]
([1]Osaka Prefecture University, Japan)
([2]Prince of Songkla University, Thailand)

In these days, it is usual to reserve accommodations on travel information sites and general to refer travelers’ reviews at that time. However, it is difficult to search suitable information by oneself because there is a huge amount of reviews on web sites. Thus, it is required to immediately obtain information of evaluations and shows which topics of hotels are evaluated. We assumed detailed evaluations of several topics are adequate to this requirement. Therefore, these evaluations are important for travelers’. In this paper, we investigated what problems would be found when we estimated polarity of each topic in each sentence. In addition, we proposed a method to estimate the polarity with dependency relationship. As a result of investigation, we found that accuracy of estimation deteriorated due to dropping evaluation and causes why the accuracy deteriorated resulted from ellipsis of words and dependency relationship.



OS13-3 Recommendation from access logs with ensemble learning

Takashi Ayaki, Hidekazu Yanagimoto, and Michifumi Yoshioka
(Osaka Prefecture University, Japan)

Many recommendation systems find similar users based on the profile of the target user and recommend products that he/she may be interested. The profile is constructed with purchase histories. But histories of new customers are not stored and it is difficult to recommend products to them. The problem is called a cold start problem. We propose a recommendation method using access logs because the access logs are gathered more easily than purchase histories. In this study we construct user's profiles using product categories browsed by his/her from access logs and predict the purchase product with Gradient Boosting Decision Tree (GBDT). And we carry out evaluation experiments using access logs in a real online shop and discuss performance of our proposed method comparing with conventional machine learning, Support Vector Machine (SVM). We confirmed the proposed method achieve higher precision than SVM over 10 experiments.

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OS13-4 Customer State Estimation with Poisson Distribution Model

Hidekazu Yanagimoto
(Osaka Prefecture University, Japan)

In this paper a new access log analysis is proposed which estimate both an active state and an inactive state from observations simultaneously. I improve burst analysis to detect not only active states but also inactive states from observations. Speaking concretely, I construct a generative model that assumes the observations, which mean event frequencies in this paper, are generated under some Poisson distributions. The Poisson distributions include some distributions including their parameters which are less than average frequency. A cost function, which consists of log likelihood and state transition cost, is defined and activation states are estimated from the observations minimizing the cost function. The proposed method was applied to query occurrence data in access logs and I confirmed the proposed method could find active states and inactive states simultaneously.

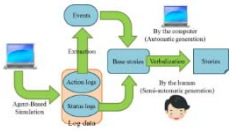
OS13-5 Analysis of Infrequent Words in Tourism Blogs

Tetsuya Nakatoh[1], Kiyota Hashimoto[2], and Sachio Hirokawa[1]
([1]Kyushu University, Japan)
([2]Prince of Songkla University, Thailand)

According to Zipf's Law, more than half of the words that occur in a set of documents of natural language occur only once in the documents. Those infrequent words have been excluded in the conventional text mining analysis. However, those rare words are meaningful and valuable, particularly as tourism information of each region. The present paper proposes a measure to evaluate those rare words based on the search count on the Web. If the search count of a word with a region is almost equal to that of the word, the word should be very particular to the region. The present paper extracted all the infrequent words that appear with the verb "eat" from 7,917,385 blogs on Kyushu area and evaluated the regionality. We analyzed the appearance situation of many rare regional interesting foods.

OS13-6 A novel semi-automatic story generation based on agent-based simulation

Kiyohito Fukuda, Naoki Mori, and Keinosuke Matsumoto
(Osaka Prefecture University, Japan)



Recently, automatic novel generation and automatic story generation have attracted considerable interest as a challenging problem in computer science fields. With a view towards realizing effective automatic novel and story generation, a number of studies on automatic novel and story generation have been reported. However, there has been a problem in that these previous studies have only succeeded in generating lower quality novels rather than original ones. In this study, we propose a novel semi-automatic story generation method that utilizes log data of agent-based simulation (ABS). This is based on the approach that “a human generates novels in cooperation with the computer”. The computational experiments are carried out to confirm the effectiveness of the proposed method.

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Room B

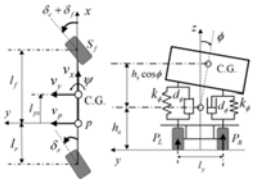
OS6 Elemental Technology for Vehicles

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

OS6-1 Improved Control Scheme for Rollover Prevention of Heavy Vehicles

Daiki Yamamoto[1], Shunya Ukeda[1], Yuichiro Taira[2], and Masahiro Oya[1]
([1]Kyushu Institute of Technology, Japan)
([2]Sojo University, Japan)

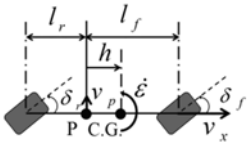
In the paper, we develop an improved adaptive rollover prevention controller for heavy vehicles. At first, we propose a design scheme of an improved ideal vehicle model. In the ideal vehicle model, for the small rollover index, good steering performance can be maintained. Only in the case where the rollover index exceeds a dangerous value, rollover prevention control works in the ideal vehicle model. Next, an adaptive tracking controller is developed so that the behavior of the actual heavy vehicle can track that of the ideal vehicle model.



OS6-2 Adaptive longitudinal velocity and steering controller for vehicles

Koki Matsushita, Hidetaka Ohta, Masuhiro Nitta, and Masahiro Oya
(Kyushu Institute of Technology, Japan)

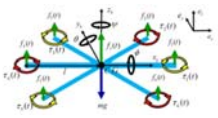
In this paper, we propose an adaptive controller for both longitudinal and lateral motions of vehicles. The vehicle system has some unknown parameters and includes nonlinear characteristics in its longitudinal and lateral coupled dynamics. Therefore, it is difficult to apply an adaptive control scheme which assures the robust stability for the variation of the vehicle parameters. To address the problem, we develop a new expression of the vehicle dynamics to which adaptive control scheme can be easily applied. Based on the new expression, we propose a new adaptive scheme to improve the stability of the longitudinal dynamics of the vehicle as well as its lateral motions simultaneously. The performance of the proposed controller is evaluated through numerical simulations.



OS6-3 Robust Trajectory Tracking Control of Multirotor Helicopter with Unknown Thrust and Drag Coefficients

Panfeng Shu[1], Hideki Wada[2], Katuhiro Okumura[3], and Masahiro Oya[1]
([1]Kyushu Institute of Technology, Japan)
([2]Shin-Nippon Nondestructive Inspection co.,Ltd., Japan)
([3]Fukuoka Industrial Technology Center, Japan)

In this paper, we propose a robust trajectory tracking controller for multirotor helicopter with six rotors. The developed controller can ensure good control performance even when there exist variations of not only the mass and moment of inertia of multirotor helicopter but also the thrust and drag coefficients. Moreover, the proposed robust controller has simple construction, and it is suitable for practical applications. Finally, to confirm the usefulness of the proposed controller, numerical simulations are carried out.



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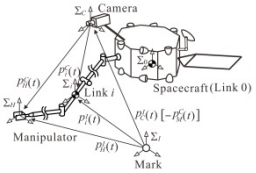
OS6-4 Observer-based tracking control of a spacecraft-manipulator system using a camera mounted on its spacecraft

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

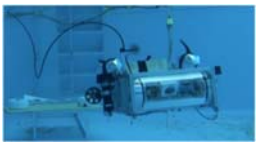
This paper deals with a tracking control system for a space robot with a manipulator. Many tracking controllers need the posi-tions of the robot body and the manipulator hand with respect to an inertial coordinate system. In order to measure them, a visual sensor using a camera is frequently used. However, there are two difficulties in measuring them by means of a camera. The first one is that a camera is mounted on the robot body, and hence it is difficult to directly measure the position of the ro-bot body. The second one is that the sampling period of a vision system with a general-purpose camera is much longer than that of a general servo system. In this paper we develop a state observer that overcomes the two difficulties, and design a tracking control system with the observer. Simulation results demonstrate the effectiveness of the proposed observer.



OS6-5 Development of an altitude maintenance system for underwater robots using laser beams

Ryo Taba[1], Keita Hirayama[1], Fumiaki Takemura[1], Suriyon Tansuriyavong[1], Kuniaki Kawabata[2], Shinichi Sagara[3], and Kei Ogasawara[4]
([1]National Institute of Technology, Okinawa College, Japan)
([2]Japan Atomic Energy Agency, Japan)
([3]Kyushu Institute of Technology, Japan)
([4]INCORPORATED FOUNDATION OKINAWA PREFECTURE ENVIRONMENT SCIENCE CENTER, Japan)

Distribution map of the degree of coral has been created by Manta method to use coral conservation activities. The manta method is a survey method that divers investigate the degree of coral and whitening state while being towed to a boat. But the manta method makes great physical burden also underwater robot can substitute, and desirable underwater robot that can maintain an altitude between underwater robot and seabed. Therefore, we have developed the altitude maintenance system for underwater robot for the purpose of investigate by Manta method is described in this paper. The distance measuring method using the laser beams and a monocular camera with image processing is adopted reason that waters inhabiting coral is high transparency. The evaluation experiments in the pool with the system and underwater robots were confirmed to have sufficient accuracy for the assumed survey mission.



OS6-6 Development of an automatic detection method for crown-of-thorns starfish using contour information

Masahiro Suganuma and Shinichi Sagara
(Kyushu Institute of Technology, Japan)

In recent years, outbreak of Crown-Of-Thorns Starfish (COTS) in the sea around Okinawa has become a problem. Currently, extermination of COTS is being carried out by divers but it is very dangerous to do the work for divers due to their toxic thorns. Therefore, we have developed an underwater robot which is mounted a camera system for obtaining situation in the sea. In order to perform actual work, it is essential to detect an object of interest. Although color information is used in general object detecting method, it is known that the red component of the light is attenuated in water. Therefore, we focused on thorns are ecological characteristics of COTS. In this paper, we report on the proposal as well as the result of the detection method of COTS by a combination of corner detection and contour information.

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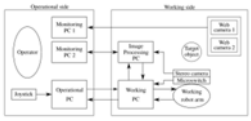
Room C

GS13 Robot vision and image processing

Chair: Fusaomi Nagata (Tokyo University of Science, Yamaguchi, Japan)

GS13-1 A visual supporting system for teleoperation of a robot arm with stereo camera

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



In this research, a visual supporting system for teleoperation of a robot arm with stereo camera for position measurement is developed. The system is constructed by combining a teleoperation system of a robot arm with stereo camera and a visual supporting system for another teleoperation system of robot arm with USB camera. The robot arm is controlled by the manual operation of the operator and the autonomous control via visual servo. The visual servo is realized by template matching technique. Furthermore, visual supporting functions of visually showing the position of the target and the detection result of robot arm tip contact with target are implemented. In order to confirm the effectiveness of the visual supporting system, an experiment was conducted.

GS13-2 Moving objects detection from dynamic backgrounds

Arinto Setyawan, Joo Kooi Tan, Hyoungseop Kim, and Seiji Ishikawa
(Kyushu Institute of Technology, Japan)

Objects detection from an image is one of the basic problems of study in computer vision. In particular, moving objects detection is important, since moving objects are those to which one should pay attention in, e.g., walking or driving. This paper proposes a method of detecting moving objects by inferring backgrounds frame by frame. The proposed method can cope with dynamical change of the background including sudden illumination change. Experimental results show satisfactory performance of the proposed method.

GS13-3 Boundary aware regional contrast based visual saliency detection

Sk. Md. Masudul Ahsan, Joo Kooi Tan, Hyoungseop Kim, and Seiji Ishikawa
(Kyushu Institute of Technology, Japan)

Most existing methods measure the saliency of a pixel or a region based on its contrast within a local or global context of an image. Some methods focus on suppressing the background regions and thereby detect salient objects. In this paper, we propose a simple novel approach for salient region detection that exploits regional color contrast based spatial non-redundancy to generate an image saliency map. We also use image boundary regions as a cue for the background and measure the dissimilarity of the other regions from the boundary regions in color domain and spatial domain to subdue the background. We combine those dissimilarity measures to produce a saliency map. Both qualitative and quantitative experiments are performed on a benchmark dataset which show that our approach outperforms ten state-of-the-art methods.

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GS13-4 An optical projection system with mirrors for laparoscope

Mai SUGAWARA, Kaoru KIYOMITSU, Tatsuya NAMAE, Toshiya NAKAGUCHI, and Norimichi TSUMURA
(Chiba University, Japan)

We propose an optical projection system aimed at improving laparoscopic surgery based on 3D measurement which will give effective information for robotic-assisted surgery and computer aided surgery. Laparoscopic surgery, which makes small port for the laparoscope and surgical instruments such as clamp through the body of the patients, is minimally invasive and has generated growing interest. There are techniques using the stereo laparoscope to obtain depth information. Active sensing, which is added a structured light to the laparoscope, can reconstruct 3D shape. However, active sensing which needs projection devices of the structured light, lead to grow in size. Large-sized projection and sensing systems affect surgical procedures. To remove the obstacle for the surgery, it is important to design downsized systems. Therefore, we build the optical projection system to stereoscopic vision of laparoscope, and we show a new shape reconstruction method from its active sensing.

Room D

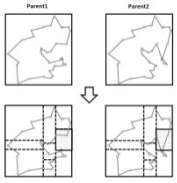
OS3 Bio-inspired theory and applications (1)

Chair: Kunihito Yamamori (University of Miyazaki, Japan)

OS3-1 Performance evaluation of partitioning crossover for national TSPs

Kento Seki, Masaru Aikawa, Kunihito Yamamori, and Ikuo Yoshihara
(University of Miyazaki, Japan)

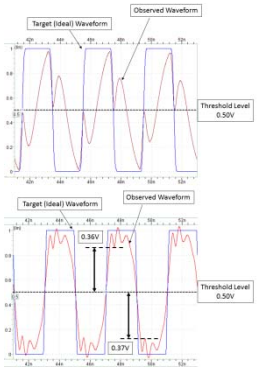
In this paper, we propose a new crossover suitable for solving National TSPs which are benchmarks of Traveling Salesman Problems. We name the proposed crossover as Partitioning crossover (P-cross) which combines Zoning crossover (Z-cross) and Karp's partitioning algorithm (KPA). P-cross is a crossover to exchange the one of the zones divided by KPA between two parents. We evaluate performance of P-cross by National TSPs from the view of tour quality and CPU time. We compare P-cross with Z-cross by three benchmarks. As a result, P-cross succeeds to find a better solution than that of the Z-cross in the two benchmarks. In addition, P-cross was about three times faster than Z-cross for all benchmarks.



OS3-2 An Evolutionary Design Methodology for High Speed Point-to-Point Transmission Line Used in Printed Circuit Boards

Syun Akutsu[1], Ikuo Yoshihara[2], and Moritoshi Yasunaga[1]
([1]University of Tsukuba, Japan)
([2]Miyazaki University, Japan)

Signal integrity degradation is one of serious design problems in PCB traces in GHz-domain. In order to overcome this problem, we have previously proposed "Segmental Transmission Line (STL)". In this paper, we newly apply the STL to the end-to-end transmission system and show its effectiveness of at the end point of the transmission line. In the simulation measurements, the logical margin in the STL can be increased to 0.37V from almost 0V in the conventional transmission line, where ideal margin is 0.5V. Furthermore, we measure the S-parameters of STLs to analyze them in the frequency domain and show that STL is a specialized transmission line that suppresses reflections and increases transmissions of signals.

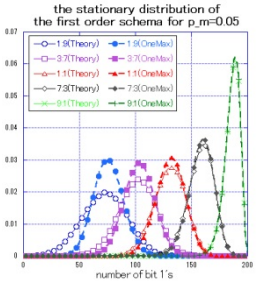


January 20 (Wednesday), 13:00–14:00

OS3-3 Asymmetric Mutation Model in Genetic Algorithm

Du Yifei, Aoki Kenji, Sakamoto Makoto, Yamamori Kunihito, and Furutani Hiroshi
(University of Miyazaki, Japan)

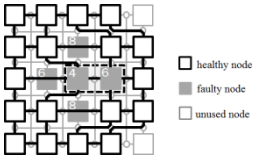
Genetic algorithms (GAs) are stochastic optimization techniques, and the theoretical study of the process of GA evolution is very important in the application of GA. Mutation is one of most important operators in GA, and Markov chain theory has attracted researchers' attention for the study of mutation. By applying Markov chain to study symmetric mutation model in GA, we have obtained the relation between the mutation rate and the evolution of the first order schema. This paper theoretically analyzes the effects of mutation rates on GA with asymmetric mutation, and studies the evolution and stationary distribution of the first order schema. This study focuses on effects of asymmetry to the linkage of loci, and shows the degree of asymmetry in mutation has a large effect on the evolution of the first order schema.



OS3-4 A partial reconfiguration approach for 2d mesh network-on-chips with region-based fault-tolerant routing

Masaru Fukushi and Daiki Shimizu
(Yamaguchi University, Japan)

This paper proposes a novel approach for realizing highly dependable 2D mesh Network-on-Chip (NoC) system which employ region-based fault-tolerant routing. Well-known system-level fault-tolerance techniques are network reconfiguration and fault-tolerant routing, which have been studied for a different purpose. The proposed approach combines the functions of these two techniques based on the new concept of partial reconfiguration. In the proposed method, faulty NoC systems are partially reconfigured considering the undesirable fault patterns for the region-based fault-tolerant routing, thus overcoming the draw-backs of original two techniques. Simulation results show that the proposed method improves system degradation and packet latency up to 52.8% and 11.2%, respectively, compared to the existing methods.



Room E

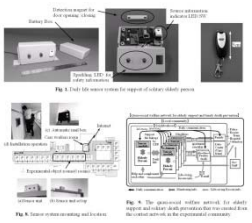
GS3 Artificial living

Chair: Shinjiro Umezu (Waseda University, Japan)

GS3-1 Simple observation sensor system and local community network model - Real society experiment aimed at eliminating solitary death for low-income elderly living alone in collective housing -

Shinjiro Mochida and Takeshi Morishita
(Toin University of Yokohama, Japan)

This study proposes a sensor system for monitoring elderly living alone in low-income residences and a network model for connecting the surrounding community to support the elderly in their community. Additionally, the sensor unit has a networked lighting function to notify those in the community of potential accidents. This system was designed to be inexpensive by linking multiple units for low-income elderly. This sensor system estimates living conditions by detecting entry door movement. The information is delivered to the family and supporters of the target elderly by e-mail as safety information. In addition, we implemented this sensor system and local community network model at a real world welfare facility. We report that the sensor systems and community network improves communication between the elderly, their families, and their neighbors, thereby improving the safety of the elderly.

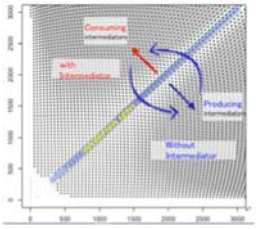


January 20 (Wednesday), 13:00–14:00

GS3-2 Chemical Reaction Networks by using Strand displacement reactions and its application for Molecular Robotics

Yasuhiro Suzuki
(Nagoya University, Japan)

In order to implement Chemical Reaction Networks, CRNs by using DNA molecules, utilizing the strand displacement reactions has been proposed. In implementing CRNs by using strand displacement reactions, auxiliary substances are required; and these auxiliary substances change dynamical property of chemical reactions. We propose CRNs implemented strand displacement reaction is suitable for realizing molecular multi-agent systems, MMS.



GS3-3 A Study on House Buyer Mobile Information Service for Construction Project (Withdrawal)

Yung-Piao Chiu, Lu-I Chen, and Yan-Chyuan Shiau
(Chung Hua University, Taiwan)

GS3-4 Emergent group behaviors from bacteria quorum sensing simulation

Nesrine Ouannes[1], NourEddine Djedi[1], Yves Duthen[2], Hervé Luga[2]
([1]Biskra university, Algeria)
([2]Toulouse 1 university, France)

The quorum sensing (QS) is the mechanism that bacteria use to communicate together. This communication allows bacteria to coordinate their behaviors, and allows colonies behaviors to emerge in various environments. Here, the bacteria cells grow exponentially according to our previous model of simulated bacteria chemotaxis [1,2]. Then, the communication between bacteria is guaranteed according to the proposed algorithm of quorum sensing acting at cellular level. Quorum Sensing helps groups of bacteria to act synchronously in a simulated environment with limited resources. A molecular exchange is used in our previous model to simulate bacteria chemotaxis [1,2]; the surviving bacteria have to overcome the problems of detecting resources (or sensing the environment), and modulating their motion to generate a foraging behavior. This paper presents a simulation of a growth system and communication between bacteria that are living in a virtual environment, starting by simulating the individual bacteria behaviors such as growth, division and communication with each other and with the environment. This quorum sensing process plays a major role in: (a) colonial behavior of bacterial populations (or multicellular behavior emergence), allowing the interaction between bacteria of the same species depending on the population density; (b) the control of cell population density; (c) changes in behavior that are triggered by the molecules when a quorum is present; These molecules migrate from one cell to another cell, that is close proximity (i.e. area detection); the bacterial communities are formed and subsequent synchronization mechanisms appear. The results presented in this paper show the synchronized behaviors obtained by the bacteria groups emerged over time, illustrated by growth plots. In summation, we propose some applications areas for this kind of behavior along with some additional perspectives.

