

ABSTRACTS

Plenary Speech (Room G)

January 21 (Wednesday), 10:55-11:45

Chair: Hiroshi Tanaka (Tokyo Medical and Dental University, Japan)

Dynamical network biomarkers for identifying early-warning signals of complex diseases

Luonan Chen

(Key Laboratory of Systems Biology, Shanghai Institutes for
Biological Sciences, Chinese Academy of Sciences, China)

There are non-smooth or even abrupt state changes during many biological processes, e.g., cell differentiation process, proliferation process, or even disease deterioration process. Such dynamics generally signal the emergence of critical transition phenomena, which result in drastic changes in system states or eventually qualitative changes in phenotypes, i.e., diseases. Hence, it is of great importance to detect such transitions and further reveal their molecular mechanism at network level. Here, we describe the recent advances on dynamical network biomarkers (DNBs) as well as the related theoretical foundation, which can identify not only early signals of the critical transitions but also their leading networks, which drive the whole system to initiate such transitions for complex diseases. For demonstrating the effectiveness of this novel approach, examples for complex diseases are also provided to detect pre-disease stage, for which traditional methods failed.

References:

1. Luonan Chen, Rui Liu, Zhiping Liu, Meiyi Li, Kazuyuki Aihara. Detecting early-warning signals for sudden deterioration of complex diseases by dynamical network biomarkers. *Scientific Reports*. 2, 342; DOI:10.1038/srep00342, 2012.
2. Rui Liu, Meiyi Li, Zhi-Ping Liu, Jiarui Wu, Luonan Chen, Kazuyuki Aihara. Identifying critical transitions and their leading networks in complex diseases. *Scientific Reports*, 2, 813; DOI: 10.1038/srep00813, 2012.
3. Rui Liu, Xiangdong Wang, Kazuyuki Aihara, Luonan Chen, Early diagnosis of complex diseases by molecular biomarkers, network biomarkers, and dynamical network biomarkers. *Medicinal Research Reviews*, DOI:10.1002/med.21293, 2013.
4. Rui Liu, Xiangtian Yu, Xiaoping Liu, Dong Xu, Kazuyuki Aihara, Luonan Chen. Identifying critical transitions of complex diseases based on a single sample. *Bioinformatics*, DOI:10.1093/bioinformatics/btu084, 2014.
5. Xiangtan Yu, Guozheng Li, Luonan Chen. Prediction and early diagnosis of complex diseases by edge-network. *Bioinformatics*, doi: 10.1093/bioinformatics/btt620, 2013.

Biography:

Luonan Chen received BS degree in the Electrical Engineering, from Huazhong University of Science and Technology, and the M.E. and Ph.D. degrees in the electrical engineering, from Tohoku University, Sendai, Japan, in 1988 and 1991, respectively. From 1997, he was an associate professor of the Osaka Sangyo University, Osaka, Japan, and then a full Professor. Since 2010, he has been a professor and executive director at Key Laboratory of Systems Biology, Shanghai Institutes for Biological Sciences, Chinese Academy of Sciences. He was the founding director of Institute of Systems Biology, Shanghai University. He was elected as the founding president of Computational Systems Biology Society of OR China, and Chair of Technical Committee of Systems Biology at IEEE SMC Society. He serves as editor or editorial board member for major systems biology related journals, e.g. *BMC Systems Biology*, *IEEE/ACM Trans. On Computational Biology and Bioinformatics*, *Journal of Molecular Cell Biology*, *Mathematical Biosciences*, and *Journal of the Royal Society Interface*. His fields of interest are systems biology, computational biology, and nonlinear dynamics. In recent years, he published over 200 journal papers and two monographs (books) in the area of systems biology.

Invited Session on Bird song as self-organized systems (Room F)

January 22 (Thursday), 13:00-15:00

Chair: Charles Taylor (University of California, Los Angeles)

Speakers:

Charles Taylor (University of California, Los Angeles)
Takashi Ikegami (The University of Tokyo)
Kazuo Okanoya (The University of Tokyo, Riken)
Kazutoshi Sasahara (Nagoya University)
Reiji Suzuki (Nagoya University)

Biographies of speakers

Charles Taylor is a professor in the Department of Ecology and Evolutionary Biology at the University of California, Los Angeles (UCLA). He has long been engaged with Artificial Life, and has co-authored two of the Artificial Life volumes, along with Chris Langton and others. He was co-editor of the Artificial Life journal and is currently working with self-organization in complex bird songs.