January 20 (Wednesday), 14:45–15:45

Room A

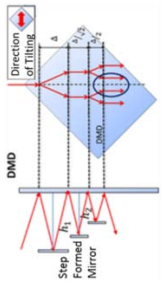
GS14 Sensor and multi-sensor data fusion

Chair: Maki K. Habib (American University in Cairo, Egypt)

GS14-1 Development of the descrete laser beam scanning device which combined a step formed mirror with DMD

Shoma Matsunaga, Takaaki Itoh, and Nobuhiro Okada
(The University of Kitakyushu Faculty of Environmental Engineering, Japan)

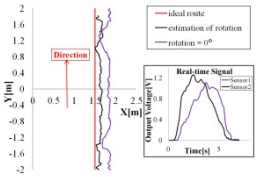
There are many scenes where a laser beam is used in the field such as measurement, processing, communication, and medical. In these applications, scanning quickly and exactly the beam direction of the laser is important. We attempted to realize it by adopting DMD (Digital Mirror Device: Texas Instruments) as scanning mechanism. The purpose of this study is to develop a technique to control the direction of the laser beam by combining a step formed mirror with DMD. By using the system, the laser beam can perform multistage reflection. In this study, we confirmed whether realization of this mechanism was possible by calibrating the step formed mirror and DMD and experimenting it.



GS14-2 Detection of human position and motion by tilted thermopile infrared sensor from ceiling

Zhang Xipeng, Seki Hiroaki, and Hikizu Masatoshi
(Kanazawa University, Japan)

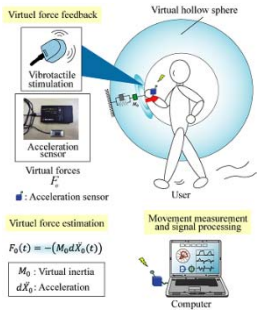
There are some equipments can be used to detect human, such as pyroelectric infrared sensor, ultrasonic sensor, camera and so on. However, their systems have some problems with the boundedness detection, low resolution, privacy and high cost. So we propose to use thermopile infrared sensors without focus lens and with high-gain amplifier to detect human position and movement. This paper presents an approach to detect human 2D position and body orientation by two tilted thermopile infrared sensors mounted on the ceiling. After measuring, we can build an approximate equation between output voltage, directivity and body orientation from each sensor to human. These equation set can be solved by steepest descend method to obtain 2D human position in real-time, meanwhile body orientation can also be basically obtained by slight change of some positions when human moving. We made some experiments to confirm that the proposed system can work.



GS14-3 Investigation of Relationships between Body Sway and Fingertip Vibrotactile Stimulation Based on Virtual Light Touch Contact

Mami Sakata[1], Keisuke Shima[1], and Koji Shimatani[2]
([1]Yokohama National University, Japan)
([2]Prefectural University of Hiroshima, Japan)

The authors previously proposed a novel system called virtual light touch contact (VLTC) to provide support for standing and walking based on the mitigation of body sway. The study reported here examined the relationships between the virtual-partition parameters of this system and the body sway of users in a standing state based on evaluation experiments conducted with healthy volunteers. The results showed that virtual force calculated exclusively from fingertip acceleration signals can be used to mitigate body sway in standing state better than in a situation where there is no contact with the partition. This suggests that no motion sensor is required for the VLTC system, as the effects of VLTC can be realized with only a simple acceleration sensor. This paper proposes a new version of the VLTC system with a simple acceleration sensor for finger motion monitoring, and discusses prototype-based verification of the method's effectiveness.

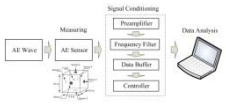


January 20 (Wednesday), 14:45–15:45

GS14-4 NDT for crack detecting on steel material in term of 2D and 3D based on acoustic transducer placement using PZT

Sutham Satthamsakul, Witsarut Sriratana, Taweepol Suesut, and Pavich Pasuwanich
(King Mongkut's Instititue of Technology Ladkrabang, Thailand)

This study proposes the influences of the position and direction of sensor module in terms of 2 dimensions and 3 dimensions under the same measurement conditions in order to detect the cracks or completion of material in the methodology of non-destructive testing (NDT) based on acoustic transducer using piezoelectric (PZT). An improvement of PZT uses the acoustic signals for detecting cracked and defective positions in 1 dimension form of metal materials. The studies also analyze a variable of time difference would be obtained from PZT and then created the equation to determine the cracked positions in terms of 2 dimensions and 3 dimensions. This research focused on using and connecting easy and cheap equipment to measurement and evaluation system, as well as LabVIEW software and C++ programming language. However, the system was developed can be easily adjusted and revised to meet the detection purpose.



January 20 (Wednesday), 14:45–16:00

Room B

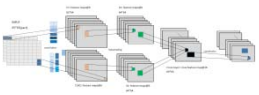
OS5 Biomimetic Machines and Robots

Chair: Keigo Watanabe (Okayama University, Japan)
Co-Chair: Fusaomi Nagata (Tokyo University of Science, Yamaguchi, Japan)

OS5-1 Stacked convolutional auto-encoders for surface recognition based on 3d point cloud data

Maimaitimin Maierdan, Keigo Watanabe, and Shoichi Maeyama
(Okayama University, Japan)

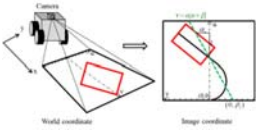
This paper addresses the problem of feature extraction for 3d point cloud data by using autoencoder. Deep learning is one of the most active fields of artificial intelligence, especially in variety of visual applications, such as image classification and object recognition. However it has not been successfully applied to 3d object recognition. In this paper, it aims to find out how to effectively use the deep learning on 3d object recognition. The autoencoder is used to produce the feature maps of different surface conditions. The surface conditions in this paper are defined as curved surface, inclined plane and normal plane, where those surface conditions are represented by calculating the surface normal vector. The experimental results of the processed surface condition data show the performance of the proposed method using autoencoder.



OS5-2 Optimization of an image-based fuzzy controller for an automatic parking system using a genetic algorithm

Yin Yin Aye, Keigo Watanabe, Shoichi Maeyama, and Isaku Nagai
(Okayama University, Japan)

An automatic parking system of a car-like mobile robot is an important issue in commercial applications. An image-based fuzzy controller for an automatic parking system of a car-like mobile robot was developed in previous work, where the membership functions were tuned by experimentally. The aim of this paper is to optimize the parameters of the membership functions which were performed in previous work by using a genetic algorithm. The details of GA implementation, such as the design parameters and choice of fitness function are described. Simulation results illustrate the effectiveness of the developed schemes.



January 20 (Wednesday), 14:45–16:00

OS5-3 Motion Estimation of a Walking Robot Based on Laser Speckle Odometry

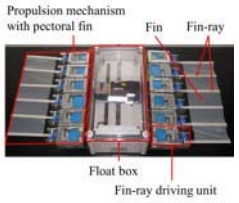
Rui Saito, Isaku Nagai, and Keigo Watanabe
(Okayama University, Japan)

In this study, a laser odometry technique is proposed as localization for underwater mobile robots. Laser odometry is a method for estimating the motion by tracking laser speckle patterns. It can measure three dimensional positions and a rotation. We explain the overview of the multi-legged robot, the principle of the laser odometry, and the construction of the sensor module. The estimated trajectory of a real walking robot with the optical sensor is also reported, indicating the usefulness of the proposed method.

OS5-4 Attitude Control for Manta Robots Using a Fuzzy Controller

Yukito Hamano[1], Keigo Watanabe[1], Masaaki Ikeda[2], and Isaku Nagai[1]
([1]Okayama University, Japan)
([2]Universiti Sultan Zainal Abidin, Malaysia)

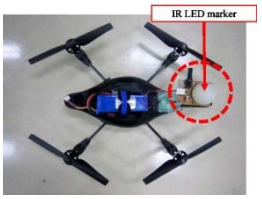
Underwater robots equipped with cameras are actively developed for the biological research of marine life. We have already developed a Manta robot that possesses propulsion mechanisms with pectoral fins, which were constructed by mimicking the pectoral fin of a Manta ray. The Manta robot generates the propulsive force by undulating such propulsion mechanisms with pectoral fins. A dynamical model of Manta robots is complicated to take account of hydrodynamic drag acting on the fins. Therefore, it is not suitable for model-based control. In this study, fuzzy control that doesn't use any dynamical model is applied for controlling the attitude of a Manta robot. Some experiments are conducted to prove its usefulness.



OS5-5 Three-dimensional Guidance Experiments for a Quadrotor Based on an HPF

Kimiko Motonaka, Keigo Watanabe, and Shoichi Maeyama
(Okayama University, Japan)

In this research, it is aimed at controlling a quadrotor autonomously in an actual environment. There exists "kinodynamic motion planning," which is a way for solving kinematic constraints and dynamic constraints simultaneously and designing a control input, referring to only the current state of the controlled object. We proposed a kinodynamic controller using a harmonic potential field for a quadrotor, and showed from actual experiments that in the previous research, the proposed controller was able to guide the quadrotor to an arbitrary target point in the same altitude as an initial position of the quadrotor. In this paper, the proposed controller is further shown to be able to guide the quadrotor to a target point which needs to change the altitude.



January 20 (Wednesday), 14:45–15:45

Room C

GS6 Control techniques

Chair: Yuichiro Taira (Sojo University, Japan)

GS6-1 Sampled-data output-feedback control: optimal linearization-based digital redesign approach

Ji Hyun Moon and Ho Jae Lee
(Inha University, Korea)

This study discusses a digital redesign approach for nonlinear systems based on the stabilizable and detectable optimal linear model of the nonlinear system. Based on the optimal linear model, we design an observer-based output-feedback controller in the sense of the state matching. The condition of the optimal linearization and digital redesign is formulated in terms of bilinear and linear matrix inequalities, respectively. In addition, the sampled-data closed-loop stability of the nonlinear system with digitally redesigned controller is investigated. The effectiveness of the proposed method is demonstrated through a numerical simulation.

GS6-2 Developing a ROS Node to Control ICS Servo Motors

Maki Nakashima, Hideaki Itoh, Hisao Fukumoto, Hiroshi Wakuya, and Tatsuya Furukawa
(Saga University, Japan)

Development of intelligent robots is made easier by Robot Operating System (ROS). However, many robots that are currently supported by ROS are either expensive or hard to obtain in Japan. Therefore, in this study, we have developed a ROS node that can control Interactive Communication System (ICS) servo motors. The ICS servo motors are inexpensive serial motors widely available in Japan. To build the ROS node to control the ICS motors, we have modified an existing ROS node named arbotix. The node that we have developed can control the servo motors directly from any computer that runs ROS. Experimental results show that we have succeeded in simultaneously controlling multiple ICS servo motors using the node.

GS6-3 Parallelization of POMCP for Movement Imitation in a Humanoid Robot

Yoshitaka Sakai, Hideaki Itoh, Hisao Fukumoto, Hiroshi Wakuya, and Tatsuya Furukawa
(Saga University, Japan)

Teaching movements to robots has been a time-consuming task that requires expert knowledge. As an easier method to teach movements to robots, the authors have been studying an approach called learning by imitation. In our previous study, we succeeded in building an imitation system using a powerful optimization method called the Approximate Inference COntrol (AICO). However, it sometimes failed to find a good solution because it uses some approximations. Therefore, in this study, we consider developing a system using another optimization method called Partially Observable Monte-Carlo Planning (POMCP). POMCP does not rely on approximations, but it requires a long time to find the optimal solution. To cope with this problem, we propose to reduce the POMCP optimization time by introducing parallel computation.

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GS6-4 Motion Planning and Motion Analysis of CUV

Yusuke Furoi, Shin Tsujita, and Etsuro Shimizu
(Tokyo University of Marine Science and TechnologyJapan)

In this research, a new type of ROV (Remotely Operated Vehicle) for water tank cleaning and inspection is designed to improve the cleaning efficiency of flocks accumulated on the bottom (referred here after as CUV [Cleaning underwater vehicle]). We aim to grow performance by considering a condition of constraint that related water tank. Specifically, the efficient path which considered effect of a cable motion is derived. The mathematical model of CUV for the case that CUV is running on a slope is derived. In addition, the controller to run straight on the slope is also designed.

Room D

OS4 Bio-inspired theory and applications (2)

Chair: Kunihito Yamamori (University of Miyazaki, Japan)

OS4-1 Classification Accuracy Improvement by Synthesized Training Images from 3D Object Model

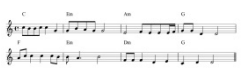
Wataru Juso, Kunihito Yamamori, and Masaru Aikawa
(University of Miyazaki, Japan)

In this paper, we propose a method to improve image classification accuracy by increasing of the number of training images. It is very important for accurate classification to obtain enough number of high quality training images. Our method synthesizes images from various viewpoints by transforming original images based on 3D object model. By corresponding some vertexes of 3D object model to feature points of a training image, change of appearance in 3D object model through the move of viewpoint is projected onto a training image.

OS4-2 An automatic music composition by concatenating pieces based on fitness evaluation

Takafumi Yamada, Masaru Aikawa, and Kunihito Yamamori
(University of Miyazaki, Japan)

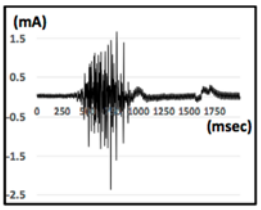
In this paper, we propose an approach to automatically create natural and various music by concatenating pieces with taking into account of musical heuristics. Our automatic music composition method consists of 5 stages; (1) decision on music plan such as tempo, chord progression and so on, (2) estimation of a natural key progression, (3) generation of pieces in the scale of the key, (4) evaluation of pieces by fitness function, (5) concatenating pieces with high fitness evaluation value. A piece is the smallest component of melody, and consists of more than 2 measures. Generation of pieces at random keeps variety, and selection of pieces based on musical heuristics prevent unnatural music generation. We evaluate composed music by questionnaire survey, and obtain some positive answers.



January 20 (Wednesday), 14:45–15:45

OS4-3 An attempt to use a gesture control armband for a user authentication system using surface electromyograms

Hisaaki Yamaba[1], Akitoshi Kurogi[1], Shin-ichiro Kubota[1], Tetsuro Katayama[1],
Mirang Park[2], and Naonobu Okazaki[1]
([1]University of Miyazaki, Japan)
([2]Kanagawa Institute of Technology, Japan)



At the present time, mobile devices such as tablet-type PCs and smart phones have widely penetrated into our daily lives. Therefore, an authentication method that prevents shoulder surfing is needed. We are investigating a new user authentication method for mobile devices that uses surface electromyogram (s-EMG) signals, not screen touching. The s-EMG signals, which are generated by the electrical activity of muscle fibers during contraction, are detected over the skin surface. Muscle movement can be differentiated by analyzing the s-EMG. In this paper, a method that uses a list of gestures as a password is proposed. And also, results of experiments are presented that was carried out to investigate the performance of the method extracting feature values from s-EMG signals (using Fourier transform) adopted in this research. MyoTM, which is the candidate of s-EMG measurement device used in a prototype system for future substantiative experiments, was used in the experiment together with the s-EMG measuring device used in the previous research to investigate its performance.

OS4-4 Proposal of an Authentication Method using Two Types of Machine Learning and Mouse Operation Trajectory

Yoshihiro Kita[1], Kentaro Aburada[2], Tetsuro Katayama[3], Mirang Park[4], and Naonobu Okazaki[3]
([1]Tokyo University of Technology, Japan)
([2]Oita National College of Technology, Japan)
([3]University of Miyazaki, Japan)
([4]Kanagawa Institute of Technology, Japan)

The authentication systems using operation trajectory by the mouse are reported. These methods have the low authentication accuracy, as compared with other biometrics authentication. In this paper, the mouse operation is stabilized by the mouse pad which are drawn the lines for operation supporting, and our system learns the behavioral features of users by machine learning for judging the user. We expect the practical application of the authentication method using the mouse operation trajectory by the improvement of authentication accuracy by our method.

Room E

OS17 Soft matters

Chair: Ken Naitoh (Waseda University, Japan)
Co-Chair: Shinjiro Umezu (Waseda University, Japan)

OS17-1 Fabrication of micro gelatin fiber utilizing coacervation method

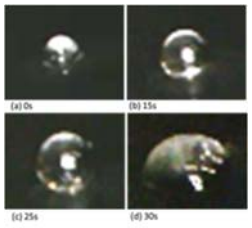
Takafumi Arai, Katsuhisa Sakaguchi, and Shinjiro Umezu
(Waseda University, Japan)

Biotechnology was drastically advanced by the development of induced pluripotent stem cells of iPS cells and ES cells. Micro/ nano bio field was opened by the cells and taylor-made medicine was highly focused to develop an intractable disease to be cured. Gelatin was useful biomaterial because the melting temperature was from at 25 to 33 degrees C, and deformation was easy due to sol-gel transition in low temperature. The applications of gelatin fiber were considered as suture thread, blood vessel prosthesis, cell growth based material, filter materials, and so on. It was essential to fabricate different diameters of gelatin fiber because the cell size was different by species and the applications. In this paper, we developed fabrication method of gelatin fiber utilizing coacervation method. We fabricated narrow gelatin fiber that had diameter over 10 μm.

January 20 (Wednesday), 14:45–15:45

OS17-2 Fundamental printing characteristics on gelatin utilizing micro 3D printer

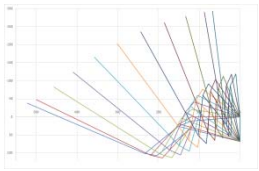
Ryu-ichiro Tanaka, Katsuhisa Sakaguchi, and Shinjiro Umezu
(Waseda University, Japan)



The bio 3D printer is able to print cells and biomaterials precisely. We developed a micro 3D printer that is based on the electrostatic inkjet. The electrostatic inkjet was suitable for 3D bio printer because the merits of the micro 3D printer are high precision to print and ability to eject highly viscous liquid. In this paper, gelatin, an important biomaterial is printed utilizing a micro 3D printer. However, it was difficult to fabricate 3D structures of gelatin because the printed gelatin was not remained and spread due to low viscosity before the solidification. To clear this problem, we developed new experimental set-up with a peltier device that can control the temperature around the impact point. Then, the temperature was controlled appropriately, then the spread of gelatin was prevented. Therefore, we investigated 2D and 3D printing characteristics on gelatin with the new experimental set-up.

OS17-3 Bio-inspired wing folding mechanism of micro air vehicle (MAV)

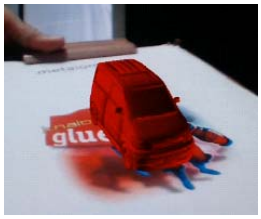
Takamichi Abe, Shinjiro Umezu, and Hiroshi Yamakawa
(Waseda university, Japan)



Study on micro air vehicle (MAV) has been highly focused on exploration disaster and danger zone that it is difficult for human beings to enter. Many studies have purpose to investigate the flying mechanism and to develop the flying machine. On the other hand, few studies were carried out to examination the wing-folding mechanism. When the bird and the flying insects land, they usually fold their wings. If they do not fold their wings, their movement area is limited. In this paper, we focused on the artificial wing-folding device. We designed a new artificial wing that has link mechanism. With the wing-folding device, the wing span of the MAV was reduced to 11.6% when the MAV folded the wing. The movement of this machine is to spread the wing, next to flap it, then to fold it.

OS17-4 Quality evaluation of 3D image represented by points

Hideo Miyachi
(Tokyo City University, Japan)



Increasing computer power, the size of 3D model is larger and larger. For making communication by using 3D graphics better, data reduction is expected. I have developed a new method that generates a 3D image by represented by points that are captured from multiple images with color and Z value. The advantage of this approach is that we can control the maximum size of the generated data easily. The size is not depended on the original data size and the complexity. It is determined by the resolution of the images and the footprint of the object at capturing. On the other hand, this way has some drawbacks. Occluded area cannot be captured. Therefore, the image quality should be evaluated. In this paper, the benchmarks are described, and the quality of the 3D image is discussed.