Takashi Ikegami received his doctorate in physics from the University of Tokyo. Currently, he is a professor at the Department of General System Studies, at the University of Tokyo. His research is centered on complex systems and artificial life, a field which aims to build a possible form of life using computer simulations, chemical experiments and robots. He is a member and the editorial boards of Artificial Life, Adaptive Behaviors, BioSystems and frontiers.

Kazuo Okanoya is a professor in Department of Cognitive and Behavioral science at The University of Tokyo. He obtained a Ph.D. in 1989 from University of Maryland under the supervision by Prof. R. J. Dooling in the area of comparative bioacoustics. He was an Associate Professor of Cognitive Science at Chiba University during 1994-2004, and Lab Head of Biolinguistics at Riken Brain Science Institute during 2004-2010, before taking the current position. He is interested in animal communication and emergence of language and emotion.

Kazutoshi Sasahara is an Assistant Professor in Graduate School of Information Science at Nagoya University. He received his Ph.D. in Multidisciplinary Sciences from The University of Tokyo in 2005. He has been studying the complexity of birdsong syntax using computational learning theory and complex network theory.

Reiji Suzuki is an Associate Professor in the Graduate School of Information Science at the Nagoya University. He received his Ph.D. from Nagoya University in 2003. He has been studying how evolutionary processes can be affected by ecological factors such as lifetime learning (phenotypic plasticity), niche construction and network structures of interactions, using ALife approaches. Recently, he is also studying a temporal soundspace partitioning in bird communities as a self-organizing phenomenon based on behavioral plasticity.

Bird song: A model complex adaptive system

Charles E. Taylor and Martin L. Cody
(University of California, Los Angeles, United States)

Bird songs make an attractive model for studying complex systems. They may range from simple repeated sequences, to complex sequences of different phrase types, much like human language. There is probably no single way to best characterize their complexity. We should avoid saying that that "bird songs are in complexity class X". The diversity of examples suggests that the song of one bird species or another can probably be found to exemplify and model many kinds of complex systems. We suggest that the complexity classes for cellular automata distinguished by Wolfram might give some insight into the capacity of bird songs to transmit information and of the complexity needed to generate them.

Invited Session on Bird song as self-organized systems (Room F)

January 22 (Thursday), 13:00–15:00

Evolution of song complexity in Bengalese finches - Domestication, sexual selection, and epigenetics -

Kazuo Okanoya
(The University of Tokyo, Japan)

Bengalese finches are a domesticated strain of wild White-rumped munias. The process of domestication is about 250 years. During this process, not only plumage but also song changed radically: Munias sing simple linear songs while Bengalese sing sequentially and phonologically complex songs. We examined factors related with sexual selection and domestication to account for the differences in song and other social behaviors. We found the case of evolution of song complexity in Bengalese finches could be used as a parallel model with human language evolution in terms of domestication, sexual selection, and epigenetics.

Exploring Birdsong Structure Using Networks

Kazutoshi Sasahara
(Nagoya University, Japan)

Birdsong is an acoustic communication signal primarily used in male–male competition and male–female attraction. The structure of birdsong among species varies markedly in complexity. Some species such as the Zebra Finch (*Taeniopygia guttata*) sings monotonous songs consisting of a few syllable types repeated in a fixed sequence. Other species such as the Bengalese Finch (*Lonchura striata* var. *domestica*) sing less stereotypic songs in which a dozen syllable types are used in different sequential contexts. Still others such as the California Thrasher (*Toxostoma redivivum*) make long complex songs containing hundreds or even thousands of different syllables. Though it remains unclear why birdsong structure differs so remarkably among species and how such structural diversity evolved, such knowledge is crucial to better understandings of avian communication. Addressing these topics quantitatively requires applying novel efficient methods for acoustic sequence data [1]. We therefore developed two kinds of network-based methods for analyzing birdsong sequence. The first method uses computational learning theory to model the phonological syntax of less stereotypic songs [2]. We integrated two elemental methods—namely, an n-gram model and Angluin's machine learning algorithm—into a single framework in order to model song syntax as the minimized automaton that accepts (or generates) the smallest set of possible syllable sequencing patterns, in which nodes represent states and directed links represent stage transitions. We demonstrate this method with an example of Bengalese finch songs. By contrast, the second method involves complex network theory in order to address transitional relationships in a large repertory of syllable types [3]. In this method, we construct song networks in which nodes represent syllable types and links, either directed or undirected, represent non-self-transitions among types. The song network with undirected links is quantified by network measures, including average path length and clustering coefficient, and compared with random networks. The song network with directed links is characterized by the composition of five types of transition motifs: one-way, bottleneck, margin, branch, and hourglass. We demonstrate how this method is useful to addressing the complex song structure of California Thrashers and the syllable-shared patterns of Black-Headed Grosbeaks. Both methods involve networks, yet apply different underlying theories, thereby shedding light on different aspects of birdsong structure. Exploring birdsong structure with these methods can further current understandings of the evolution of vocal communication among birds and of animal communication systems in general.

Complex systems approaches to temporal soundspace partitioning in bird communities as a self-organizing phenomenon based on behavioral plasticity

Reiji Suzuki¹ and Martin L. Cody²
(¹Nagoya University, Japan)
(²University of California, Los Angeles, USA)

This paper introduces our several preliminary approaches toward understanding temporal soundspace partitioning in bird communities as a self-organizing phenomenon based on behavioral plasticity. First, we describe this phenomenon from our recordings, and show there are asymmetric relationships and the diversity in the temporal avoidance behaviors among the species, using transfer entropy analysis. Then, we consider the evolutionary significance of such a diversity using a computational experiment of the coevolution of the temporal overlap avoidance of singing behaviors among sympatric species with different species-specific song lengths, implying that diversity in the behavioral plasticity in bird communities can contribute to more efficient establishment of the soundspace partitioning. Finally, we introduce our preliminary works on extracting the temporal dynamics of interaction processes among multiple birds from recordings with a microphone array by using an open source software system for robot audition called HARK.

January 21 (Wednesday), 09:15–10:15

Room A

OS11 Applied bioinformatics for systems biology and medicine

Chair: Kaoru Mogushi (Juntendo University, Japan)

Co-Chair: Masaki S. Morioka (Tokyo Medical and Dental University, Japan)

OS11-1 Controllability of protein-protein interaction networks and their relationships with drug-targets, essential genes, and degree connectivities

Takeshi Hase^{1,2,3}, Kaito Kikuchi^{1,4}, Samik Ghosh^{1,2}, Hiroaki Kitano^{1,2,5,6}, and Hiroshi Tanaka^{3,7}
(¹The Systems Biology Institute, Japan)

(²Laboratory of Disease Systems Modeling, Center for Integrative Medical Sciences, RIKEN, Japan)

(³Tokyo Medical and Dental University, Japan)

(⁴The University of Tokyo, Japan)

(⁵Sony Computer Science Laboratories, Inc., Japan)

(⁶Okinawa Institute of Science and Technology, Japan)

(⁷Tohoku Medical Megabank Organization, Tohoku University, Japan)

Proteins make their function through interaction with other proteins and thus genome-wide protein-protein interaction networks (PINs) are useful resources to find essential, disease and drug-target genes. In order to investigate statistical and topological features of PINs, researchers developed several network-analysis metrics. In this study, we focused on two representative network-analysis metrics, “degree” that is number of links to the node and “controllability” that can identify drivers that play an important role to control an entire network. We investigated drivers and degrees of proteins in 6 PINs including human PIN and their relationships with essential, disease, and drug-target genes. We found (i) that high-degree drivers tend to be essential and (ii) low- and middle-degree drivers are more likely to be drug targets than low- or middle-degree non-drivers. These results indicate that integration of controllability and degree could be a promising strategy to infer candidate drug-targets and potential essential genes.