January 21 (Thursday), 09:30–10:45

Room A

OS1 Advanced and Intelligent Systems for Education

Chair: Takashi Yamaguchi (Tokyo University of Information Sciences, Japan)
Co-Chair: Yorinori Kishimoto (Tokyo University of Information Sciences, Japan)

OS1-1 Development of Problem-Based Programming Learning System Using Stepwise Refinement

Eiji Nunohiro, Yorinori Kishimoto, Takashi Yamaguchi, Masanori Ohshiro, and Shigeo Tsukuta
(Tokyo University of Information Sciences, Japan)

The author developed Computer Aided Programming Training support system called “CAPTAIN system” as an e-learning system. The purpose of CAPTAIN is to allow the learners to create a program like puzzle game and understand the structure and control flow of the program. However, the student’s capabilities required for programming include not only the capability to create a program but also the higher capability to solve a problem. In consideration of such a demand of society, it is necessary for the learners not to concentrate solely on an improvement of the capability to create a program in programming learning but to carry out learning activities to expand capabilities for analysis and design of a problem solution. The purpose of this research is to propose learning method of mastering the capability to solve a problem in programming education, and develop the Problem-based Programming Learning system using stepwise refinement.

OS1-2 An expression method of hierarchical structure diagram for problem-based programming learning system

Yorinori Kishimoto, Eiji Nunohiro, Takashi Yamaguchi, Masanori Ohshiro, and Shigeo Tsukuta
(Tokyo University of Information Sciences, Japan)

In education of programming, it requires the learning method of mastering the capability to solve a problem in programming education, and develop the Problem-based Programming Learning system using stepwise refinement, i.e., “PPL system”. We propose an expression method of hierarchical structure diagram for problem-based programming learning system. In this system, learners read a given problem, refine it stepwise and finally master the capability to solve it. This system required the expression for a stepwise problem solving process. So, we propose the Problem Breakdown Chart (PBC). PBC can represent stepwise refinement of system design. It shows function as box, and it shows system design phase process as nested box. And it can be shown non-deterministic system framework and deterministic system implementation. In this paper, we show an idea of expression method for stepwise problem solving process.

OS1-3 Automatic Learning Planning Systems for Programming Learning Support System

Masanori Ohshiro, Takashi Yamaguchi, Yoshihiro Kawano, and Eiji Nunohiro
(Tokyo University of Informaiton Sciences, Japan)

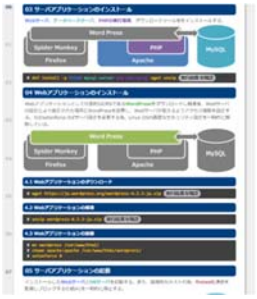
The authors have developed a programming training system CAPTAIN (Computer Aided Programming Training And INstruction). In this training system, each complete runnable program is fragmented randomly into a few lines by the system. Students must sort the lines as an original source program similarly to solving a puzzle game. In the system, a program source is divided in block syntax elements. We call the method syntax-oriented fragmentation. In our previous paper, we introduced auto verification method for semantic correctness of students’ answers. An original source code is analyzed and fragmented using structure-oriented method described in our previous paper. In addition, the dependencies graphs of identifiers are extracted from the original source code in our new method. Nodes of the graphs are the fragments. The order of graphs describe semantic context of the source code. The system checks automatically the order of the graphs in students’ answer and concludes that the answer is correct when the order of semantic context is kept. In general, checking of semantic correctness of source codes is very difficult and on the other hand, it is easy to check it in our systems because the system has a correct answer (an original source code) and must check only the sorted fragments made from the original code.

January 21 (Thursday), 09:30–10:45

OS1-4 Application of Cloud-based Educational Infrastructure on Exercises of Information Technologies

Shigeo Tsukuta, Shota Sekikawa, Takashi Yamaguchi, Yorinori Kishimoto, and Eiji Nunohiro
(Tokyo University of Information Sciences, Japan)

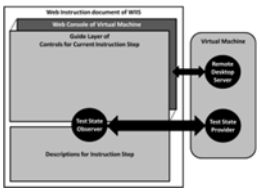
The students have to learn a lot of specific information technologies in educational institution of computer sciences and informatics as the information technologies are progressed and widely broadened to various fields. Therefore the practical training of information technologies requires various computing environment for each technologies such as computer literacy, data analysis, software development, system construction, network configuration, and etc. In the past cases, the educational institution has prepared the education infrastructure such as educational workstation and the pre-configured personal laptop computers in order to satisfy whole computing environment for all their educational course. In this research, we have developed a cloud-based education infrastructure. From the practical use in a lecture of Web system development with exercises, we have verified the effectiveness of proposed cloud-based education infrastructure.



OS1-5 Web-based Interactive Instruction System using Cloud Computing

Takashi Yamaguchi, Shota Sekikawa, and Shigeo Tsukuta
(Tokyo University of Information Sciences, Japan)

Recently, Information and Communication Technology (ICT) is rapidly progressed and widely applied to various field in addition to the information and communication industry. Therefore it requires us to learn a lot of new technologies as possible to use for practical works. In this paper, we proposed a Web-based interactive instruction system framework that is consist of instruction test schema the communication schema between Web application and virtual machine in cloud. A proposed Web-based instruction system produces the practical examination environment for ICT on Web instruction document. Moreover, the user can receive interaction that is the result of user controls for instruction steps. This system can provide the exactly same examination environment and the step by step interactive instruction within Web instruction document.



Room B

GS1 Artificial intelligence

Chair: Sigeru Omatu (Osaka Institute of Technology, Japan)

GS1-1 Hypothesis testing based on observation from Thai sentiment classification

Ponrudee Netisopakul, Rathawut Lertsuksakda, and Kitsuchart Pasupa
(King Mongkut's Institute of Technology Ladkrabang, Thailand)

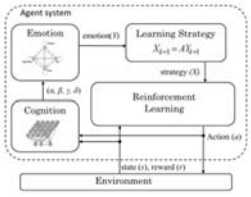
This work focuses on error analyses from the Support Vector Machine (SVM) classification on Thai children stories at a sentence level. The construction of the Sentiment Term Tagging System (STTS) program allows the researchers to make observations and hypothesize around the areas where most anomalies occur. Three hypotheses, based on terms sentiment chosen for SVM predictions, are evidently proved to hold. In addition, a number of ways to improve the Thai sentiment classification research are suggested, including considerations to add 'negation' into the process, add 'weighing scheme' for different part-of-speech, disambiguate word senses, and update the Thai sentiment resource.

January 21 (Thursday), 09:30–10:45

GS1-2 Efficient Reinforcement Learning Using an Adaptive Control of Meta-Parameters Based on a Markov Emotional Model

Shogo Watada, Masanao Obayashi, Takashi Kuremoto, and Shingo Mabu
(Yamaguchi University, Japan)

We propose a new method to automatically design a Meta-parameter controller used in reinforcement learning. In the decision making system based on Markovian emotional model that we have already proposed, decision-making process of the robot is achieved by two phases of the process that are decision of emotions (learning of emotional-construction) and optimal behavior selection for emotions (learning of emotional-behavior). In this work, we apply our emotional decision making system to a reinforcement learning method as a basic behavioral learning, and emotional-behaviors of the system are used to adjust Meta-parameters for realization of efficient reinforcement learning. Simulation results showed that appropriate and more complex rules to adjust Meta-parameters were designed automatically by emotional learning.



GS1-3 Efficient Reinforcement Learning Using Learning Strategies Based on a Simplified Emotion Model (Withdrawal)

Shogo Watada, Shota Shimizu, Masanao Obayashi, Takashi Kuremoto, and Shingo Mabu
(Yamaguchi University, Japan)

GS1-4 Adjustable threshold selection by using artificial neural network for metric-based design flaw detection

Sakorn Mekruksavanich
(University of Phayao, Thailand)

The identification of design flaws in software systems is important for minimizing cost and improving the effectiveness of software maintenance. Heuristic metric detection is one of the most popular flaw identification methods, using a pre-defined set of thresholds to interpret the detection results. However, although this is effective for flaw detection, obtaining proper threshold values is complicated. This study therefore proposed an adjustable threshold methodology for metric-based design flaw detection. An artificial neural network was used to compute the contribution metrics and threshold of each metric. The threshold values of the derived model were adapted to conform to the characteristics of software data input. The experimental results revealed that the proposed scheme established more suitable thresholds for metric-based design flaw detection. Moreover, this method was also simple, requiring less time to implement, without the requirement of expert knowledge necessary for traditional metric-based detection.

GS1-5 A hybrid approach to large scale map building using range and vision sensors for mobile robots (Withdrawal)

Ankit Ravankar, Abhijeet Ravankar, Yukinori Kobayashi, and Takanori Emaru
(Hokkaido University, Japan)

January 21 (Thursday), 09:30–10:45

GS1-6 A combined differential evolution and learning vector quantization algorithm for data classification

Sakkayaphop Pravesjit
(University of Phayao, Thailand)

This paper proposes a combined differential evolution algorithm (DE) with learning vector quantization algorithm (LVQ) for data classification. In this paper, the LVQ technique is applied in order to improve the initial population. After that the DE/current-to-best/1 strategies in mutation stage, crossover stage, and selection stage from the differential evolution algorithm will be processed until stopping condition is met and the best solution is returned. In the experiment, five benchmark classification dataset of UCI including iris dataset, glass dataset, letter dataset, breast-w dataset, and segment dataset are tested. The performance of the proposed algorithm is compared with traditional differential evolution algorithm, and original learning vector quantization algorithm. The computational results show that the proposed algorithm can compete with the standard algorithms and it could be improved in this direction to solve other data classification problem in the literature.

Room D

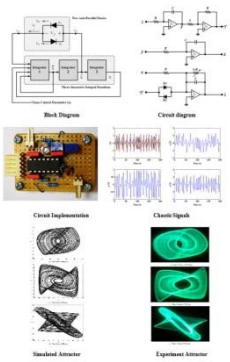
GS4 Chaos & Complexity

Chair: Ken Naitoh (Waseda University, Japan)

GS4-1 A Back-to-Back Twisted Chaotic Jerk Attractor using Inherent Hyperbolic Sine Function in Anti-Parallel Diodes for Secure Communications

Sura Laptawee and Wimol San-Um
(Thai-Nichi Institute of Technology, Thailand)

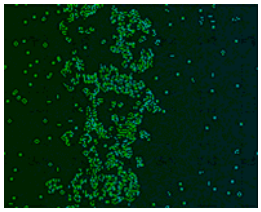
A new simple chaotic system with both dynamic and jerk forms through the use of an inherent hyperbolic sine function in anti-parallel diode configuration. Numerical analysis was performed through an existence of attractor, Equilibria, Jacobian matrices, and eigenvalue that indicates the stability of the system. Numerical simulations have been performed in MATLAB through the models of diode and op-amp no. 1N4148 and TL084, respectively. Simulated dynamic properties of the chaotic systems are described through, bifurcations, and time-domain chaotic waveforms. In particular, the circuit reveals a complex back-to-back twisted chaotic attractor which never been found in other circuit configuration. The proposed circuit offers a potential alternative to robust cost-effective nonlinear oscillators in communications and controls applications.



GS4-2 Extension of cellular automata by introducing an algorithm of recursive estimation of neighbors

Yoshihiko Kayama
(BAIKA Women's University, Japan)

This study focuses on an extended model of a standard cellular automaton (CA) that includes an extra index consisting of a radius that defines a perception area for each cell in addition to the radius defined by the CA rule. Extended standard CA rules form a sequence ordered by this index, which includes the CA rule as its first term. This extension aims at constructing a model that can be used within the CA framework to study the relationship between information processing and pattern formation in collective systems. Although the extension presented here is merely an extrapolation to a CA with a larger rule neighborhood, the extra radius can be interpreted as an individual difference of each cell, which provides a new perspective to CA. Some pattern formations in extended one-dimensional elementary CAs and two-dimensional Life-like CAs are presented. It is expected that the extended CA can be applied to various simulations of complex systems and other fields.



January 21 (Thursday), 09:30–10:45

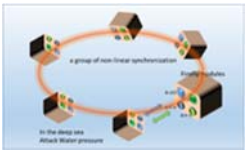
GS4-3 A Note on Sequences Generated Small One-Bit Cellular Automata (Withdrawal)

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

GS4-4 Development of a communication system using a non-linear synchronous firefly

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

We have to create a firefly synchronization circuit using the LED investigation. It was also investigated the conditions under which it becomes non-linear mode in the SPICE simulator. Also we went a simulation with multiple circuit in which the CR circuit based on Matlab in preparation for firefly circuit created by the microprocessor. Also, we went the non-linear synchronous test create a firefly circuit by the microprocessor. In addition, it was carried out simulation is also considered application as a resource exploration robot by small robots.



GS4-5 Notions of opacity in hybrid systems for cybersecurity

Koichi Kobayashi
(Hokkaido University, Japan)

A hybrid system is composed of continuous dynamics such as differential equations and discrete dynamics such as finite automata. It is well known as a mathematical model of cyber-physical systems. In this paper, notions of opacity of hybrid systems are defined. Opacity aims to determine if a secret behavior in the system is kept opaque to outsides. Using a mixed logical dynamical (MLD) system model, the verification problem of opacity is reduced to a mixed integer programming (MIP) problem. Furthermore, we consider the optimal control problem such that a given hybrid system becomes opaque.

January 21 (Thursday), 09:30–10:30

Room E

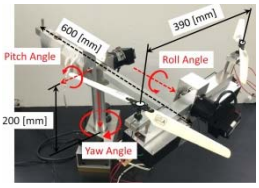
OS16 Robotics with Intelligence and/or Informatics

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

OS16-1 Adaptive PID control system for underactuated flying object through model-based prediction

Akira Yanou, Mamoru Minami, and Takayuki Matsuno
(Okayama University, Japan)

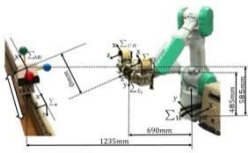
This paper explores adaptive PID control system for an underactuated flying object through model-based prediction. Helicopter is applied in large field because of flight ability such as vertical ascent, vertical descent and hovering. However the helicopter, which is one of the underactuated flight objects, is complex and has nonlinear dynamics. In this research, controlled target is an underactuated flight object with two inputs and three outputs. The proposed method predicts the system outputs using the model of controlled target, and the control inputs are calculated by using their values. That is, PID control gains are adaptively changed at each control period by the model-based controlled result with time passing virtually. The control gains consist of switching part and fixed part in order to tune the control performance. An experimental result is shown to consider the effectiveness of the proposed method.



January 21 (Thursday), 09:30–10:30

OS16-2 Visual Servoing Frequency Response of Eye-vergence System in Lateral Motion with Evolutionary Pose Tracking of 3D-Object

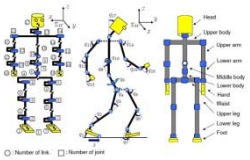
Hongzhi Tian, Yu Cui, Mamoru Minami, and Akira Yanou
(Okayama University, Japan)



Visual servoing towards moving target with hand-eye cameras fixed at the hand is inevitably affected by hand dynamical oscillations, therefore it's difficult to make target position always at the center of camera's view, because nonlinear dynamical effects of whole manipulator stand against tracking ability. To overcome the defects of the fixed-hand-eye system, in hand-eye-vergence system left and right cameras' directions could be rotated to observe and keep the target object to be seen at the center of camera images, reducing the influences of aberration of cameras lens. The dynamical superiorities of eye-vergence system are verified through frequency response experiments. In theory compared with fixed-hand-eye system the proposed eye- vergence system can track objects more promptly and stably. However there is a lack of understanding of the practical application status of the proposed system. Previous research has been stuck in research and improving about position tracking performance of the system. This paper, for the first time, analyzes the performance of 3D-object orientation tracking. The utilized orientation recognition method using quaternion is introduced and the orientation tracking results are shown for a more comprehensive analysis of system performance.

OS16-3 Dynamical Modeling of Humanoid with Nonlinear Floor Friction

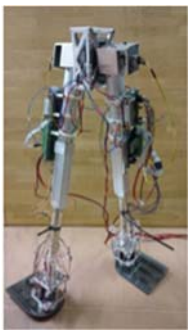
Xiang Li, Hiroki Imanishi, Mamoru Minami, Takayuki Matsuno, and Akira Yanou
(Okayama University, Japan)



Biped locomotion created by a controller based on Zero-Moment Point [ZMP] known as reliable control method looks different from human's walking on the view point that ZMP-based walking does not include falling state. However, the walking control that does not depend on ZMP is vulnerable to turnover. Therefore, keeping the event-driven walking of dynamical motion stable is important issue for realization of humanlike natural walking. In this research, a walking model of humanoid robot including slipping, bumping, surface-contacting and point-contacting of foot is discussed, and its dynamical equation is derived by the Extended NE method. And we considering the siliping of the foot of humanoid robot when the friction coefficient is small to create this walking model. In this paper we will introduce the new model which including the slipping supporting foot of humanoid robot and verify the model.

OS16-4 Development of 3D Dynamic Walker RW05 based on Passive Dynamic Walking

Tetsuya Kinugasa[1], Kazuhiro Ando[1], Yuta Onishi[1], Koji Yoshida[1], Shinsaku Fujimoto[1],
Masayuki Okugawa[2], Masamitsu Kurisu[3], Yuji Katayama[4], and Masatsugu Iribe[5]
([1]Okayama University of Science, Japan)
([2]Aichi Institute of Technology, Japan)
([3]Tokyo Denki University, Japan)
([4]Sanritz Automation Co. Ltd., Japan)
([5]Osaka Electro-Communication University, Japan)



A biped walker inheriting aspects of passive dynamic walker has an optimal body configuration for biped walking; thus, it is relatively easy for the walker to walk. One of significant aspects for the passive walking is adaptive behavior of its bipedal gait against variation of the body configuration and environment (slope inclination). To achieve the adaptive behavior, we should not introduce a control strategy to track a desired trajectory of hip joints. We have introduced, therefore, a sinusoidal oscillation for a telescopic knee in order to excite the bipedal gait, and achieved three-dimensional bipedal walking without hip actuation. However, the previous biped walkers had some problems, e.g., not negligible tension from tethers that prevented the walker from falling down. In the paper, we design a new active dynamic walker RW05, which inherits the previous biped, to reduce the influence of the tethers.

January 21 (Thursday), 13:00–14:15

Room A

OS2 ART | SCI

Chair: Takashi Ikegami (The University of Tokyo, Japan)
Co-Chair: Charles E. Taylor (University of California, Los Angeles, USA)

OS2-1 Art at the edge of chaos: Life, Art, Swords and Japanese Textiles

Charles E. Taylor[1] and Amy C. Taylor[2]
([1]University of California, Los Angeles, USA)
([2]msamytaylor.com, Chicago, IL, USA)

Art is often regarded to offer a means to see reality in a new way. “In a way, art is a theory about the way the world looks to human beings. It's abundantly obvious that one doesn't know the world around us in detail. What artists have accomplished is realizing that there's only a small amount of stuff that's important, and then seeing what it was.” Feigenbaum [1]. The field of Artificial Life introduced a new way of viewing life, as a complex adaptive system, emphasizing its logical as opposed to material foundations. Artistic programs thus played an important part of early developments in Artificial Life I and II, with work by Richard Dawkins, Craig Reynolds, Karl Sims, Demetri Terzopoulos, Przemyslaw Prusikiewicz, Survival Research Lab and others (Langton [2]; Langton et al. [3]). As the field matured, not just life, but also other complex adaptive systems were seen to be self-organizing and at “the edge of chaos”, prompting the question “What lies between order and chaos?” Crutchfield[4]. The answer was extended to include visual patterns generally —the traditional domains of art. We briefly review these developments and relate them to two long-standing traditional Japanese art forms — sword making Ogawa, [5] and natural textile dyeing. We show how these arts both explore complex systems at “the edge of chaos”.

OS2-2 Automated Evolutionary Production of Audio-Visual Pieces -- Can we call it Art?

Tatsuo Unemi
(Soka University, Japan)

The project named "Daily Evolutionary Animation" set up by the author has produced ten short movies automatically everyday by means of evolutionary computing based on a type of computational aesthetic measures. Such type of automated production is one of the alternative frameworks of artistic activities, where no artist who would intend to express something by production exists. It is possible to assume two different points of view. We might recognize the production process itself is the artwork and the author who designed and built the system is the artist. Or, we might be allowed to call the computer itself an artist from a view point of Strong AI. The point might be how the system directly producing art piece is independent from the mother system which produced the former system. The discussion will be able to contribute to disrupt the concept of the art.