OS11-2 Detection of periodic patterns in microarray data discovers novel oscillating transcripts in *Ciona intestinalis*

Hiromi N. Matsumae^{1,2}, Ryosuke R. Ishiwata^{1,3}, Toshifumi Minamoto⁴, Soichi Ogishima⁵,
Hiroshi Tanaka^{1,5}, and Norio Ishida⁶

(¹Tokyo Medical and Dental University, Japan)

(²Present Affiliation: Institute of Statistical Mathematics, Japan)

(³ Present Affiliation: Nagoya University, Japan)

(⁴Kobe University, Japan)

(⁵Tohoku University, Japan)

(⁶National Institute of Advanced Industrial Science and Technology, Japan)

Circadian rhythms are autonomous 24-hour cycle of behaviors such as sleep, feeding, and photosynthesis for many organisms on earth. Circadian behavior is coordinated by rhythmical gene expression of clock genes. Time-course transcriptome analyses by using statistical methods show periodic gene expression in many organisms. The chordate *Ciona intestinalis* shows nocturnal oxygen consumption in our previous study, however it loses most of clock genes in the genome. Understanding circadian behavior in transcriptome level in this animal, we applied one of the well-known methods, cosine fitting method “COSOPT”, to find oscillating genes in published time-series microarray data. From the result, 3.7% of probes showed 23-25 hour period by COSOPT. Coupling analysis of period detection and functional annotations, this result suggested that unknown rhythmic behavior might exist in *C. intestinalis*. We provide all source codes of COSOPT implemented by C and R.

January 21 (Wednesday), 09:15–10:15

OS11-3 Research on verification of kinship in genomic data for unrelated individuals and family members

Kazuro Shimokawa¹, Kyoko Shibata², Norihiro Kato³, Hiroshi Tanaka^{1,4}, Jun Nakaya^{1,2}
(¹Tohoku University, Japan)
(²Tohoku University Hospital, Japan)
(³National Center for Global Health and Medicine, Japan)
(⁴Tokyo Medical and Dental University, Japan)

We have developed a verification system of kinship, by applying to genetic analysis in two different cohort studies, one is a community resident cohort and the other is a family study. There is a possibility that some cryptic kinship is present in the community resident cohort. Also, there is a possibility that some mistakes in clinical information are present in the family cohort. Our study aims to develop a software to examine correspondence of clinical information with genome information.

OS11-4 Trends in data sharing of genomic and phenotype data toward personalized prevention and medicine

Soichi Ogishima¹, Hiroshi Tanaka², and Jun Nakaya^{1,2}
(¹Tohoku University, Japan)
(²Tokyo Medical and Dental University, Japan)

The great advances of ultra-high-throughput sequencing technologies are expected to realize personalized prevention and medicine. However, risk factors and their relationships have not been clarified yet. Large-scale data are required to prove relationships between genomic and phenotype risk factors. To obtain large-scale data, data sharing of genomic and phenotype data has been rapidly accelerated. The Global Alliance for Genomics and Health (GA4GH) was founded to accelerate the potential of genomic medicine to advance human health. Over 200 leading universities and institutions in healthcare, research, and information technology participate in this alliance. The partners in this alliance are working together to establish a common framework of harmonized approaches to enable the responsible, voluntary, and secure sharing of genomic and clinical data for large-scale collection of data on genome sequencing and clinical outcomes. We review trends in data sharing of genomic and phenotype data toward personalized prevention and medicine.

Room B

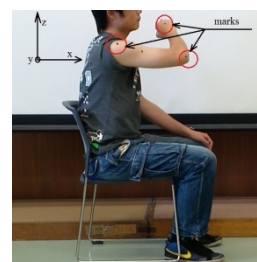
GS18 Motion planning and navigation

Chair: Yuichiro Taira (Sojo University, Japan)

GS18-1 Experimental and theoretical analysis of human arm trajectories in 3D movements

Tadashi Kashima and Keita Sugawara
(National Institute of Technology, Tomakomai College, Japan)

In this study, experiments for three-dimensional (3D) movements have been conducted, and the positions of marks provided on a shoulder, an elbow, and a hand are obtained. In addition to the arm trajectories in a 3D space, these are projected to sagittal, frontal, and transverse planes. Here, specific features in these planes are investigated, and detail properties of human arm trajectories have been uncovered. In addition, kinematics of a human arm during a movement has been analyzed. Hence, a kinematical arm model with joint redundancy is defined, and the kinematics of the model is reconstructed from the measured trajectories. Subsequently, the trajectories of all joint angles during a movement are obtained by use of the kinematics, and their characteristics are analyzed. The result shows that the angular trajectories are remarkably similar to those produced under the minimum angular jerk.