OS2-3 The Art and Science of Artificial Life

Victoria Vesna[1], Takashi Ikegami[2], and Hiroo Iwata
([1]University of California, Los Angeles, USA)
([2]University of Tokyo, Japan)
([3]Tsukuba University, Japan)

Research on artificial life involves attempts to produce lifelike phenomena through simulations using computer models, robotics, and biochemistry. We propose an autonomous sensor network system spatially distributed in a fully immersive physical environment[1][2]. One node is composed of two sensors, light and humidity, that senses the corresponding environment information with an adaptive sensing periodicity. The sensor information obtained by each node is sent to other nodes via wireless connections. One of the most interesting findings here is that the network spontaneously generates a resonating state to the space and time context. The significance of this work is twofold. First, artificial life is shown as an autonomous chemical network that is translated into a digital sensor network system. Second, this work shows how an artificial life system behaves in an open environment as opposed to a closed, simulated environment for relatively longer periods of time. The Bird Song Diamond art installation utilizes recordings of birds[3] and visuals to create a fully experiential space that maps real and artificial worlds. By creating a space that enacts the networked behavior of participants in relation to the natural systems, all their senses are engaged based on the principles of the scientific findings. We expect this to become a new method of experimentation with artificial life in an open environment.

January 21 (Thursday), 13:00–14:15

OS2-4 BIRD SONG DIAMOND: Call and Response and Phase Transition work

Aisen Caro Chacin[1], Maša Jazbec[1], Mizuki Oka[1] and Itsuki Doi[2]
([1]Tsukuba University, Japan)
([2]Tokyo University, Japan)

Bird Song Diamond is an interactive installation based on the patterns of communication within the spatial networks of birds in the field[1][2]. It brings together interaction designers, sound artists, artificial life and virtual reality engineers from UCLA, Art|Sci, University of Tsukuba, and the University of Tokyo to create an immersive experience that has both a mobile and a site specific iteration. Mobile version: The Call and Response system consists of a transceiving parabolic station, where participants can hear bird sounds and mimic them. The system compares the accuracy of the call and based on the participants' sonic contribution, it activates visualizations of an artificial geometric organism that co¬evolves with the newly formed communication patterns. This artificial audiovisual organism is born from birdsong and human¬bird mimicry making grammatical structures which emerge from the conversations between birdsong field recordings and human samples that are collected throughout the duration of the exhibition. Site specific version: The Phase Transition System has been designed for the Empowerment Informatics Virtual Reality Space at the University of Tsukuba. Participants can enter a submersive 3D stereoscopic projection of an artificially programmed flock of birds (BOID Model)[3]. Parametric surround sound pointed at specific quadrants of the space also illude at the reality of the experience coordinated with the passing of the virtual flock. Participants are also invited to fly inside the space utilizing a harness that lifts the person based on the flapping of wings we provide for them. They have markers that track the position of each participant allowing them to interact with the virtual environment and become part of the flock.

January 21 (Thursday), 13:00–14:30

Room C

OS10 Large scale social simulation: I. agent

Chair: Takashi Shimada (The University of Tokyo, Japan)
Co-Chair: Nobuyasu Ito (The University of Tokyo, Japan)

OS10-1 A Basic Study of Massive Parallelization for Multi-Agent Systems

Yuichi HIROKAWA[1], Noriaki NISHIKAWA[1], Toshiyuki ASANO[1],
Masaaki TERAI[2], and Teruo MATSUZAWA[3]
([1]Japan Agency for Marine-Earth Science and Technology, Japan)
([2]The Institute of Physical and Chemical Research (RIKEN), Japan)
([3]Japan Advanced Institute of Science and Technology, Japan)

In high-performance computing (HPC) of multi-agent systems (MAS), there often exists a load imbalance that slows down the calculation. In this paper, a parallelization method to relax the load imbalance problem is shown. The method for MAS is evaluated on three major architectures, including many-core processors on an x86-based server with GPUs, and the Earth Simulator. For simplicity, the boids model is used to simulate a swarm intelligence. The method can decrease the ill effects of a load imbalance to almost zero in a simulation of 50 million agents. In addition, the method guarantees the accuracy of sequential execution, even in a parallel calculation with a pseudo-quadruple calculation. The method has been confirmed to have the potential to complete a simulation in real-time on the Earth Simulator. In addition, the method has the ability to calculate 100 billion agents in a reasonable amount of time.

OS10-2 Platform Design for Large-Scale Artificial Market Simulation and Preliminary Evaluation on the K computer

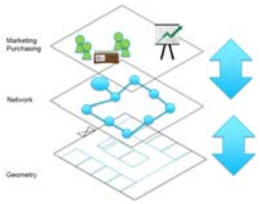
Takuma Torii[1], Tomio Kamada[2], Kiyoshi Izumi[1], and Kenta Yamada[1]
([1]The University of Tokyo, Japan)
([2]Kobe University; RIKEN AICS, Japan)

Artificial market simulations have potential to be a strong tool for studying rapid and large market fluctuation and designing financial regulations. High-frequency traders, that exchange multiple assets simultaneously within a millisecond, is said to be a cause of rapid and large market fluctuation. For such a large-scale problem, this paper proposes a platform for artificial market simulations. The platform enables modeling financial markets composed of various brands of assets and a large number of agents trading on a short timescale. For parallel simulations, this platform exploits the variety in trading frequency among agents, that is, the fact that some traders do not require up-to-date information of markets changing in millisecond order. To allow users to define their simulations without parallel computing expertise, this platform provides a simulation model for parallel environments. We evaluated a prototype implementation on the K computer using up to 256 computing nodes.

OS10-3 Agent-based Simulation of movement and purchasing behavior of walking shoppers

Hideyuki Mizuta[1], Kumiko Maeda[1], Sachiko Yoshihama[1], and Hironobu Nakasuji[2]
([1]IBM Research, Japan)
([2]University of Tsukuba, Japan)

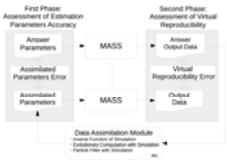
In this paper, we introduce an agent-based simulation of movement and purchasing behavior of walking shoppers in a large shopping mall including a number of shops and passageways. Agents have integrated characteristics of pedestrian in a geographical space and consumer in an economic transaction. We develop a new simulation for a shopping mall with interacting walking consumer agents to investigate improved shopping experiences and marketing strategies. Agents can have heterogeneous preferences for purchasing goods at tenant shops based on their segments that also generate different attribute for walking around and visiting areas. Through what-if simulations with different scenarios including floor layout and marketing strategies, we can evaluate KPIs for tenant and mall such as revenue, number of customers, conversion rate and duration.



January 21 (Thursday), 13:00–14:30

OS10-4 Possibility Assessment Framework of Data Assimilation Based on Pareto Efficiency for Multi-agent Social Simulation

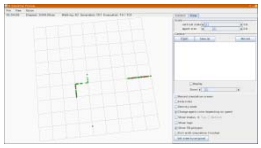
Hidetoshi Kawaguchi[1] and Itsuki Noda[2]
([1]Tokyo Institute of Technology, Japan)
([2]National Institute of Advanced Industrial Science and Technology, Japan)



We propose a framework to evaluate a possibility of data assimilation for Multi-agent Social Simulations(MASS), and confirmed its efficacy through an experiment. Data assimilation is a method to estimate simulation parameters and boundary conditions to fit simulation results to observed data in the real world. Basic dynamics of MASS has not been established and include large ambiguous factors like human thought. Therefore, its is not a trivial issue to know the possibility of data assimilation of a given MASS. Because of ambiguous or non-established dynamics and theory for MASS, we need methods or frameworks to check the possibility and soundness of data assimilation. The proposed framework is composed of two phases. The first phase evaluates how accurate input parameters are estimated by a given assimilation condition and method. The second phase measures how likely the MASS can reproduce a given output data from the assimilated input parameters.

OS10-5 Pedestrian simulator with flexible framework to enhance detailed behavior and environmental change

Itsuki Noda and Tomohisa Yamashita
(AIST, Japan)



We propose a new version of our pedestrian simulator, CrowdWalk, with a flexible framework to control and to enhance detailed behaviors of pedestrians and changes of conditions of environments. In order to provide a simulation framework of pedestrian dynamics to satisfy conflicting requests, scalablity and flexibility, we add a new functionality to control simulation conditions by Ruby script inside of the simulation to CrowdWalk. The new functionality enables change simulation environments and agent behaviors during the simulation. Using this facility, we can carry out various simulation uniformly without changes of the simulator itself.

OS10-6 An interactive job management system for comprehensive simulations: OACIS version 2.0

Yohsuke Murase[1], Takeshi Uchitane[1], and Nobuyasu Ito[2]
([1]RIKEN, Advanced Institute for Computational Science, Japan)
([2]The University of Tokyo, Japan)

We present version 2.0 of OACIS (Organizing Assistant for Comprehensive and Interactive Simulations), an open-source software to manage vast amount of simulation results and jobs in an organized way. Recent development of high- performance computers enabled us to explore parameter-space comprehensively, however, in such cases, manual management of simulation jobs and results are impossible. OAICS automates most of the repetitive tasks when conducting simulations and makes parameter-scan much easier. In this article, we present a brief overview and new features of OACIS version 2.0.

January 21 (Thursday), 13:00–14:45

Room D

OS7 Intelligent Data Analysis

Chair: Kiyota Hashimoto (Prince of Songkla University, Thailand)
Co-Chair: Sachio Hirokawa (Kyushu University, Japan)

OS7-1 Survey on Japanese Academic Library Reference Services

Sachiko Nakajima[1,2], Yukiko Watanabe[2], and Sachio Hirokawa[2]
([1]Baika Wemen's University, Japan)
([2]Kyushu University, Japan)

The authors analyzed Japanese academic libraries' websites for reference-related activities, especially how libraries inform users of terminology as well as virtual reference materials through email or web-forms on their main webpages. Major differences were found in a comparison with a survey of US academic libraries.

OS7-2 Effect of Synonym on Prediction Performance for Postoperative Hospital Stay by Text Mining

Haruka Kubo[1], Takanori Yamashita[1], Yosifumi Wakata[1], Hidehisa Soejima[2],
Naoki Nakashima[1], and Sachio Hirokawa[1]
([1]Kyushu University, Japan)
([2]Saiseikai Kumamoto Hospital, Japan)

We analyzed medical records of the case of proximal thighbone fracture operation. The records consist of 5 components. We applied SVM (support vector machine) to extract the characteristic words to predict the patients of long post-operatively stay. This analysis of 3,840 medical records of Saiseikai Kumamoto Hospital showed that the objective component contains the most crucial words. We applied an entry of Wikipedia as a dictionary to improve performance and extracted characteristic word for the long-term hospitalization, then comprised with the previous experiment.

OS7-3 Comparison of SVM and Decision Tree for Prediction of Postoperative Hospital Stay

Yuusuke Adachi[1], Takanori Yamashita[1], Yosifumi Wakata[1], Hidehisa Soejima[2],
Naoki Nakashima[1], and Sachio Hirokawa[1]
([1]Kyushu University, Japan)
([2]Saiseikai Kumamoto Hospital, Japan)

In the medical practice, vast medical data are accumulated every day by medical computerization now. Due to increasing those data, the importance of utilizing them also increases. In particular, the analysis of the non-structured text data such as medical records has been developing, and it is demanded analyzing using them effectively. In this study, we predicted the long-term hospitalization patient from the medical records, from the inpatient who received proximal thighbone bone fracture operation to a discharge, with two machine learning methods, SVM and Decision Tree. In addition, we analyzed the factor that showed a difference of the predicted performance of two method.

January 21 (Thursday), 13:00–14:45

OS7-4 Performance Effect of Feature Selection on Support Vector Machine

Naoya Onimura, Brendan Flanagan, Takanori Yamashita, and Sachio Hirokawa
(Kyushu University, Japan)

In text classification, it is fundamentally possible to obtain high prediction performance using all words of the target data, although by using an optimal feature selection technique it is possible to achieve even higher prediction performance. This paper examines methods of feature selection for text classification by SVM. A combination of three word kinds of significance rankings and two attribute selection techniques by SVM were proposed. Prediction performance was evaluated for a total of 13 categories of the corpus re0.

OS7-5 Correspondence of Clustering of Questions and Clustering of Answers

Yuusuke Yoshida[1], Kiyota Hashimoto[2], Takahiro Suzuki[1], and Sachio Hirokawa[1]
([1]Kyushu University, Japan)
([2]Prince of Songkla University, Thailand)

Many companies provide FAQ Web pages for responding users' question and for offering useful information. However, no one can prepare a perfect answer for all questions in advance. It would be desirable if we could choose a priori answer for variety of questions. As a preliminary study of this purpose, the present paper compares the clustering results of question pages and answer pages on personal computer troubles.

OS7-6 Text Mining of Daily Sales Reports

Nao Wariishi[1], Shuichi Mitarai[2], Takahiro Suzuki[1], and Sachio Hirokawa[1]
([1]Kyushu University, Japan)
([2]Lafla Inc., Japan)

It is one of the most important issues for companies in any industries to improve the salespeople's business activities because the improvement leads to corporate achievements. In many companies, salespeople often record their activities in their daily sales reports. For example, they record when they contacted with their customers, what they talked with them, future outlook of the negotiation and so on. In this paper, by applying machine learning, we extract the factors which identify the differences of business activities between salespeople with good sales results and the other salespeople. Furthermore, we evaluate the classification performance using the importance of each factor.

OS7-7 A quantitative contents diversity analysis on consumer generated media site

Kyohei Kamihata and Eisuke Ito
(Kyushu University, Japan)

Recent years, the CGM (Consumer Generated Media) services, such as YouTube and Nico video, are popular. CGM sites is growing service into the media which have a big influence on society. A lot of videos are posted to a CGM site, many users are viewing a lot of video every day. Uniformity of the contents contributed to a CGM site is pointed out now. We think when diversity of contents decreases and uniformity of contents advances, the cultural diversity is lost. It seems difficult to bring about new cultural innovation from the culture which was too specialized in the specific environment and was lost of diversity. We analyzed diversity of video contents about Nico video as a CGM site. In this paper, we analyzed that the degree of similarity between the video tags.

January 21 (Thursday), 13:00–14:15

Room E

OS15 Robot Control

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

OS15-1 Guaranteed cost control of robot manipulator with prescribed degree of stability

Hiroaki SHIGEHARA, Nobuya TAKAHASHI, and Osamu SATO
(University of Miyazaki, Japan)

Linear quadratic regulator (LQR) is an important design method of a stable state feedback system for a linear control system. By using this method, under the controllability condition of the system structure, it is possible to obtain a stable closed loop system. In spite of the plant is stable or not, the result system has the poles located in the left-half plane. Furthermore, the closed-loop system is guaranteed that the minimization of the performance index which constructed as a quadratic form with state vector, input vector and weighting matrices. The fundamental characteristics of the closed-loop system is able to adjust by choosing an element of weighting matrix. The feedback gain matrix is obtained from the solution of the algebraic Riccati equation (ARE). Chang et al extend LQR to the case with the system includes a structured uncertainty [1]. This design method is called as guaranteed cost control. With a solvable condition of the nominal system and under an additional assumption, the robust closed-loop system is obtained from the solution of the stochastic algebraic Riccati equation (SARE). This equation is formed as extended version of the ARE with an additional upper bound term of the effect of structured uncertainty. Thus GCC is considered as of the natural extended version of the LQR. On the other hand, Anderson extend LQR problem with the performance index is defined as increased as exponential [2]. In this result, it is possible to relocate all the poles of the closed-loop system to leftward in the complex plane. The moving distance is prescribed as a degree of stability in the performance index. Thus, the method is possible to arrange the place of the poles obtained from the LQR like method. In the robot control problem, there exists many types of uncertainty, effect of angular backlash of gear, wheel slip and so on. They can not to measure by using onboarded inner sensor of the robot, but the effects of these uncertainties to the robot performance are not ignorable. So that it is necessary to estimate the effect of these uncertainty and to design a robust stable system. Our proposed method is able to apply to these problem. In this paper, we extend GCC to the prescribed degree of stability method, and we apply our proposed design method to the of the robot manipulator control problem. Through the numerical example, we show the validity and effectiveness of our proposed method.

OS15-2 Development of an automatic flocculation tester for highly-efficient data acquisition

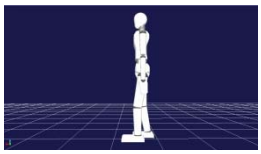
Yasunobu Hitaka[1], Kazuhiro Fujisaki[2], and Naoko Nishio[1]
([1]Kitakyushu National College of Technology, Japan)
([2]KIT Senior Academy, Kyushu Institute of Technology, Japan)

A new flocculation tester which automates mixing/stopping the suspended solution for flocculation processes and monitoring the turbidity of the supernatant or settling velocity of the flocculated particles on a real-time basis is developed to conduct the flocculation test with highly efficient data acquisition. To achieve the automatic mixing/stopping or monitoring, the Arduino microcontrollers are installed in our tester. For mixing/stopping, the DC motor is controlled by the sequence control. Moreover, PI control is implemented to control the motor speed accurately and robustly. For monitoring, the transmission photo sensor is installed to measure the turbidity or settling velocity. In this paper, the details of our proposed tester are presented. Also, the preparation of the calibration curve by using the spline interpolation method is presented and the validity of the calibration curve is investigated by experiments.

January 21 (Thursday), 13:00–14:15

OS15-3 Bipedal walking with consideration for the softness of the robot ankle

Kohei Yoshida, Sadaaki Kunimatsu, and Mitsuaki Ishitobi
(Kumamoto University, Japan)



In angle control for the ankle joint of the bipedal walking robot, when an excessive torque of the ankle joint occurs due to large disturbance, a sole of the robot sometimes leaves the floor. Then, it is difficult to control the robot. Therefore, it is desirable to maintain plane contact between the sole and the floor as much as possible. To solve this problem, it is important to provide the ankle with softness, where softness does not mean material one such as gel but functional one as a way to use torque of the ankle joint. The way to provide the ankle with softness controls the torque of the ankle joint depending on the situation. By using gait generation method with control of the ankle joint torque, we make a bipedal walking simulation with dynamics simulator ”Choreonoid” developed by AIST, and confirm its usefulness.

OS15-4 Analysis of manipulator in consideration of impact absorption between link and projected object

Asaji SATO[1], Osamu SATO[2], Nobuya TAKAHASHI[2], and Masahiro YOKOMICHI[2]
([1]Miyakonojo College, National Institute of Technology, Japan)
([2]University of Miyazaki, Japan)

In this paper, equations of motion of a manipulator are derived in consideration of the characteristics of DC servomotors, and a performance criterion for saving energy is defined in consideration of energy consumption of the driving source. When the manipulator is operated in a vertical plane, the system is highly non-linear due to gravity, and an analytical solution cannot be found. By considering for catching the object which moves parabolic, trajectories for saving energy are calculated by iterative dynamic programming method. And, the dynamic characteristics of two-link system controlled based on the trajectory for saving energy are analyzed theoretically. When the object moves parabolic, measurement method for the force of collision between link and object is examined by experiment.

OS15-5 A study about control for rolling objects and beam system

Yohei YAMASHITA[1], Asaji SATO[2], and Osamu SATO[1]
([1]University of miyazaki, Japan)
([2]Miyakonojo College, National Institute of Technology, Japan)

In this paper, equations of motion of a manipulator are derived in consideration of the characteristics of DC servomotors, and a performance criterion for saving energy is defined in consideration of energy consumption of the driving source. When the manipulator is operated in a vertical plane, the system is highly non-linear due to gravity, and an analytical solution cannot be found. By considering for catching the object which moves parabolic, trajectories for saving energy are calculated by iterative dynamic programming method. And, the dynamic characteristics of two-link system controlled based on the trajectory for saving energy are analyzed theoretically. When the object moves parabolic, measurement method for the force of collision between link and object is examined by experiment.

January 21 (Thursday), 13:00–16:45

Room F

Poster Session

PS1 A model towards analysis of regenerating patterns using multivariable polynomials - Polynomial Life -

Hiroshi Yoshida
(Kyushu University, Japan)

A model towards analysis of regeneration phenomena in multicellular organisms is proposed here. In this model, a multicell is expressed as a multivariable polynomial, thereby cell proliferation, movement, and elimination can easily be described as various operations for polynomials. Such a model is here called polynomial life. In the presentation I am going to present some patterns generated with polynomial-life models and to discuss regeneration on multicellular organisms.