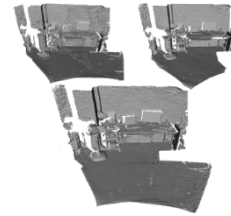


January 21 (Wednesday), 09:15–10:15

GS18-2 An Integrated Approach of ICP and Visual Odometry for KinectFusion Based on Scene Complexity Analysis

Somkiat Khamphuea, Toshiaki Kondo, and Itthisek Nilkhamhang
(Sirindhorn International Institute of Technology, Thammasat University, Thailand)

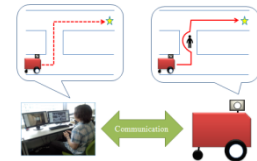
This paper presents a novel approach for 3D reconstruction based on the KinectFusion. The iterative closest point algorithm (ICP) employed in the KinectFusion works well when there are sufficient 3D features in a scene to be reconstructed. Conversely, it is difficult to reconstruct simple scenes with limited 3D features such as planar structures. We propose to use visual odometry (VO), in place of the ICP, when only insufficient 3D features are available in a scene. Regardless of whether there are sufficient 3D features or not, VO works well as long as the scene contains sufficient 2D features such as textures and corner points. The proposed method then automatically selects the ICP or VO, depending on the complexity of the scene. The complexity of the scene is evaluated with the magnitudes of the discontinuities in surface normal vectors in depth maps. Experimental results show that the proposed method outperforms the methods based on either the ICP or VO alone.



GS18-3 Operability Evaluation of a Navigation System for Tele-Presence Robots

Kyosuke Soda and Kazuyuki Morioka
(Meiji University, Japan)

This study aims to achieve cooperative navigation systems of tele-presence robots which anyone can operate easily. This paper proposes a method of generating and online updating way points according to operator's intentions at remote sites. That makes flexible remote navigation utilizing autonomous behaviors of the mobile robot. In this paper, the remote navigation experiments were performed and the results show effectiveness of proposed method. Also, operability of mobile robots using the proposed system is discussed.



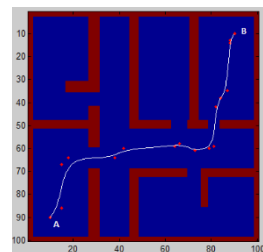
GS18-4 NURBS based robot navigation

Sawssen Jalel^{1,2}, Philippe Marthon², and Atef Hamouda¹

(¹Tunis El Manar University, LIPAH research laboratory, Faculty of Sciences of Tunis, Tunisia)

(²University of Toulouse, Site ENSEEIHT de l'Institut de Recherche en Informatique de Toulouse (IRIT), France)

This paper describes a novel roadmap algorithm for generating an optimal path in terms of Non-Uniform Rational B-Splines (NURBS) curves. This method consists of two steps. The first interested in determining an optimal path between a start and goal configurations. Skeletonization, graph theory and mathematical morphology are used to compute the set of control points which will be approximated by a NURBS curve that ensures the properties of smoothness, the minimum length and obstacles avoidance. Regard to the second, it is interested in refining the curve previously generated by considering the maximum allowable value of the curvature. In this study, NURBS curves are involved in meeting the system's constraints via a suitable parameterization of the weights of control points which allows better benefit from the influence and the geometrical meaning of this parameter. Simulation studies are carried out to validate the effectiveness of the proposed algorithm.



January 21 (Wednesday), 09:15–10:15

Room C

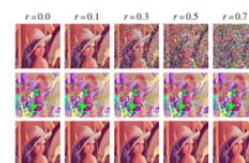
GS20 Neural networks

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

GS20-1 Extended Projection Rule for Quaternionic Multistate Hopfield Neural Network

Toshifumi Minemoto, Teijiro Isokawa, Haruhiko Nishimura, and Nobuyuki Matsui
(University of Hyogo, Japan)

Storing and recalling performances of embedded patterns on associative memory are investigated in this paper. The associative memory is composed of quaternionic multistate Hopfield neural network. The state of a neuron in the network is described by three kinds of discretized phase with fixed amplitude. These phases are set to discrete values with arbitrary divide-size. Hebbian rule and projection rule are used for storing patterns to the network. Recalling performance is evaluated through storing random patterns with changing the divide-size of the phases in a neuron. Color images are also embedded and their noise tolerance is explored.



GS20-2 Medical image diagnosis of kidney regions by deep feedback GMDH-type neural network using principal component-regression analysis

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

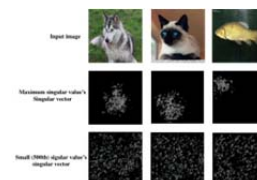
The deep feedback Group Method of Data Handling (GMDH)-type neural network is applied to the medical image recognition of kidney regions. In this algorithm, the principal component-regression analysis is used for the learning calculation of the neural network, and the accurate and stable predicted values are obtained. The 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 recognition of kidney regions because the optimum neural network architecture is automatically organized.



GS20-3 The dynamics of deep neural networks

Yhoichi Mototake and Takashi Ikegami
(The University of Tokyo, Japan)

Since Hinton et al. [1] introduced new learning algorithms for multilayered feed-forward networks, now commonly known as deep neural networks (DNN), many people have started to investigate this potential capabilities and applications. For example, Google Inc. showed that deep learning can automatically extract cat faces and human body images from millions of randomly selected Youtube images [2]. In other work, Szegedy et al. [3] obtained high recognition rates at human like ability by using very deep multi layered neural networks. In this study, we computed the information flow within a DNN in order to reveal its underlying dynamical systems properties. Our results support the hypothesis that DNN get their high performance by removing and expanding feature information as the layers goes up and compresses a high dimensional data set's distribution onto low dimensional manifolds.



January 21 (Wednesday), 09:15–10:15

GS20-4 Remarks on Adaptive Type Neural Network Self-Tuning Controller and Its Stability

Takayuki Yamada
(Ibaraki University, Japan)

This paper discusses the stability of the adaptive type neural network self-tuning controller. This paper does not suppose that the plant is linear. However, it supposes the local stability still. The local stability means that the neural network weights are close to their converged values. By the use of this assumption, we can discuss how the plant Jacobian (the derivative of the plant output with regard to the plant input) affects the stability condition of the adaptive type neural network self-tuning controller. As the result of the discussion, the plant Jacobian affects the stability of the neural network. I think that it is helpful for the discussion of the neural network controller performance and basic study of the nonlinear neural network controller although it is supposed that the neural network is linear. This paper also presents the simulation results in order to verify the discussion of the stability.

Room D

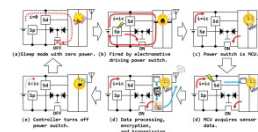
GS22 Sensor and multi-sensor data fusion

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

GS22-1 A sensor node architecture with zero standby-power on wireless sensor network

Akira Yamawaki, Mayu Yamanaka, and Seiichi Serikawa
(Kyushu Institute of Technology, Japan)

The wireless sensor network (WSN) is a promising technology to improve the social life cooperating to the robotic technologies like nursing robots, disaster rescue robots, industrial robots, and so on. For such WSN, we propose an architecture of the sensor node with zero standby power consumption. This is accomplished by combining a power transistor cutting the ground line, an energy harvester used for just turning on the power transistor and a conventional battery. That is, new hybrid power supply circuit combining the conventional battery and the energy harvester is proposed for the sensor node. The preliminary experiments demonstrate that our proposal can actually activate the sensor node, which stays at the sleep mode with zero power consumption, with a short-time electromotive force generated by the piezoelectric sensor. It is also confirmed that the sensor node activated can establish the wireless communication correctly.