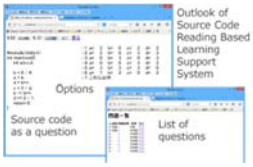
PS2 A simple method to simulate chemical reactions

Masanori Shiro
(HIRI, AIST, Japan)

To find a condition in an origin of life is an important and interesting problem. Although much effort using simulations and experiments of it is invested, the condition is still unclear now.
In the simulation field, a reason of it is its huge amount of calculation. Because quantum mechanics calculations are required to simulate of the chemical reactions although it is very heavy. In fact, more than one week computing needs for one pico second simulating using optimized software. Actually, it is very difficult to reveal how to evolve from the inorganic matters to nucleotides, phosphatide and glucose, using simulations.
To avoid the calculations of quantum mechanics, some types of simplified methods are proposed based on experimental constants as Gillispie method. However in our problem of the origin of life, we do not have any experimental constants now.
Hence, we now suggest an other simple method using a probability distribution of molecules and energies. It is one of the mean field approximations but whole parameters included effect of cosmic ray and hot water, are given as probability distributions. For instance, we pick up a pair of molecules from molecular distribution with a picked energy from energy distribution, and do simple comparison between potential and their total kinetic energy. If we found larger kinetic energy, atoms will be exchanged, in other words, a chemical reaction will develop. If less than it, no reaction will pass off. Many trials of this comparisons will lead a stable distribution under the given mean potential. This is time depended simulation and simple way but not found the best condition for the origin of life yet…

PS3 A source code reading based learning support system for novice programming education

Koki Okimoto[1], Shimpei Matsumoto[1], Shuichi Yamagishi[1], and Tomoko Kashima[2]
([1]Hiroshima Institute of Technology, Japan)
([2]Kindai University, Japan)



Programming has been considered as an essential skill in higher education faculties of informatics, mainly colleges and universities. The aim of this study is to develop a source code reading based learning support system available for self-study and mini-examination to check the understanding degree on the programming language specification. The developed system can easy to collect data to judge each student's understanding degree of programming language specification and the difficulty of source code. The developed system of this study can automatically generate a source code of C programming language, and gives a question that requires students to answer the proper value of a variable after the execution of source code.

January 21 (Thursday), 13:00–16:45

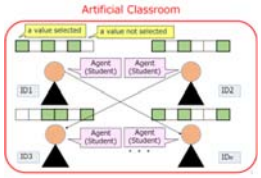
PS4 A study on the noise-robustness algorithms on various types of cepstral feature representation for real-world speech recognition

Jeih-weih Hung, Jung-Shan Lin, and Hsi-Yuan Liao
(National Chi Nan University, Taiwan)

In this study, we focus on evaluating different types of cepstral feature in speech recognition under noise-corrupted environments. At first, three types of speech feature representation are introduced, including mel-frequency cepstral coefficients (MFCC), warped discrete Fourier transform cepstral coefficients (WDFTCC) and gammatone cepstral coefficients (GTCC). These three feature representations primarily differ in the applied filter-bank. Then we perform several noise robustness techniques on the above three types of feature to evaluate the corresponding additivity in improving the recognition accuracy under a wide range of noise-corrupted environments provided in the Aurora-2 connected digit database and task. Experimental results reveal that, in the case of no noise robustness processing, MFCC performs slightly better than WDFTCC and GTCC, while GTCC and WDFTCC outperform MFCC in the case that all three of them are enhanced by any of the noise robustness approaches in advance.

PS5 A study on visualization method of exclusion process in artificial classroom

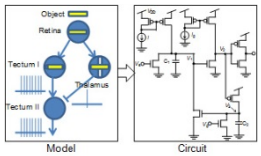
Kengo Iwai[1], Shimpei Matsumoto[1], Kosuke Kato[1], Yoshinobu Maeda[2], and Shuichi Yamagishi[1]
([1]Hiroshima Institute of Technology, Japan)
([2]Niigata University, Japan)



Bullying is a critical social problem that needs to be solved. There is a computational model of Maeda and Imai as one of the research on bullying at schools. They proposed an agent-based model of a friendship process, and it showed that isolated agents, who are unable to find a set of values in common with others, are generated through the homogenization and the distinctiveness. Further, it is considered from various aspects in light of a convergence state and an agent configuration. However, there is a problem in the previous study that previous studies have not fully discussed the exclusion process of the isolated agents from the viewpoint of a visualization. So, in this study, we proposed a visualization method using the concept of self-organizing map for the multi-agent model of bullying and developed a visualization system to understand the isolated process of the model.

PS6 Analog complementary metal oxide semiconductor circuit for simple shape recognition based on the frog vision system

Ayuto Murase and Kimihiro Nishio
(National Institute of Technology, Tsuyama College, Japan)



We proposed in this study a novel analog complementary metal oxide semiconductor (CMOS) circuit for simple shape recognition based on the frog vision system. The frog vision system can recognize the simple shape such as the rectangle and square although the vision system is the simple structure. The circuit was evaluated by the simulation program with integrated circuit emphasis (SPICE). The simulation results with SPICE showed that the proposed circuit can recognize the simple shape. In the future, the realization of new vision sensor can be expected by using the proposed circuit.

January 21 (Thursday), 13:00–16:45

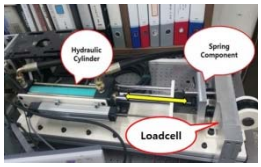
PS7 Analyzing a Relation between Skill Levels and Eye Tracking Patterns: Towards Effective Learning System that Suggests Weak Points

Atsushi Shimizu, Keisuke Takahashi, Daisuke Yagi, Tetsuo Tanaka, and Kazunori Matsumoto
(Kanagawa Institute of Technology, Japan)

A key issue in studies of e-learning is developing a system that supports learners as regards individual personality, skills and preferences. Typical documents used in e-learning systems consist of several types of components; texts, graphs, figures, program codes, equations, etc. This requires a learner to collect first necessary parts of information across components, to relate and recompose them, and finally translate them into useful his own knowledge. In order to accomplish this task effectively, a crucial issue is a design of components in terms of visualization. We note here that the effective design should take skill levels of learners into account. In many cases, a good design for an expert is not necessary good for a beginner. Then, the first pillar of this study is a design of learning documents that reflects learners' skill levels.

PS8 Bilateral control of reaction force reflection for teleoperation with hydraulic system

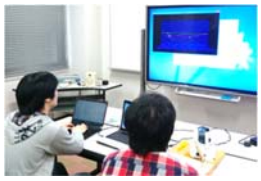
Hyun Hee Kim, Keum Gang Cha, and Min Cheol Lee
(Pusan National University, Korea)



Using a robot to dismantle the heavy structure will have many problems. Basically, the force we need to dismantle structures are very large. When a person steers the robot directly to dismantle the heavy structure is exposed to the risk of injury caused by debris during operation. Person can't accurately determine whether or not the robot contacts structures, and it can't be able to ensure precision. In this paper, a slide mode controller (SMCSPO) based remote control is applicable to solve this problems with finding the reaction force under the echo disturbance observer.

PS9 Comparison of Learning Effectiveness in Computer Aided Brush Coating Skill Training System with the Difference of Instructional Methods

Nobuto Fujimoto[1], Shimpei Matsumoto[1], Masaru Teranishi[1], Hidetoshi Takeno[1], and Tatsushi Tokuyasu[2]
([1]Hiroshima Institute of Technology, Japan)
([2]Fukuoka Institute of Technology, Japan)



The authors previously have developed a system to evaluate brush coating skill with a haptic device to improve the ability. In the skill training, historically, the instruction method with presenting the video of trainee's action has been considered to be effective. Thus, our developed system includes a software system to visualize the brush coating motion. This software system can record trainee's brush coating motion and visualize the data in virtual 3-dimensional space, so the advisor and the trainee can share a learner's skill such as jiggling and tilting of the brush coating motion with reproducing his/her past training data on the computer screen. In this paper, some kinds of instructional methods with our software system are designed to improve the learning effectiveness of our software system blended skill training environment, and the difference of the instructional methods is analyzed based on the proposed criteria.

January 21 (Thursday), 13:00–16:45

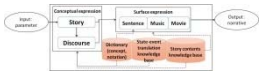
PS10 Control Design of Object Classification for An Intelligent Vehicle Combining Robot Arm with Computer Vision

Hsiang-Yung Hsu, Jeih-weih Hung, and Jung-Shan Lin
(National Chi Nan University, Taiwan)

This paper presents the control design of an intelligent vehicle system with object classification which lets the robotic manipulator overcome the obstacle of distance to distinguish various objects and execute pick-and-place action. Three main important parts are investigated, including mobile vehicle, robotic arm and image processing. Integrating those three parts together to reach the pick-and-place task for object classification is our major control objective. Some image processing algorithms are employed to determine the position and relative distance between targets. The technique of inverse kinematics is used to calculate the coordinates of objects for manipulating the robotic arm. For this intelligent system, the control design must have the potentials to analyze images from camera, and then transmit the control instructions to drive the vehicle for moving as well as the robotic arm for gripping the correct object and putting it into the desired destination. As a result, some experiments are given to demonstrate that the proposed intelligent system can achieve the purpose of object classification successfully.

PS11 Controlling the use of Semantic Concepts in an Integrated Narrative Generation System: The use of the Verb Frequency Information

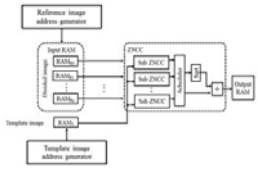
Takashi Ogata and Jumpei Ono
(Iwate prefectural university, Japan)



The authors have been developing a narrative generation system called the Integrated Narrative Generation System (INGS). This paper focuses mainly on the story generation mechanism and the verb conceptual dictionary. The most important element of a story structure generated is an event that consists of a verb's semantic concept and noun's semantic concepts. When it is necessary for the INGS to determine a verb concept in an event, it randomly selects a verb concept from relatively category in the verb conceptual dictionary. However, various types of verb concepts, such as difficult/easy to understand and new/old, are mixed in the current version of the dictionary. The final paper will describe the data acquisition process and the results, their application to the INGS, and an investigation by a questionnaire survey. We will survey, for example, when we use verb concepts according to high-frequency verb words, whether the output text is more understandable.

PS12 Design of a ZNCC template matching processor based on FSBMA

Yuma Matsui, Akihiko Tsukahara, and Akinori Kanasugi
(Tokyo Denki University, Japan)



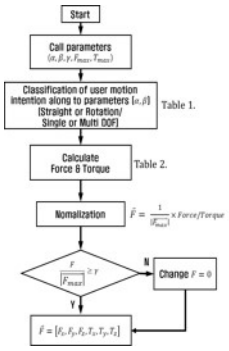
The template matching is a method to judge whether the same pattern as the small part of the image is present in the entire image. This method has been widely applied to such as image recognition in the robot. Correlation coefficient is the most effective as a method of template matching. In this paper, we propose a template matching processor with zero-mean normalized cross-correlation (ZNCC) and describe the results of implementation and experimentation in FPGA. As the search technique, full search block matching algorithm was used for high accuracy. Further, the data format of the proposed processor is single-precision floating-point format which can be used for general purposes.

January 21 (Thursday), 13:00–16:45

PS13 Loadcell based user motion intent identification for an active upper limb exercise robot

Juhyeon Lee, Sunghoon Eom, Jeonil Moon, and Seungyeol Lee
(Daegu Gyeongbuk Institute of Science & Technology, Korea)

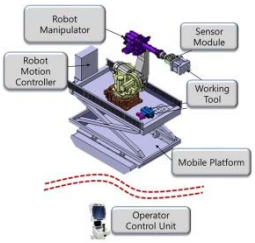
An active upper limb exercise robot which overcome the limit of the existing rehabilitation exercise robot is provided the patient with the customized exercising program reflecting information of the user's movement intention and the recovery of physical motor skill. The robot system above includes a physical human-robot interface (pHRI) device that can transfer the right assistance-power to the user reflecting the patient's movement will and condition. In this paper, it is suggesting the algorithm to understanding the intent of user's movement that is to be applied on the pHRI. The signal measured through the sensors (load-cell) which is attached in the physical human-robot interface is classified as total nine kinds on the space of the rectangular coordinate system and is identified user motion intention. The proposed user motion intent identification algorithm is verified by computer simulation.



PS14 Design of force-regulated impact control algorithm for a reinforced concrete chipping robot

Jaeuk Cho, Seungyeol Lee, and Sunghoon Eom
(Daegu Gyeongbuk Institute of Science & Technology, Korea)

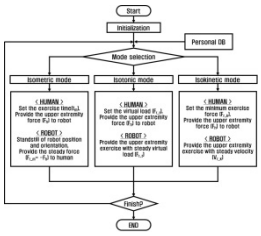
Currently, many studies have been conducted on field robots that have been spotlighted as a solution of problems such as wage increase, labor shortage, and danger to human life caused by construction accidents. This paper presents the force-regulated impact control algorithm of a reinforced concrete chipping robot that is a type of field robots. The algorithm regulates an impulse with reaction forces when the robot carried out concrete chipping for the maintenance of underground structures. The impulse is distinguished from reaction forces through differentials of reaction forces and variable impulse control is applied. The performance and efficiency of the proposed algorithm is verified through simulation.



PS15 Approach to human-robot cooperation for an active upper extremity exercise robot

Sunghoon Eom, Jeon-Il Moon, and Seungyeol Lee
(Daegu Gyeongbuk Institute of Science and Technology, Korea)

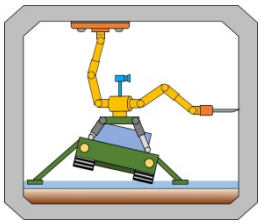
In this paper, the operation of active upper extremity exercise robots is discussed in detail in terms of human-robot cooperation. The proposed operating method is applied to the operating program of an active upper extremity exercise robot providing three exercise modes: isometric, isotonic, and isokinetic modes depending on the active exercise characteristics of users. In addition, because all exercise modes are developed based on the database of the extremity information of users (forearm length of a user, maximum velocity that a user can make, force/torque, etc.), the robot can provide suitable exercise for a particular user. Furthermore, this robot includes an emergency stop function to ensure the safety of users when the robot malfunctions during upper extremity exercises using the three modes and an abnormal state processing function to restart or return to the previous exercise based on the discretion of users.



January 21 (Thursday), 13:00–16:45

PS16 Human-robot collaboration for a reinforced concrete box culvert (RCBC) maintenance robot

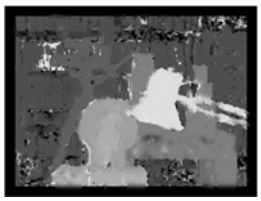
Seungyeol Lee
(Daegu Gyeongbuk Institute of Science & Technology, Korea)



Reinforced Concrete Box Culverts (RCBCs) are the fast, easy solution for applications under roads, railways and runways as drainage culverts, underpasses or service ducts. Sudden road collapses (Sinkhole) can occur at poorly engineered and maintained RCBCs neighboring sites. One of the problems associated with maintenance of RCBC is that the work has been overlooked current maintenance problems including; a labor-intensive, costly, and hazardous work. This paper is to propose a RCBC maintenance robot which can assist human labors during RCBC maintenance works in underground. To improve productivity and safety in RCBC maintenance procedures, a human-robot cooperative system with failsafe algorithm is described in conceptual design of the RCBC maintenance robot, would describe integration of advantages of both robots and humans, and bilateral interaction of between robots and humans.

PS17 Improving Performance of Stereo Matching based on Color and Fuzzy Inference System

Eun Kyeong Kim, Hyunhak Cho, Eunseok Jang, Nakjong Choi, and Sungshin Kim
(Pusan National University, Korea)



Images contain a lot of information which is color, brightness, saturation, shape of objects, and everything. Among the types of image, stereo images have an advantage of including distance information. Distance information can be calculated by disparity which means a gap between x-coordinate of one point on the left image and x-coordinate of corresponding point on the right image. Disparity can be obtained by calculation process called stereo matching. In general, stereo matching processes to find out a minimum value of cost function. However, there are the factors to reduce an accuracy of stereo matching: occlusion, texture-less and so on. Therefore, this paper proposes the method for improving the performance of stereo matching. Color information is used for considering the relationship between adjacent pixels. And fuzzy inference system is applied to decide pixel's disparity. As a result, error pixels decrease by 12.26 percent in comparison with an established one.

PS18 Investigating the Relation of Eye Tracking Patterns and Preferences: Towards a Methodology of Digital Documents

Keisuke Takahashi, Atsushi Shimizu, Daisuke Yagi, Tetsuo Tanaka, and Kazunori Matsumoto
(Kanagawa Institute of Technology, Japan)

This paper is concerned with a relation of eye tacking patterns and his/her preferences of objects, and furthermore is concerned with a design methodology of digital documents. We in this paper demonstrate several experimental results, and they are applicable in many practical areas including constructions of effective e-commerce Web sites, providing effective e-learning documents, next generation recommendation systems based on preferences, etc. In these areas, designing of digital documents is a crucial task in attracting and maintaining stakeholder's interests. Eye tracking patterns can be powerful tools that unravel the deeper and unknown behavior of document readers. Most of digital documents consist of several types of information, such as texts, images, sounds, movies, etc. They collaboratively work to convey intensions of designers. We have to remark here they share the restricted space so that the balance of them affects the effectiveness of the documents. The size ratio of these components in particular varies depending on a designer's choice. We however do not have clear design criteria for it. In this paper, we as a first step to the ultimate purpose analyze fundamental properties information design and eye tracking.

January 21 (Thursday), 13:00–16:45

PS19 On-Site Worker's Knowledge Evaluation Method with Monte-Carlo Tree Search for a Practical Re-entrant Scheduling Problem

Ryota Furuoka and Shimpei Matsumoto
(Hiroshima Institute of Technology, Japan)

This paper shows application results of Single Player Monte-Carlo Tree Search (SP-MCTS), an alternative of MCTS, for a practical reentrant scheduling problem addressed by our previous works. Especially in this paper, on-site worker's IF-THEN knowledge evaluation method with SP-MCTS is proposed. The authors have considered that the usefulness of SP-MCTS is not only to get useful results. This paper firstly describes the basic idea of SP-MCTS, and second shows the detail of the scheduling problem including formulation. After, this paper examines the availability of SP-MCTS for a practical problem. Especially, the potentiality of SP-MCTS for knowledge evaluation support is discussed from the experimental results.

PS20 Performance Comparison of Trajectory Functions by the Approximation using the Taylor series and the Fourier series for Minimizing the Consumption Energy of a Manipulator

Yoshio Yokose
(Kure College of Technology, Japan)

The global warming and the environmental destruction are caused from the mass consumption of energy in a factory in which robotic manipulators are used. It is necessary to take the trajectory planning into considerations in order to save the consumption energy. It is easy to obtain the optimal solution analytically in a linear system. However, the dynamical equation of the multi-link manipulator is non-linear. In this paper, the angle functions of the manipulator are approximated by the sequence of functions. The coefficients of the function space are searched by using the GA so that the objective function can be optimized with satisfying the boundary conditions. This paper uses the Taylor series and the Fourier series for the approximating function. And, this paper describes an application of the GA to plan the trajectories of a manipulator with non-linear friction and geometric constraints.

PS21 RFID patent citation network - an experimental examination

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

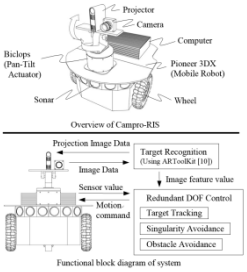
This study investigated the small world network in patent citations. The data of RFID patents was employed for analysis. The empirical results demonstrated that patent citation can be depicted as "small world". Furthermore, the patent citation network appears to the power-law connectivity distribution and shows preferential connectivity characteristic. In addition, the patents of high betweenness centrality were evaluated. Eighty-one percent of the patent citation activities showed relations with the patents of high betweenness centrality. The outcome of this study can provide a specific method for managers to recognize key patents, to plan their own patent deployment and to get insight into the optimum ways to navigate within such networks.

January 21 (Thursday), 13:00–16:45

PS22 Robust projection method for 3D space by a mobile robot with camera and projector based on a structured-environment approach

Kenji Tatsumoto and Satoshi Iwaki
(Hiroshima City University, Japan)

In this paper, we discuss a mobile robot that provides visual support for human activities by projecting information onto the surfaces of various objects in living spaces through a structured-environment approach. Campro-RIS employs a parallel two-wheeled vehicle system with a camera and a projector whose angle can be controlled with a pan/tilt actuator. By actively examining visual markers placed in the environment in advance, the robot projects distortion-free image information onto surfaces located at arbitrary distances and orientations even in extremely complex environments containing various objects. To precisely project the image onto the target location while simultaneously avoiding obstacles around the robot and staying within the pan/tilt actuator's movable range, we propose a robust projection control method built upon an image-based visual servoing technique based on actuator redundancy. The effectiveness of the proposed method is demonstrated in a three dimensional experimental system.



PS23 Temporal change in plantar surface contact area in walking motion

Koichi Kurita
(Kinki University, Japan)

We present a method for extracting individual human qualities based on the detection of the plantar surface contact area in a walking motion, with the use of a high-speed camera system with 150 frames per second. This technique captures images of the plantar surface contact area through a transparent acrylic slab by using the evanescent waves that form on the transparent acrylic surface where the plantar touches. Images were obtained of the temporal changes in the plantar surface contact areas of 14 healthy individuals between 22 and 23 years of age using the proposed technique. There were differences because the waveforms reflected, not only differences between the shapes of individual soles but also the plantar skin deformations of each individual. This suggests that the extraction of individual qualities based on subtle differences in the temporal changes in the plantar surface contact area can be achieved using the proposed technique.

PS24 The implementation of physical human-robot interface for upper limb exercise robot

Heung ki Kim, Jeon il Moon, Seung yeol Lee, and Sung hoon Eom
(Daegu Gyeongbuk Institute of Science & Technology, Korea)

The aim of this study is to solve the problem of personalized physical human-robot interface which can improve comfortable feelings of wearing assist device using 3D scanner and 3D printing technology.
First, in order to materialize of custom pHRI, gathering STL human model data by 3D scanner is transformed to mesh structure which can be freely transform work in a CAD (Computer Aided Design) tool. Second, the transformed data is used for most important pHRI design factor.
As a mentioned, the pHRI characteristics of proposed implementation major factor is safety and next 1. Reflection of human anatomy feature 2. Increasing of wearing convenience 3. Sensor arrangement for user motion intention. Additionally, In case of robot manipulator malfunction, user must be separated from pHRI rapidly. For this reason, pHRI must be designed open upper type. However, application of open upper type has problem with using cantilever type load-cell sensor. Because of this load-cell sensor cannot measure X-axis. Therefore, solving this problem, suggest of different type of pHRI design. It can be guarantee of user safety and measuring other axis.

January 21 (Thursday), 13:00–16:45

PS25 Toward visualization of software project using digital kanban log analysis

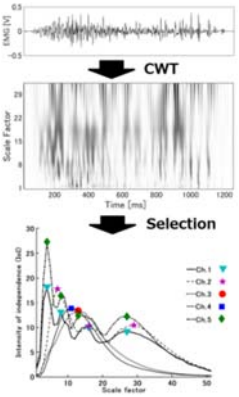
Shun Nakazawa, Tetsuo Tanaka, and Kazunori Matsumoto
(Kanagawa Institute of Technology, Japan)

The authors developed a digital Kanban tool that has the following functions: WIP limit, task visualization for each developer, GitHub link-up, and distributed-development support. Our Kanban has been applied to some student projects at Kanagawa Institute of Technology and was used to evaluate some functions. As a result, our Kanban's users can rapidly grasp who is the developer in charge of the task. In this paper, we focused on the change histories of the task states of our Kanban. To support the planning, management, and improvement of the software development project, we designed a calculation function for prediction of lead time, detection of the stagnant task, prediction of throughput, and proposal of appropriate WIP limit.

PS26 Wavelet feature selection using independent component analysis for forearm motions discrimination

Takayuki Mukaeda and Nan Bu
(National Institute of Technology, Kumamoto College, Japan)

This paper proposes a novel feature selection method in order to tackle high-dimensional features for motion classification using time-frequency characteristics of electromyography signals. Continuous wavelet transform is utilized to extract feature patterns of the time-frequency domain, which contain rich information for motion classification but occupy a high-dimensional space. In the feature selection procedure, the importance of each frequency feature element that is the scale factor in the wavelet transform is evaluated as intensity of independence calculated using independent component analysis. A selection rule is introduced to retain frequency features that are important for motion classification. The extracted feature patterns are input into a support vector machine to classify forearm motions. Experimental studies have been conducted with four subjects with eleven forearm motions. The experimental results indicate that the proposed method can achieve high classification accuracy, and confirm the validity of this method.



January 21 (Thursday), 15:00–16:15

Room A

GS2 Artificial Life & Multi-agent systems

Chair: Kazuto Sasai (Tohoku University, Japan)

GS2-1 Repair of diabetic wound and enhancement of collagen content using nanofibrous glucophage-loaded collagen/PLGA scaffold membranes

Cheng-Hung Lee[1], Yu-Huang Lin[2], and Shih-Jung Liu[2]
([1]Division of Cardiology, Chang Gung Memorial Hospital-Linkou, Taiwan)
([2]Department of Mechanical Engineering, Chang Gung University, Taiwan)

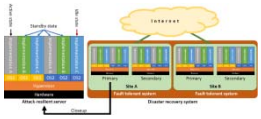
Nanofibrous drug-loaded collagen/poly-D-L-lactide-glycolide (PLGA) scaffold membranes that provided the sustained release of glucophage was developed for the wounds associated with diabetes. PLGA, glucophage, and collagen were firstly dissolved in 1,1,1,3,3,3-hexafluoro-2-propanol and were electrospun into nanofibrous membranes by electrospinning. High concentrations of glucophage were released for over three weeks from the nanofibrous membranes. The glucophage-loaded collagen/PLGA membranes markedly promoted the healing of diabetic wounds. Moreover, the collagen content of diabetic rats using drug-eluting membranes was higher than that of the control rats, because of the down-regulation of matrix metalloproteinase 9.

January 21 (Thursday), 15:00–16:15

GS2-2 A Cyber Attack-Resilient Server Inspired by Biological Diversity

Fumikazu Sano[1], Takeshi Okamoto[1], Idris Winarno[2], Yoshikazu Hata[2], and Yoshiteru Ishida[2]
([1]Kanagawa Institute of Technology, Japan)
([2]Toyohashi University of Technology, Japan)

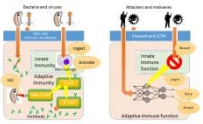
We propose a novel cyber attack-resilient server inspired by the concept of biological diversity, which consists of heterogeneous virtual machines running different operating systems and different implementations of the same server protocol specification. This approach is based on the observation that not all implementations are affected by the same vulnerability except for vulnerabilities in the specification. We built and tested a prototype system to evaluate the continuity of the service. The results showed that the prototype system could suppress downtime of the DNS service by exploiting a vulnerability to below 4 seconds with no false positive detections.



GS2-3 Toward an Artificial Immune Server against Cyber Attacks

Mitsunobu Tarao and Takeshi Okamoto
(Kanagawa Institute of Technology, Japan)

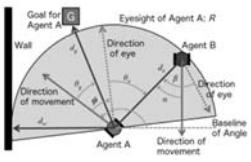
This paper proposes a novel framework for an artificial immune server with both innate and adaptive immune functions. The innate immune function detects cyber attacks on a known or unknown vulnerability. If a cyber attack is detected, the function creates a new process of the server application and terminates the compromised process. The adaptive immune function learns the requests with exploit code detected by the innate immune function. The adaptive immune function enables the server application to maintain its own service without termination of the server application after the innate immune function recognizes the attack. We implemented and tested a prototype system on a vulnerable web server. The performance tests showed that the prototype system could maintain the web service in all except the first attack.



GS2-4 Symbolization of action primitives in recurrent-Q learning agents playing a collision avoidance game

Takashi Sato
(National Institute of Technology, Okinawa College, Japan)

In this paper, we suppose the gesture theory that is one theory on the origin of language, which tries to establish that speech originated from gestures. Based on the theory, we assume that "actions" having some purposes can be used as "symbols" in the communication through a learning process. The purpose of this study is to clarify what abilities of agents and what conditions are necessary to acquire usages of the actions as the symbols. To investigate them, we adopt a collision avoidance game and a recurrent Q-learning agents as the game players. Our simulations showed that each agent can obtain an ability to avoid collision with the other by using visual information that the other turns its own eye away from the agent through the learning process. Further, we found that the agent also learns a whirling behavior to avoid collision by expanding the maximum number of learning.

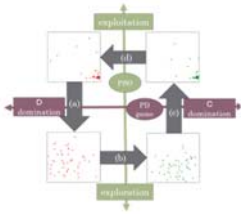


January 21 (Thursday), 15:00–16:15

GS2-5 A coupling of cooperate-defect prisoner's dilemma dynamics and explore-exploit PSO dynamics

Tadashi Nakatani, Takaya Arita, and Reiji Suzuki
(Nagoya University, Japan)

This paper proposes the incorporation of a cooperation dynamics based on the prisoner's dilemma (PD) game into the particle population behavior based particle swarm optimization (PSO). Our proposed method has a mechanism that makes exploration and exploitation repeated dependent on the state of the particle distribution and a strategy distribution. When the particles are exploration, this causes an increase in the number of cooperative strategies, which brings about an increase in the information change between particles. This makes the population converge to a (local or global) optimum. When the particles are exploitation, this causes an increase in the number of defective strategies, preventing information exchange. This makes the population distributed. These mechanisms should generate an exploration-exploitation cycle. The proposed algorithm reports on the results of the preliminary evaluation using standard benchmark functions. We also observe and investigate the cyclic behavior of the particle population between exploration and exploitation.



January 21 (Thursday), 15:00–16:45

Room C

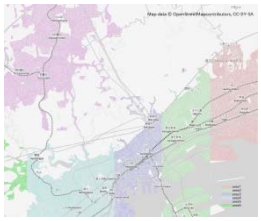
OS11 Large scale social simulation: II. Network

Chair: Hiromichi Suetani (Oita University, Japan)
Co-Chair: Takashi Shimada (The University of Tokyo, Japan)

OS11-1 Factor Analysis of Vehicle Traffic Simulation on Large Scale Road Network

Takeshi Uchitane[1] and Nobuyasu Ito[1,2]
([1]RIKEN AICS, JST CREST, Japan)
([2]The Univercity of Tokyo, Japan)

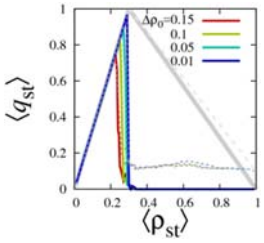
When considering to optimize, control or predict traffic phenomena on large scale network, it is important to build a suite traffic model and to obtain enough estimations about the model responses. When it comes to design and analysis of experiments with traffic simulations, we usually treat the model input and output as high dimensional variables. In high dimensional space, however, it is too difficult to optimize, control or predict the phenomena. In this paper, we applied factor analysis to the traffic simulation results on Kobe city, japan. From the result of factor analysis, we can explain the variance of simulation results with 33 independent linear vector and independently distributed errors. It means that the some variance of simulation results are correlated. Therefore, we conclude that we should consider the correlations before fitting simulation results to real data.



OS11-2 Macroscopic fundamental diagram and stability in simple models of urban traffic

Naoki Yoshioka[1,2], Takashi Shimada[2], and Nobuyasu Ito[1,2]
([1]RIKEN Advanced Institute for Computational Science, Japan)
([2]The University of Tokyo, Japan)

Macroscopic Fundamental Diagram (MFD) is a producible unimodal relation between average vehicle density and average flow rate in urban traffic. Although this idea is tested by a few experiments and simulations, its mechanism is not well understood. In order to understand it, a simple graph-based model of urban traffic is proposed. MFDs in our model system are investigated numerically for grid networks. It is found that MFDs in our system are discontinuous, which is inconsistent with the observation of real urban traffic.



January 21 (Thursday), 15:00–16:45

OS11-3 Simulation study of mobility threshold for epidemic

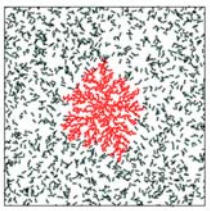
Shih-Chieh Wang[1] and Nobuyasu Ito[2]
([1]Advanced Institute for Computational Science, RIKEN, Japan)
([2]The University of Tokyo, Japan)

For the purpose of giving mobility threshold of epidemic, two microbe characteristics of transmission are adopted in our new epidemic model- vector carrier epidemic model (VC model). The self-productive microbe and infectivity are described as a tent-map function $ V(t) $ and a threshold $ V^0 $ in our model, respectively. Using simulation, the epidemic threshold of population density and of population mobility can be found, and thresholds are consistence with percolation theory.

OS11-4 Simulation of pedestrian flow with fall incidents

Takayuki Hiraoka[1,2], Takashi Shimada[1,2], and Nobuyasu Ito[1,2,3]
([1]The University of Tokyo, Japan)
([2]JST CREST, Japan)
([3]RIKEN AICS, Japan)

Although falling incidents plays an indispensable role in crowd disasters, few efforts have been devoted to incorporate its effect into numerical simulation of pedestrian model. We regard falls as halt of the agent particle's dynamics and consider a simple model of its propagation. By using numerical simulation, different spreading patterns are obtained. We find the scaling relation between the radius of gyration and the number of the fallen pedestrians.



OS11-5 A Rating Method for Board Games with Handicaps

Yuu Mizuhara and Kazuyuki Aihara
(The University of Tokyo, Japan)

We propose a new rating method for board games with handicaps. This method is based on the Prestige Score and the Elo Rating System. For board game rating, the Elo Rating System is widely used. The Elo Rating System treats handicaps in probability of rated players' win. On the other hand network-based ranking methods are recently proposed for no handicap professional sports rating. The prestige Score is one of them. We can not directly apply, however, the Prestige Score to board game rating with handicaps. Therefore, we have combined a network-based ranking method with the Elo Rating System, and apply it to rating of ”Go” players. The proposed rating system has almost the same performance to predict the future game outcomes as the Elo Rating System.

January 21 (Thursday), 15:00–16:45

OS11-6 Lifetime distributions of the elements in growing systems

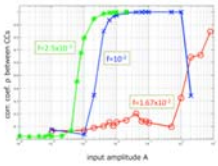
Takashi Shimada[1] and Yohsuke Murase[2]
([1]The University of Tokyo, Japan)
([2]RIKEN Advanced Institute for Computational Science, Japan)

Typical classes of lifetime distributions of the elements in complex systems are revisited. After reviewing theoretical and empirical classes of lifetime distribution, we focus on to the systems which consist of simple elements those have no elementintrinsic mechanism of aging. By adopting a recently proposed simple model of evolving open systems, we show that the survival rage of the elements in such system can have power-law decay. However, this power-law decay does not mean a divergence in the average lifetime: the system keep growing but no one in it survives eternally. Together with the previous results, it is shown that the present model, in which each element has no intrinsic aging mechanism in it, can provide three distinct behaviors in terms of lifetime: exponential for fixed system size, stretched exponential with its exponent 1/2 in widely fluctuating case, and the power-law survival in steadily growing phase.

OS11-7 Macroscopic reliability of chaos in recurrent neural networks: An approach based on canonical correlation analysis

Hiromichi Suetani
(Oita University, Japan)

Neural activity in the brain is composed of the combination between spontaneous activity as an autonomous nonlinear dynamical system and responses to the external sensory inputs. In this study, we investigate how a recurrent neural network exhibiting intrinsic chaos can be reliable against the external inputs. Using canonical correlation analysis (CCA), we find that macroscopic variables starting from different initial conditions show clear reliability, i.e., the almost same response to the same inputs, whereas microscopic variables of the single neuron level don't show any reliability over different trials.



January 21 (Thursday), 15:00–16:00

Room D

GS8 Evolutionary computations (Genetic algorithm)

Chair: Takayasu Fuchida (Kagoshima University, Japan)

GS8-1 Hybrid vehicles design based on simultaneous perturbation optimization

Kentaro MIYAMOTO, Kenji SAWADA, and Seiichi SHIN
(The University of Electro-Communications, Japan)

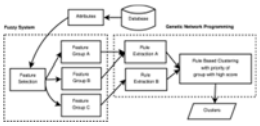
To reduce the environmental burden, hybridization of the powertrain is used in automobile industries. Efficiency of the hybrid vehicle (HV) depends on the combination of each component. However, it is difficult for experienced engineers to determine even a sub-optimal fuel efficiency combination. Motivated by this, this paper considers a numerical optimization method for the HVs system design. Especially, we use the Simultaneous Perturbation Optimization Methods (SPOM), which allows us to optimize many design parameters using not a mathematical model but a simulation model of design object. This feature is a great advantage in HVs system design. Since even the HV simulation model is complicated, we often simplify the simulation model in mathematical model based optimization methods. This process causes the approximating error between the mathematical and simulation models. On the other hand, SPOM can directly use the simulation model in the optimization process.

January 21 (Thursday), 15:00–16:00

GS8-2 Evolutionary Rule Based Clustering with Fuzzy Feature Selection for High Dimensional Databases

Wirarama Wedashwara, Shingo Mabu, Masanao Obayashi, and Takashi Kuremoto
(Yamaguchi University, Japan)

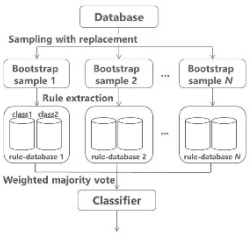
This paper proposes a feature selection algorithm for data clustering using genetic network programming (GNP) with fuzzy theory. An addition of feature selection using fuzzy database system aims to optimize clustering for high dimensional databases by decreasing the presence of less relevant features. GNP creates clusters based on pattern classification, where a cluster label is assigned to each object represented by a set of selected relevant fuzzy features. The optimization of the clusters is executed so that the relevant rules with high similarity are put into the same cluster. The results of clustering simulations show that the proposed method can create better clusters comparing to the conventional clustering methods.



GS8-3 An intrusion detection system using random forests based on class association rules

Shun Gotoh, Shingo Mabu, Masanao Obayashi, and Takashi Kuremoto
(Yamaguchi University, Japan)

With rapid developments of network technology, devices connected to the network in a variety of fields have increased and then network security is more critical. Classification Rules for intrusion detection is desirable not only to be easily analyzed for humans but also to be accurate in new patterns. Genetic Network Programming (GNP) is one of the rule mining techniques as well as the evolutionary optimization techniques. It can extract rules efficiently even from an enormous database, but still need the accuracy and stability for practical use. This paper describes a classification system with random forests employing weighted majority vote in the classification to enhance its performance. For the performance evaluation, NSL-KDD (Network Security Laboratory-Knowledge Discovery and Data Mining) dataset is used and the proposed method is compared with the conventional methods including other machine-learning techniques (SVM, J4.8) in terms of the accuracy and false negative late.



GS8-4 Applying a genetic algorithm to the one-dimensional cutting stock problem

Patcharawadee Poolsamran and Supamid Sangproo
(Burapha University Sakaeo Campus, Thailand)

This paper presents the genetic algorithm approach for solving the one-dimensional cutting stock problem. This algorithm mimics the process of natural selection that consist of three genetic operators: crossover operator, mutation operator, and selection operator. In this study, a pair of parent solutions is selected for breeding by using roulette wheel selection and after that creates two offspring by cycle crossover operator. Then, the two offspring are changed by exchange mutation operator. Finally, individual chromosome is selected based on fitness value in order to be the member of population in next generation. This generational process is repeated until the fixed number of generations reached. The simulation result is a cutting schedule that satisfies a given demand while minimizing the material wasted and amount of stock material used. The computational experiments show the efficiency of the algorithm in finding optimum solution for small to large size problems.

January 22 (Friday), 09:15–10:30

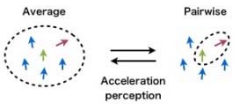
Room A

OS14 Protocomputing

Chair: Moto Kamiura (Tokyo Denki University)
Co-Chair: Tomohiro Shirakawa (National Defense Academy of Japan, Japan)

OS14-1 Swarming behavior based on acceleration

Kohei Sonoda[1], Takayuki Niizato[2], and Yukio Gunji[3]
([1]Ritsumeikan University, Japan)
([2]Tsukuba University, Japan)
([3]Waseda University, Japan)



Propagating wave in animal groups has been frequently observed. The wave is one of important compositions for collective motion. Almost all models of collective motion, however, cannot describe the wave. We introduced a pairwise interaction, “copying”, in which an agent attends and copies the movement of a specific member of its neighborhood based on acceleration perception. This interaction is a contrast to models based on averaging of neighboring agents. Switching the both interactions, a group of our collective model shows propagating wave. Consequently, the group also shows intermittent orientation with swarming behavior.

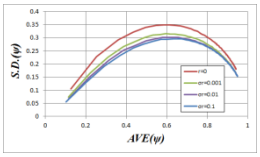
OS14-2 FPGA Accelerated Video Processing for 3D Self Localization to Realize Autonomous Control of UAV

Tsukasa Nakazawa, Hiroshi Sato, and Tomohiro Shirakawa
(National Defense Academy of Japan, Japan)

In this paper, we describe our high resolution video processing system using FPGA. The system was developed to realize autonomous control of multicopter without limitation in movable range. By combining a FPGA board and an action camera, we constructed a light weight, small-sized and power-saving video processing system. We performed an evaluation experiment for this system, and as a results we demonstrated that the system is capable of real time self-localization without external devices.

OS14-3 Jaccard matrix supporting calculations of nonlinear correlation

Moto Kamiura
(Tokyo Denki University, Japan)



There are some indices, which have the same forms, related with statistical causal induction: i.e. pARIs, Tversky index, Jaccard index, etc. In our previous study, the index pARIs is extended to pARIX which is a local index on a continuous two-dimensional real space. pARIX leads to "injectivity" and "single-valued-ness" of a functional data set. In the present paper, we attempt to coordinate a global representation of the local "injectivity" and "single-valued-ness": i.e. we present Jaccard matrix, the elements of which are given by pARIX. The mean and standard deviation of the elements of Jaccard matrix are tested by some given probabilistic data.