GS22-2 A general-purpose tool for indoor localization via Beacon and NFC enhanced by using pressure sensor

Fujio Yamamoto
(Kanagawa Institute of Technology, Japan)

In order to get positional information indoors, we thought about adopting a construction that is composed of three-levels, namely, a floor, a room in the floor, and an object in the room. Based on this we have developed a general-purpose tool for indoor localization via Beacon and NFC enhanced by using pressure sensor. Using the difference of atmospheric pressure between floors can make the floor level detection. Room detection in a floor is performed using Beacons, and the specific position in the room can be determined by touching a NFC tag in the room. We confirmed by a case study that calculating the nearest Beacon among many visible Beacons could make detecting a room. This tool is expected to be applicable to many applications such as localization and tracking of indoor objects.

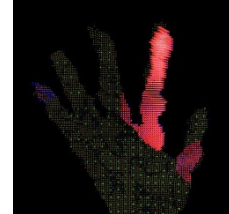


January 21 (Wednesday), 09:15–10:15

GS22-3 Low cost 3D tracking system that tracks deformation of arbitrary non-rigid objects

Takashi Miyake¹, Nobuhiro Okada², and Kazuo Kiguchi¹
(¹Kyushu University, Japan)
(²The University of Kitakyushu, Japan)

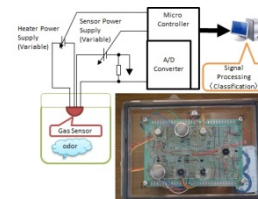
We constructed a system for 3D tracking of arbitrary non-rigid objects which can estimate their deformation vectors without prior knowledge such as 3D models or markers. This system uses two algorithms Iterative Closest Point (ICP) and Thin Plate Spline - Robust Point Matching (TPS-RPM). Furthermore, our system requires only one sensor, a depth sensor. This time we used a Kinect as a depth sensor, thus our system can be realized at very low cost. However, the accuracy of our entire system results was unclear. Therefore in this paper, we demonstrated the accuracy and the comparison results through experiments with other marker based method.



GS22-4 Olfactory sensor system with variable voltage power units for a heater and sense-circuit of metal-oxide semiconductor gas sensor

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

Artificial olfactory is studied in a long time and many ways. The artificial olfactory is called an electronic nose system (e-nose). The system has sensor modules and a signal processing module. For the sensor modules, MOS gas sensors and QCM gas sensors are useful. Our researching e-nose system has MOS gas sensors. Many of MOS gas sensors utilize an effect of an oxidation-reduction reaction on the surface of the sensors. The sensors are used after warming up which is heated by oneself. Furthermore, characteristics of the sensors are changed by changing temperature of the sensors. In this paper, we show a sensing system which has four MOS gas sensors with controllable power supply, and results of our system to sense soy-source, because we are considering applying the system for management of cooked foods. Furthermore, we show ability of our system for applying quality control system of cooked foods.



Room F

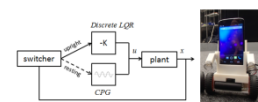
GS17 Mobile robots

Chair: Eiji Uchibe (Okinawa Institute of Science and Technology, Japan)

GS17-1 Two-wheeled Smartphone Robot Learns to Stand Up and Balance by EM-based Policy Hyper Parameter Exploration

Jiexin Wang¹, Eiji Uchibe², and Kenji Doya^{1,2}
(¹Kyoto University, Japan)
(²Okinawa Institute of Science and Technology, Japan)

This paper proposes a novel policy search algorithm called EM-based Policy Hyper Parameter Exploration for a smartphone robot to learn its policy parameters. This method integrates two reinforcement learning algorithms: Policy Gradient with Parameter Exploration (PGPE) and EM-based Reward-Weighted Regression. Like PGPE, our method can utilize a deterministic policy and the policy parameters are sampled at the beginning of each episode. This procedure reduces the variance of the actual return. In addition, the update rule does not require a learning rate because it is derived based on the reward-weighted regression using the EM algorithm. The proposed method is tested in using a two-wheeled smartphone robot and experimental results show the robot can learn standing-up and balancing behaviors efficiently.