January 22 (Friday), 09:15–10:30

OS14-4 Development and evaluation of Snazzy QR-code generator

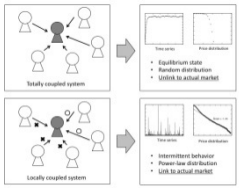
Fukiko Ishikawa and Moto Kamiura
(Tokyo Denki University, Japan)

QR codes are used widely around the world in recent years. Those can be readily read by cell-phone, smartphone or tablet computer, and can be easily made by smartphone or tablet computer. The conventional QR cord is monochromatic and expresses only a cord. In contrast, there is the one which it is colored to a cell, and can enjoy QR code as a design. It is called a Snazzy QR code. In this paper, I will report on the Development and evaluation of Snazzy QR-code generator.

OS14-5 Extremely Local Interaction in the Market Model

Kazuto Sasai[1], Yukio Gunji[2], and Tetsuo Kinoshita[1]
([1]Tohoku University, Japan)
([2]Waseda University, Japan)

Agent-based models of markets are useful to understand complex property of actual market such as anomalous behaviors of markets. A model of zero-intelligence (ZI) agent is broadly studied as a simple microeconomic model of markets. In this paper, we focus on the robustness of zero-intelligence plus (ZIP) model. The original ZIP model falls into unstable with some noise. From our perspective of uncertainty of complex systems, we introduce the extremely localized interaction scheme to ZIP model. The model archives robust intermittency against the noise parameter. Further, the statistical property of intermittent behavior shows the power-law nature. The findings tells us a new perspective of the adaptation for uncertainty.



January 22 (Friday), 09:15–10:15

Room B

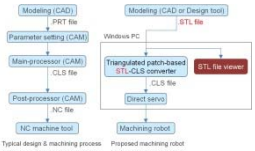
OS8 Intelligent Robotics and Mechatronics

Chair: Maki Habib (American University in Cairo, Egypt)
Co-Chair: Fusaomi Nagata (Tokyo University of Science, Yamaguchi, Japan)

OS8-1 Viewer, Converter and Preprocessor for Smart Machining Process Using an Industrial Robot

Fusaomi Nagata[1], Kazuhiro Takeshita[1], Shingo Yoshimoto[1], Akira Yoshinaga[1], Shingo Kurita[1], Akimasa Otsuka[1], Keigo Watanabe[2], and Maki K. Habib[3]
([1]Tokyo University of Science, Yamaguchi, Japan)
([2]Okayama University, Japan)
([3]American University in Cairo, Egypt)

In this paper, viewer and converter softwares are presented for smart machining process using an industrial robot. The viewers for NC, CLS, DXF and STL files illustrate their surface representation with normal direction vectors. For example, the DXF is a data format developed by Autodesk to realize data interoperability among different makers' CAD systems. The STL means Stereolithography which is a file format proposed by 3D Systems and recently is supported by many design tools and CAD/CAM softwares. On the other hand, the converters for DXF and STL files generate the corresponding CLS files with normal direction vectors. Our developed machining robot is controlled based on the CLS data, so that the implemented converter allows the machining robot to be controlled based on information included in DXF and STL files. The convenience and user-friendliness of the proposed softwares are confirmed through experiments.

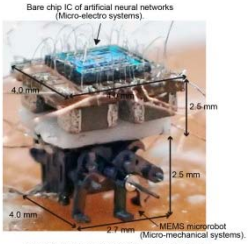


January 22 (Friday), 09:15–10:15

OS8-2 Insect-type MEMS microrobot with mountable bare chip IC of artificial neural networks

Ken Saito, Kazuki Sugita, Yuki Ishihara, Kei Iwata, Yohei Asano, Yuki Okane, Satoko Ono,
Satohiro Chiba, Minami Takato, and Fumio Uchikoba
(Nihon University, Japan)

This paper discussed about insect-type MEMS microrobot system which could locomote without using computer programs. Locomotion of the MEMS microrobot was generated by using analog circuit of artificial neural networks. We constructed the artificial neural networks as a bare chip integrated circuit (IC) which could mount on top of the MEMS microrobot. As a result, the MEMS microrobot system could perform the locomotion by using constructed bare chip IC of artificial neural networks. The insect-type MEMS microrobot system was 0.079 g in weight and less than 5.0 mm in size. In addition, we analyze the heat conduction of the shape memory alloy-type actuator. It was shown that the heat of shape memory alloy conduct to the mechanical parts of the MEMS microrobot; therefore, locomotion become slowly after 30 s. The slow locomotion was 2 mm/min.

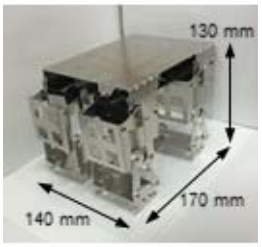


Insect-type MEMS microrobot system.

OS8-3 Gait pattern changing of quadruped robot using pulse-type hardware neural networks

Daisuke Tanaka, Daichi Nagashima, Tomohiro Hidaka, Minami Takato, Fumio Uchikoba, and Ken Saito
(Nihon University, Japan)

This paper studied about gait pattern changing of the constructed quadruped robot system using pulse-type hardware neural networks (P-HNN). P-HNN could output the locomotion rhythms which are necessary to generate the gait patterns of the quadruped robot. We constructed the 10 cm in size prototype quadruped robot system. Quadruped robot system consisted by mechanical components and electrical components. The mechanical components consisted by four legs, body frames and four servo motors. Quadruped animal-like locomotion could realized by only four servo motors using link mechanisms of each legs. The electrical components consisted by P-HNN, control bode and battery. P-HNN was constructed by analog discreet circuits which could mount on top of the quadruped robot. As a result, constructed P-HNN could output the locomotion rhythms which were necessary to generate the gait pattern of the quadruped robot.



Constructed prototype quadruped robot

OS8-4 Mechatronics: Learning and Creative Thinking

Maki Habib[1], Fusaomi Nagata[2], and Akimasa Otsuka[2]
([1]The American University in Cairo, Egypt)
([2]Tokyo University of Science, Yamaguchi, Japan)

Mechatronics supports new ways of thinking, innovations, design methodologies and practices to the development of new intelligent devices, products and engineering systems. This paper introduces Mechatronics learning process that is directly coupled with the development of thinking skill capability that relied of stimulation synergy of knowledge from different sources, interactive of communicate and functional skill development. This paper also introduces the concept of Human Adaptive Mechatronics (HAFM) and its role as a user-friendly approach aiming to enhance, skills, decision-making and performance.

January 22 (Wednesday), 09:15–10:15

Room C

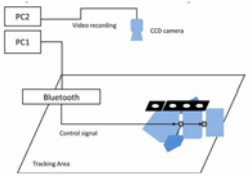
OS18 System sensing and its applications 1

Chair: Hisaya Tanaka (Kogakuin University, Japan)
Co-Chair: Masafumi Uchida (The University of Electro-Communications, Japan)

OS18-1 Propulsion modeling of caudal fin driving system on Balloon Fish Robot

Masato Haga and Masafumi Uchida
(The University of Electro-Communications, Japan)

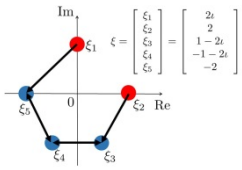
Recently, studies have been done to build biomimetic robots by combining the characteristics of fish robots and airship robots. In our research, we will consider balloon fish robots (BFR).This paper presents our understanding of the motion of the BFR through simulation and experimental results. The simulation of the motion of the BFR is based on traveling-wave equation, which is defined as the product of a sine wave and a quadratic curve. In this study, we derived an equation of motion for the BFR. We conducted an experiment to measure the drag coefficient. By solving the equation of motion with the Runge-Kutta method, we are able to calculate theoretical values for the propulsion velocity of the BFR. We validate the simulation by comparing theoretical values with the experimental value of the propulsion speed. As a future task, we have to measure the thrust of BFR.



OS18-2 On leader follower formation control of multi-agent systems with obstacle avoidance using complex laplacian

Daiki Yamada, Kazushi Nakano, and Tetsuro Funato
(The University of Electro-Communications, Japan)

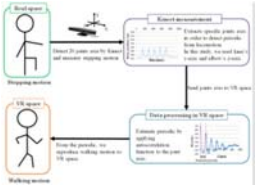
Formation control is one of the methodologies to accomplish a difficult mission by cooperating with several agents like a multi-robot system. The advantages of the formation control are to improve the working efficiency of given tasks and the fault tolerance by decentralizing functions to make it easier to add other functions. This study addresses a formation control with two leaders using complex-valued laplacian with considering obstacle avoidance. The complex-valued laplacian makes it possible to consider the scale of formation by controlling the distance between two leaders. From this point, our approach is effective in a situation of maintaining a formation shape. Moreover, a potential field method is introduced to take obstacle avoidance into account. Finally testing simulations are shown to demonstrate the effectiveness of our proposed control law.



OS18-3 Development of Locomotion Interface Using Stepping Motion Detected by Kinect

Itto Abe and Hisaya Tanaka
(Kogakuin University, Japan)

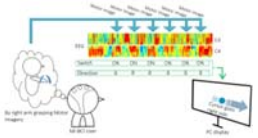
Virtual reality (VR) is now being used in different fields of applications. However, it is still difficult to reproduce a human's walking motion in VR space because of the lack of sufficient space. In this study, to reproduce a human's walking motion in VR space online, we examined a human's stepping motion at four speed levels (i.e., 30, 60, 90, and 120 bpm) so as to reproduce walking speed in VR space that is compliant with stepping motions. As a result, when speed increases, stepping motion periodicity decreases. Moreover, we determined the periodic length of four analysis windows (i.e., 30, 60, 90, and 120 frames). By estimating a reasonable length of a window, we can apply this window when reproducing a walking motion in VR space online. The results suggest that the reasonable periodic length was ≥90 frames.



January 22 (Friday), 09:15–10:15

OS18-4 ERD Analysis Method in Motor Imagery Brain–Computer Interfaces for Accurate Switch Input

Shuhei Nagamori and Hisaya Tanaka
(Kogakuin University, Japan)



Motor imagery brain–computer interface (MI-BCI) can control computers using MI. However, input accuracy is approximately 50%, partly owing to individual variability in event-related desynchronization (ERD) detection among different subjects. In an earlier study, we determined that using a max power in the mu band method, i.e., the peak trace method (PTM), is effective for ERD detection. In this study, we compare the PTM to the band power method to determine the most effective method for ERD detection during MI tasks. Experimental results indicate that we could detect ERD using the PTM; however, estimation of MI-state was difficult. We also found that the PTM might be effective for ERD detection in subjects with MI experience.

January 22 (Friday), 09:15–10:30

Room D

GS5 Cognitive Science

Chair: Shimpei Matsumoto (Hiroshima Institute of Technology, Japan)

GS5-1 Risk management of MRT viaduct construction across national highway (Withdrawal)

Hsi-Chi Yang and Wei-Chi Fang
(Chung Hua University, Taiwan)

GS5-2 Development of Assessment System for Resilience of Interpersonal Stress

Takako Otabe, Tomotaka Ando, Kouichi Tateno, and Tatsushi Tokuyasu
(Fukuoka Institute of Technology, Japan)

Recently, a number of students have been feeling difficulties in relating to the other students in their campus life. Generally, they are mentally tired from interpersonal stress. Most of schools or colleges have employed expert clinical psychotherapists, and the students took counsel with them and were getting better gradually. Then, this study proposes an assessment system for interpersonal resilience of students in order to improve the efficiency of counseling treatment. The system utilizes physiological responses of a participant against stimulus related to an interpersonal stress. The system structure, the experimental protocol, and the experimental results are shown in this paper.

January 22 (Friday), 09:15–10:30

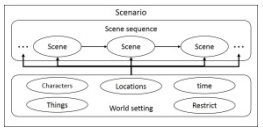
GS5-3 Human beings as particles in PSO

Makoto Kimura and Tetsuo Ono
(Hokkaido University, Japan)

Particle Swarm Optimization (PSO) is a population-based evolutionary computational algorithm. Some of PSO variants try to integrate some of human elements, such as behavior, social system, or the way of thinking. However, none has investigated how real human beings act as particles, or their optimization performance as particles. We developed a web-based game in that human players act as particles and optimize a fitness function. The experimental results showed that human players acted better than the non-human particles in some problems, changing their behavior. Although the decision making process is still under investigation, this results indicate that the knowledge of the human optimization may help to improve the optimization performance of PSO and other evolutionary computational methods.

GS5-4 Towards a Narrative Generation System based on a TRPG Model: The use of an Integrated Narrative Generation System for an Application System

Jumpei Ono and Takashi Ogata
(Iwate Prefectural University, Japan)



We present a design plan of a narrative generation system based on a scenario generation method in tabletop role-playing games (TRPGs). This system is the application of an integrated narrative generation system (INGS). A TRPG is an analog game in which one or more player (PL) play each role as characters in a framework of narrative prepared by the game master (GM). The INGS integrates various mechanisms for narrative generation that we have been developing. The INGS has conceptual dictionary, story contents knowledge and so on. In designed system, the INGS is the GM and makes a partial structure of the narrative based on the proposition and expands it. In the future, we would like to implement the experimental system. Furthermore, we aim the knowledge acquisition for INGS by the design system.

GS5-5 Network Visualization of Customer Expectation by Using Web (Withdrawal)

Ryosuke Saga
(Osaka Prefecture University, Japan)

January 22 (Friday), 10:45–11:45

Room A

GS10 Learning

Chair: Hiroshi Tanaka (Tohoku Medical Megabank Organization, Tohoku University, Japan)

GS10-1 Analysis of factor influencing the tablet pc with stylus adoption for essay-type examination: conceptual model

Sununthar Vongjaturapat[1] and Nopporn Chotikakamthorn[2]
([1]Burapha Uniersity, Sakaeo Campus, Thailand)
([2]King Mongkut's Institute of Technology Landkrabang, Thailand)

Currently, the growing popularity of tablet PC and stylus make possible a more efficient examination process for test administration. It would be helpful to look at differences in examinations, which are a very common assessment and evaluation tool in university. This research aims to propose a theoretical model for University by investigate the factors influencing Tablet PC with stylus adoption for essay-type examination. Adapting the TTF model requires re-specification to suit essay-type examination process. The re-specific model introduces new constructs and new measuring instruments. The research includes both exploratory and quantitative techniques. The structural equation model will be used for data analysis. The contribution of the model is a design guideline for the Tablet PC with stylus function that is consistent with the essay-type examination process as well as provides a starting point for evaluating improvement in implementation of tablet based assessment.

GS10-2 Investigation of Evolutinarily Adaptation of Exploration Rate in Multi-agent Reinforcement Learning

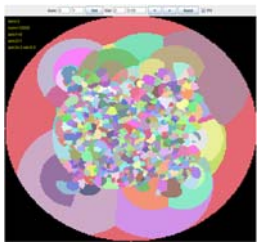
Takuya Okano[1] and Itsuki Noda[1,2]
([1]Tokyo Institute of Technology, Japan)
([2]AIST, Japan)

We investigate features of simple evolutionary adaptation methods of exploration rate in multi-agent reinforcement learning. Adaptation of exploration rate is an important issue in multi-agent learning, because exploration rate is one of key parameters to affect learning performance. We observe the adaptation methods can adjust the exploration ratio suitably (but not optimally) according to characteristics of environments. We investigate evolutionarily adaptation of exploration rate in multi-agent learning. We conducted several experiments to adapt exploration ratio in an simple evolutionary way Mimicking advantageus exploration rate(MAER). and confirmed that MAER always acquired relatively smaller exploration rate than the optimal one for the change ratio of environments. We also conducted the second evolutionary adaptation method Win or Update Exploration Rate(WoUE). The result of experiments shows that WoUE can acquire more suitable exploration rate than MAER and exploration obtained relatively similar ideal exploration.

January 22 (Friday), 10:45–11:45

GS10-3 Q-learning in high dimensional input space using pseudo Voronoi diagram

Takayasu Fuchida, Tadanori Hisanaga, Takehiro Egashira, and Taro Shibi
(Kagoshima University, Japan)



In recent years, in order to solve complex and dynamic problems by a plurality of autonomous agents in the cooperative operation, the study of machine learning in a multi-agent environment is drawing attention. In a multi-agent problem, since the number of input sources will be increased when the number of agent increase, the magnitude of the input space is increased explosively by so-called the curse of dimensionality and simulation by computer becomes impossible. In this study, by using a pseudo Voronoi division definitive in high-dimensional space, while preventing an explosion of the state space, and it performs the Q-learning by multiple agents. The pseudo Voronoi diagram is a Voronoi diagram whose space of construction is restricted into limited space. This Voronoi diagram is not equal to the correct Voronoi diagram, but computing time becomes less than correct one. We performed three types of learning process by computer simulations. First type is using factitious division, second type is using correct Voronoi division and third type is using pseudo Voronoi division. The results showed that factitious division got fastest computation time but it could not apply to high dimensional space, correct Voronoi division got highest rewards but it took most computation time and pseudo Voronoi division got middle of them.

GS10-4 Detection of perceptual aliasing state and learning method by information entropy (Withdrawal)

Hiroaki Tsunekawa and Tomoki Hamagami
(Yokohama National University, Japan)

January 22 (Friday), 10:45–12:15

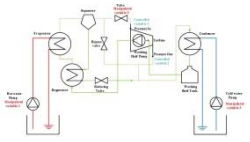
Room B

OS12 Learning and Control

Chair: Chair: Hee-hyol Lee (Waseda University, Japan)
Co-Chair: Jinglu Hu (Waseda University, Japan)

OS12-1 Inverted Decouple PID Control for Ultra-compact Binary Power Generation Plant

Kun-Young HAN and Hee-Hyol LEE
(Waseda University, Japan)

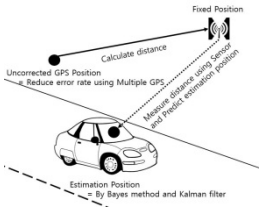


An ultra-compact binary power generation plant converts thermal energy into electric power using temperature difference between heat source and cool source. In this paper, an inverted decouple PID control system based on pseudo diagonalization method is developed for investigated plant. The method to design the inverted decoupler is presented, and the advantage and effectiveness are demonstrated through the simulation.

January 22 (Friday), 10:45–12:15

OS12-2 Multiple GPS Localization using Bayes theorem and Kalman filter

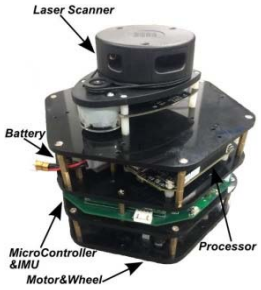
Shin Nyeong Heo and Hee-hyol Lee
(Waseda University, Japan)



This paper deals with GPS localization for autonomous car and mobile robot. If localization is working incorrectly, it could be huge relation with car accident. Accordingly, localization research is mainly focused in this paper. Especially, algorithm research for increase performance about low functional GPS is introduced. So, this paper describes how to decrease error rate of GPS and how to estimate precisely about present positions. For decrease error rate of GPS, a multiple GPS that combining 3 GPS is adopted. Usually, GPS position data have a lot of error because of influence about weather, data receive rates, noise, etc. Therefore, these multiple GPS are positioned by a center of the triangular method and system that has more accurate position. After GPS data get from the multiple GPS of the real GPS position from uncorrected GPS position. Bayes theorem and Kalman filter for the estimation exact position. First, the distance between GPS position and fixed position. GPS position is data of using multiple GPS and fixed position is sensor location of fixed position. After that, the real position is estimated using Bayes theorem and Kalman filter. This paper is consist of 5 part. Introduction part is section 1 and a multiple GPS is described in Section 2. Especially, GPS data using the center of triangulation method are calculated when 3 GPS have different distribution. Bayes theorem and Kalman filter and its combination to estimate GPS position are explain in section 3. Simulation results and conclusion are in section 4 and 5. It shows the multiple GPS localization using Bayes theorem and Kalman filter have better performance than a single GPS localization. The effectiveness of the proposed method is confirmed through simulations.

OS12-3 Hybrid Second-Order Sliding Mode Controller with PID Sliding Surface based on Dynamic Trajectory Planning for Omni-Directional Mobile Robot

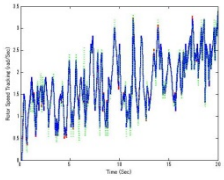
Xiaoyu Wang and Hee-Hyol Lee
(Waseda University, Japan)



This paper presents a hybrid second-order sliding mode controller with PID sliding surface based on dynamic trajectory planning for an omni-directional mobile robot. The proposed control system addresses on increasing robustness against nonlinearity and reducing disturbance rejection and chattering. Also, trajectory planning is combined with the control system by introducing the position and velocity planning stage to controller for making a smooth movement of the robot. The mobile robot used for experiment is a three-wheeled omni-directional mobile robot driven by three DC servo motors mounted in triangle. It follows a discrete kinematic model to convert the translational and rotational velocity to the wheels velocity. For this reason, it can execute rotation and translation flexibly at the same time. Finally the proposed controller is evaluated on the mobile robot.

OS12-4 Application of Self Organizing Quasi-ARX RBFN for Rotor Speed Tracking Control of a Wind Turbine

Imam Sutrisno[1], Mohammad Abu Jami'in[1], Jinglu Hu[1], and Norman Mariun[2]
([1]Waseda University, Japan)
([2]Universiti Putra Malaysia, Malaysia)

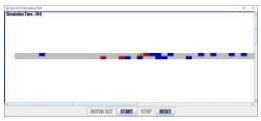


A wind turbine is already a fairly complex system with highly nonlinear dynamics. Changes in wind speed can affect the dynamic parameters of wind turbines, thus rendering the parameters uncertain. However, we can identify the dynamics of the wind energy conversion system (WECS) online by self organizing quasi-linear ARX radial basis function network (SOQARX-RBFN) model. The stability of the closed loop controller is guaranteed by the switching of the linear and nonlinear parts parameters. From the simulation results, it is observed that the proposed controller is effective to track maximum power of WECS.

January 22 (Friday), 10:45–12:15

OS12-5 Optimization for Bus Stop Position based on Cellular Automaton Traffic Model

Cui chengyou[1], Wen Min[2], Zhang Liankui[1], and Lee Heehyol[2]
([1]Yanbian Univerity, China)
([2]Waseda Univerity, Japan)



Abstract: Bus stop is one important component of the public transportation. The optimization of the bus stop produces an effect not only on the efficiency of the public transportation, but also on the quantity of the city environment. This paper researches the optimization design of bus stop from microcosmic view. In this paper, an optimization method for bus stop position based on cellular automaton traffic model is proposed. A cellular automaton traffic model for the mixed traffic flow model is built up in order to evaluate rationality of the bus stop position. The evaluating indicator includes delay time of the ordinary vehicles, delay time of the bus, the number of traffic volume, travelling time of the bus. Finally, the effectiveness of the proposed method is shown through several simulations at a imaginary road. Keywords: Bus stop, Cellular Automaton, bus stop capacity.

OS12-6 Multi-Agent Reinforcement Learning Methods with Mistaken Location Information on Hunter Games

Hee-Hyol Lee and Junpei Takeshita
(Waseda University, Japan)

This paper deals with an effect of error of position on Modular Q-Learning method that uses position of other agents for reducing the number of states on hunter games using a benchmark of multi-agent reinforcement learning, and proposes a reinforcement learning method that can avoid adverse effect of them. The proposed method compares previous positions to an observed position firstly. Next, the previous positions are used in the learning in the case of large gap of it, but in the case of small gap, the observed position is used alternatively. Simulation results show the effect of error for the observed position information is changed by setting goal, and usefulness of the proposed method.

January 22 (Friday), 10:45–11:45

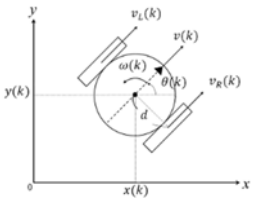
Room C

OS19 System sensing and its applications 2

Chair: Akio Nozawa (Aoyama Gakuin University, Japan)
Co-Chair: Hirotoshi Asano (Kagawa University, Japan)

OS19-1 PSO-based adaptive kalman filters for real-time mobile robot localization

Shogo Kimura, Kazushi Nakano and Tetsuro Funato
(The University of Electro-Communications, Japan)



This paper considers a problem of localization for mobile robots. The mobile robot localization is carried out by estimating the states (position and angle) from measurement sensors. One of the most well-known methods for localization is the Kalman Filter (KF). It has to set two parameters, covariances Q and R representing the process and measurement noises, respectively. However we cannot know their true values in advance since they depend on the target robot and its surroundings. While adapting the parameters to the true values, the estimation accuracy is kept at an optimal level. In this paper, the parameters are adjusted by Particle Swarm Optimization (PSO) in real-time. We show that the computation for estimating the state can be completed during a pre-determined control period and that the adaptive Kalman filter can be implemented by using the PSO in real-time.

January 22 (Friday), 10:45–11:45

OS19-2 Construction of biomodel to control drowsiness by using system identification

Kiwamu Goto[1], Hirotoshi Asano[1], Syusaku Nomura[2], Shizuka Bando[3], Tota Mizuno[4], and Akio Nozawa[3]
([1]Kagawa University, Japan)
([2]Nagaoka University of Technology, Japan)
([3]Aoyama Gakuin University, Japan)
([4]The University of Electro-Communications, Japan)

This paper investigates the possibility of constructing a bio-model of neck skin temperature for controlling driver drowsiness. Previous studies have objectively evaluated a temporary decrease in drivers' arousal levels using nasal skin temperature. Based on the transmission mechanism of the autonomic nervous system, we have shown that controlling the nasal skin temperature by stimulating the temperature of the neck is effective in suppressing drowsiness. However, current systems use an open loop control that indirectly controls neck skin temperature based on nasal skin temperature. In addition, there is a high probability that the cervical skin temperature control stimulation in accordance with the target value has not been properly. In this study, we measured the applied voltage and neck skin temperature using a thermoelectric element. The applied voltage was the input signal and the neck skin temperature was the output signal. We investigated the system by using input and output signals. The results of our study suggest the possibility of constructing an adequate biological model.

OS19-3 Psychophysiological assessment of the adaptive asynchronous human-machine system with dual task method

Yusuke Hosoda and Akio Nozawa
(Aoyama Gakuin University, Japan)

This study proposes the concept of an adaptive asynchronous human-machine system (Async-HMS), which maintains asynchronous periodic operations against a user's actions to avoid user inattention. First, in order to determine the dynamics of the operation period presented by Async-HMS, discrimination thresholds of the operation period were obtained through a psychophysical experiment. Based on the thresholds, three levels of fluctuation of the operation period were defined: constant, subliminal, and supraliminal. Second, aspects of the information processing resources of Async-HMS were assessed through a dual-task paradigm. The time shared fraction (TSF), hemodynamic parameters, and senses were evaluated as indices of the performance, autonomic nervous system's activity, and psychology, respectively.

OS19-4 Proposal of cognitive induction field model based on a rating scale

Kazune Hasegawa and Akio Nozawa
(Aoyama Gakuin University, Japan)

The induction field of vision has been attracting attention as a psychological concept that describes human visual and perceptual phenomena by a field. The induction field of vision is a field similar to the electrostatic or magnetic field formed around figures or characters. The feature quantity can be extracted from the field formed around a figure by using the induction field of vision. In previous studies, the induction-field potential energy and complexity were used to quantify sensitivity information and were reported to be indicators of the strength of the noticeable and an impression of the figure. A cognitive induction-field model that incorporates the psychological and physiological foundations of these quantification indicators is expected to be applicable to engineering applications. In this study, a cognitive induction-field model is proposed, which focuses on the fixation point, event-related potential, and rating scale.

January 22 (Friday), 10:45–12:15

Room D

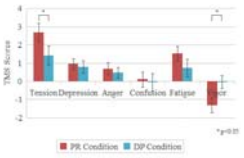
GS9 Human-machine interaction and collaboration

Chair: Ken Saito (Nihon University, Japan)

GS9-1 Psychological Effects of Physical Embodiment on Pet Therapy

Rina Hayashi[1,2] and Shohei Kato[1]
([1]Nagoya Institute of Technology, Japan)
([2]Nippon Soken, Inc., Japan)

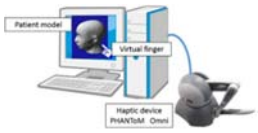
In recent years, interest in pet robots and digital pets is continuing to increase along with the pet therapy boom. Not only pet robots but also digital pets have been found to provide therapy effects. However, the established theory that physical embodiment is one of the most important elements for achieving full therapy effects is widely accepted. In this paper, we carried out an experiment to compare therapy effects between pet robots and digital pets on the Temporary Mood Scale (TMS). As a result, the reduction in the tension score and the increase in the vigor score with pet robots were significantly higher than those with digital pets ($p<0.05$). These results suggest that physical interaction is an element for relaxing mental strain and improving vitality.



GS9-2 Reconstruction of Maxillofacial Patient Model using Free Mesh Method

Tatsushi Tokuyasu[1], Takaaki Nakayama[1], Kenji Yoshitomi[1], Kazuhiko Toshimitsu[1],
Kazutoshi Okamura[2], and Kazunori Yoshiura[2]
([1]Fukuoka Institute of Technology, Japan)
([2]Kyushu University, Japan)

This study have developed a virtual training system for maxillofacial palpation, where a trainee can virtually touch the head and neck of a virtual patient model. In our previous study, the dynamic model of a virtual patient model was constructed by using linear-typed finite element method. There were some technical issues in respect to computation cost, so that this paper improve a dynamic model of the virtual patient model by using free mesh method.



GS9-3 Evaluation the impact of tablet screen size on children tracing performance

Ratchadaporn Amornchewin[1] and Karanya Sitdhisanguan
([1]Thepsatri Rajabhat University, Thailand)
([2]Silpakorn Univercity, Nakorn Pathom, Thailand)

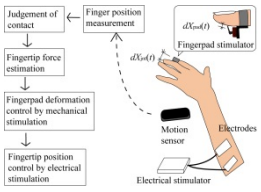
In this paper, we explored the impact of three different sizes of touch screen tablets: iPad, Samsung Galaxy Tab 7” and S4 on efficiency and usability for young children ages 4-6 year. Our study focuses on the mechanics of tracing alphabet by using finger on capacitive-touch tablets, while its outcome has potential implications towards tablet size for interfaces to support finger-tracing on such devices. The performances were recorded and observed for analysis the data respect to task efficiency and usability purpose. Then we adopted the Smileyometer based on a 1 to 5 likert scale as the instrument used to measure perceived usability. The usability evaluations results showed no significant difference in speed and accuracy performance. Furthermore, tracing the alphabet on iPad was easier, more attractive and increase attention span than others. As well as Smileyometer results, all of the participants preferred and felt comfortable to use it.

January 22 (Friday), 10:45–12:15

GS9-4 Fundamental study of a force representation device for fingertips based on somatosensory superimposed stimuli

Ryu SATO and Keisuke SHIMA
(Yokohama National University, Japan)

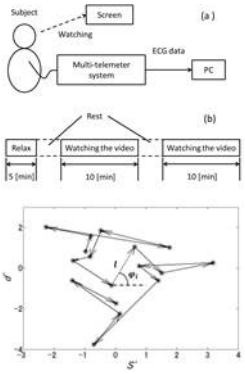
This paper proposes a new haptic device design based on electrical and fingerpad stimulation for the realization of a practical unit enabling virtual force generation. The method involves control of fingerpad deformation using a small mechanical device and control of fingertip position through the application of electrical stimuli to the user. A compact wearable device was developed as a prototype for the application of the proposed method. To verify the technique's validity, fundamental experiments involving the use of the prototype were conducted with healthy subjects. The results showed that virtual force perception is more accurate with this approach than with electrical stimuli alone. This indicates the method's feasibility for application with a wearable device enabling force feedback in a virtual reality system.



GS9-5 Evaluation of autonomic nervous activity using heart rate Lorenz plot

Naoto Terasawa and Nan Bu
(National Institute of Technology Kumamoto College, Japan)

Visually induced motion sickness (VIMS) is an important problem in the field of image safety. In order to detect VIMS in its early stage, this paper proposes an autonomic nervous activity evaluation method using Lorenz plot of heart rate variability (HRV). An evaluation point is defined based on two traditional indices, i.e., distance and area. Transition distance and direction of the evaluation points are estimated to evaluate the activity level and trend of the autonomic nervous system. Experiments were conducted using video clips that may cause VIMS. Comparison experiments were conducted between the proposed method and visual inspection of R-R interval (RRI) data. The experimental results indicate that the proposed method can generate evaluations that agree with visual inspection of the RRI variation. On the other hand, the proposed method can evaluate activities of autonomic nervous system and their levels using relatively short data records of RRI.



GS9-6 The modeling of R + 3spr type Haptic device using MATLAB

Dong Hyuk Lee, Young Sik Park, Dong eon Kim, Jae Hoon Jung, Yudong Zhao, and Jang Myung Lee
(Pusan National University, Korea)

This paper is about an R+3SPR parallel manipulator which uses stewart platform structure. Parallel manipulator is composed by one rotational actuator and three linear actuators. R+3SPR parallel manipulator which proposed in this paper is preceding research for implementation of mobile robot control and force feedback for a surrounding environment. Thus, calculates the degree of freedom of parallel manipulator, determine the position of end-effector through the forward kinematic analyzation. Lastly, verify the work space of proposed parallel manipulator through the MATLAB simulation.

January 21 (Thursday), 13:00–14:00

Room B

ISBC OS1 Applied bioinformatics for systems biology and medicine

Chair: Kaoru Mogushi (Juntendo University, Japan)

ISBC OS1-1 A computational approach to prioritize drug-target genes in the human protein interaction network

Takeshi Hase[1,2,a], Kaito Kikuchi[1,3], Samik Ghosh[1,2], Hiroshi Tanaka[4,a], and Hiroaki Kitano[1,2,5,6,a]
([1]The Systems Biology Institute, Japan)
([2]Laboratory of Disease Systems Modeling, Center for Integrative Medical Sciences, RIKEN, Japan)
([3]Department of Bioinformatics, Medical Research Institute, Tokyo Medical and Dental University, Japan)
([3]Department of Basic Science, Graduate School of Arts and Sciences, University of Tokyo, Japan)
([4]Department of Bioclinical Informatics, Tohoku Medical Megabank Organization, Tohoku University, Japan)
([5]Sony Computer Science Laboratories, Inc., Japan)
([6]Okinawa Institute of Science and Technology, Japan)
([7]Tohoku Medical Megabank Organization, Tohoku University, Japan)

Identification of novel therapeutic targets is a key for successful drug development. However, the cost to experimentally identify therapeutic targets is huge and only ~400 genes are targets for FDA-approved drugs. Therefore, it is inevitable to develop powerful computational tools to identify potential novel therapeutic targets. With a recent advancement of network science, various network metrics are now available and have been used to investigate structure of molecular interaction networks and their relationships with therapeutic targets. In this study, we proposed a computational framework that is based on leveraging the diversity of network metrics in heterogeneous molecular interaction networks to infer novel therapeutic targets. We applied the framework to several disease areas (e.g., several cancerous diseases, Rheumatoid, Alzheimer's disease) and successfully identified key genes for potential novel therapeutic targets and repositionable candidate-compounds for the diseases. Therefore, our computational framework could be powerful tools for drug development.

ISBC OS1-2 Data structure of three generation families in cohort study : for recruiting and retrieving

Kazuro Shimokawa, Hirohito Metoki, Takako Takai, Soichi Ogishima, Mami Ishikuro, Satoshi Mizuno, Satoshi Nagaie, Masahiro Kikuya, Shinichi Kuriyama, and Hiroshi Tanaka
(Tohoku University, Japan)

We have developed an input system of recruiting family information, and succeeded to operate the system. In the field of genetic statistics, a simple expressive form is used for describing family structure. This data form has enough information to use for genetics, however, it is not enough to use it for the operation of family cohort research. We have added a data structure to have information of family role, which is necessary for the three generation family cohort. In addition, we constructed a function of discovering inconsistent data, indispensably needed for the recruitment. By using our system, the data correction was advanced dramatically, and we succeeded in actual operation.

ISBC OS1-3 Deep phenotyping toward precision medicine

Soichi Ogishima and Hiroshi Tanaka
(Tohoku Medical Megabank Organization, Tohoku University, Japan)

In the post genomic era, genomic medicine, so-called precision medicine, is expected to realize to tailor medicine and prevention to the individual genetic, environmental, lifestyle and phenotypic factors of stratified patients. In precision medicine, we need large-scale longitudinal cohorts and biobanks to evaluate the most promising clinical approach in much larger numbers of patients over longer periods collecting genetic, environmental, lifestyle and phenotypic factors. To obtain longitudinal phenotypic factors which we called "deep" phenotyping is key for studies toward precision medicine. We review trends in longitudinal phenotyping using electronic health record (EHR) data toward precision medicine.

January 21 (Thursday), 13:00–14:00

ISBC OS1-4 Development of prescription support system based on pharmacogenomic information

Kaoru Mogushi[1], Shunsuke Kato[1], Toshio Naito[1], Narutaka Nakao[1], Mari Sato[1], Hideya Kawaji[2], Yasunari Yamanaka[2], Yoshihide Hayashizaki[2], and Hajime Arai[1]
([1]Juntendo University, Japan)
([2]RIKEN, Japan)

The recent improvements in the next-generation sequencing have been providing the genome analysis for individuals due to reduction of the cost. Furthermore, the number of known variants (e.g., single nucleotide polymorphism, copy number variation, and trinucleotide repeat expansion) associated with diseases and drug response has been rapidly increasing. In order for medical doctors to utilize the complex relationships among drugs and variants, the prescription support system using a pharmacogenomic database will be required.
Therefore, we developed a prototype system using an open-source Japanese electronic health record system called OpenDolphin (https://github.com/dolphin-dev/OpenDolphin). We extended the features of OpenDolphin by modifying the software, and developed an external genomic database as a web service on the Amazon EC2 cloud. Using fictional patient records, we evaluated the alert system for an anti-cancer drug using the corresponding pharmacogenomic testing. Our prototype system will be a platform for popularization of genomic medicine in Japan.

January 21 (Thursday), 15:00–16:00

Room B

ISBC OS2 Biological networks

Chair: Ken Naitoh (Waseda University, Japan)
Co-Chair: Hiroshi Tanaka (Tohoku Medical Megabank Organization, Tohoku University, Japan)

ISBC OS2-1 Bio-standard network theory: explaining simultaneously the origin of life, morphogenetic process, aging, brain, and economic system

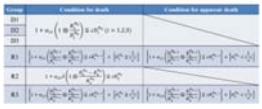
Ken Naitoh
(Waseda University, Japan)

Details of the bio-standard network theory, extended from our previous reports (Naitoh, Artificial Life Robotics J 2008, 2012 & JJIAM 2011 &J of Physics 2012), is described here. The theory explaining essentially and macroscopically the origin of life, microorganisms, morphogenetic process, aging, brain, and economic system, is based on four or six nonlinear ordinary-differential equations. Variables in the equations are densities of group of molecules, cells, neurons, or human beings.

ISBC OS2-2 Prognostic medication: for predicting premonition, recovery, lifespan, life pattern, and polymorphism

Remi Konagaya and Ken Naitoh
(Waseda University, Japan)

By proposing a theory based on six nonlinear ordinary-differential equations that explains life as an interaction of six molecular cell groups, we simulated a humans' lifetime. Then, along with the number theory, we were able to derive mathematical conditions that decides the life pattern of a person among death, apparent death (severe illness), and vigor. These mathematical conditions also gave some evidence for the simulation results obtained by the six ordinary-differential equations. We also simulated the processes by including random noise in the calculations. We confirmed that the lifespan and period of illness was affected by the degree of random noise added.



January 21 (Thursday), 15:00–16:00

ISBC OS2-3 Millenary genius: producing seminal works on computers (3rd report)

Shu Nemoto, Masahito Saiki, and Ken Naitoh
(Waseda University, Japan)

In our previous reports, we propose that the composite cycle model of two standard neural networks derived from statistical physics reveals the mechanism of comfort-generating. The composite cycle model demonstrates mysterious temporal oscillations, with frequencies related to the super-magic numbers, including the golden ratios, which give living beings comfort. Because the numbers can also be observed in music, sympathetic resonance occurs between inside and outside of the brain, which gives comfort. In this report, we conduct more detailed examination of the relation between the model's outputs and six kinds of comfortable chords of music. By optimizing some parameters in the model, we confirm conformity between all the six kinds of the ratios of the chords and the outputs. This result will lead to an artificial genius to produce creative works including comfortable music on the computer.

ISBC OS2-4 Changes in Cross-Correlations as an Indicator for Systemic Risk applying to Recent Markets

Kazuko Yamasaki
(Tokyo University of Information Sciences, Japan)

Recently, the peak out of the Chinese economy causes instability of global market. In August 2015, global stock market hit sudden loss. It is important whether the sudden loss leads the global recession or not in few years, like that the sub prim loan problem in 2007 was followed by the Leaman shock crisis in 2008. This problem is studied by the cross-correlations among the different industry sectors.
Various studies reported that financial crisis are associated with increase in both cross-correlations among stocks. In this paper, the different economic sector's indexes are studied by applying principle component analysis (PCA). The rate of increase in principle components with short 12-month time windows can be effectively used as an indicator of systemic risk—the larger the change of PC1, the higher the increase of systemic risk. Clearly, the higher the level of systemic risk, the more likely a financial crisis would occur in the near future.