January 21 (Wednesday), 09:15–10:15

GS17-2 An indoor position tracking method using inertial measurement unit and fingerprint technique for mobile robot

Chutchai Chaiyarat¹ and Olarn Wongwirat²
(¹Thai-MC Company Limited, Thailand)
(²King Mongkut's Institute of Technology Ladkrabang, Thailand)

Currently, an indoor position tracking method used for mobile robot is interested by numerous researchers. Much research uses an inertial measurement unit (IMU) to track the position. The problem of using the IMU is a position inaccuracy resulting from negative factors of sensors inside. This paper presents the indoor position tracking method of mobile robot by fusing the IMU and fingerprint data. The acceleration from the IMU is used to find the robot positions. The fingerprint technique from WLAN is deployed to mark a reference point. Then, those data are combined to adjust the position and the error from position drift can be reduced. The accuracy of proposed tracking method is verified by using the actual IMU and simulated fingerprint data in the experiments. The results express that the proposed tracking method can improve the position of mobile robot to be more accurately than using the IMU alone.

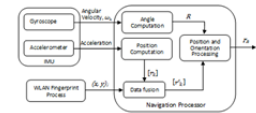


Fig. 1 Position tracking system for indoor mobile robot.

GS17-3 Development of the Pipe Robot with Flexible Movements and Adaptive Diameter

Chu Kang Chan and Harutoshi Ogai
(Waseda University, Japan)

There are many pipes used under the ground for transporting gas, liquid and protecting wire. The pipe systems need regular check to keep it to operate normally. Increasing efficiency of inspection and reducing maintenance cost are the important issue. We present a pipe inspection robot with flexible movements and adaptive diameter. This robot is designed to move in every kind of pipe systems such as horizontal pipe, vertical pipe, curve pipe and different diameter pipe. The robot has a mechanism which is autonomous adaptive to the pipes diameter range of 250-300 millimeters. The robot includes mechanical design, control systems, adaptive diameter system will be discussed in detail. Finally, the experiment result will be presented.



GS17-4 Analyzing Accuracy of Localization for Autonomous Mobile Robot

Yutaro Taira, Hirokazu Matsui, and Norihiko Kato
(Mie University, Japan)

In this report, we focused on Laser Range Finder (LRF), that is used frequently for localization of outdoor autonomous mobile robot. The localization is very important for outdoor autonomous mobile robot. There are a lot of ordinary researches relating to localization of autonomous mobile robot using LRF. Such as a 2-D localization by Monte Carlo Localization (MCL) for Mobile robots, a localization by MCL with fusing a LRF and other sensors and a localization using 3-D LRF. As the results of these researches, the autonomous mobile robots can move partly in outdoor. However, in the ordinary researches, a robot uses all the data from LRF without evaluating a confidence of the data, and it estimates the location of itself at each scanning step. It doesn't consider that low confidence data causes unsuccessful localization. In this report, we proposed a method that a robot localizes itself only at places where the localization has high accuracy and doesn't localize itself by LRF data at all the scanning steps. This is because, we consider that it is enough to localize only at high accuracy places and not-localizing is better than localizing at low accuracy places. We used a 2-D LRF sensor that can measure distances between a LRF and an object on a horizontal plane by each angle. In this report, we restricted target objects to L-shaped edges like an exterior angle of a building, since they are simple and appear frequently in an outdoor environment.

January 21 (Wednesday), 13:00–14:15

Room A

GS4 Biological evolution

Chair: Takeshi Hase (Tokyo Medical and Dental University, Japan)

GS4-1 Computational study on evolution and adaptability of recursive operations

Genta Toya and Takashi Hashimoto
(Japan Advanced Institute of Science and Technology, Japan)

A notable feature of human language is that words are organized recursively and hierarchically into sentences. It was remarked that recursive manipulation was observed only in humans in an experiment of combining cups by human infants and chimpanzees. Adopting the hypothesis that recursive operation in object manipulation is a precursor of the syntactic ability of language, we consider environments and possible processes of evolution of recursive operation using an evolutionary simulation of tool making behavior. It was found that a recursive operation could evolve when making diversified tools was adaptive and the time limitation and cost of object manipulations were not severe. An observed evolutionary process was that initially tools made by repeated operations had a common part; then, the common part was stored; and finally, the common part was prepared in advance and combined with other objects as components to produce other tools where combination behavior was performed recursively.

GS4-2 Signal drives genetic diversity: an agent-based approach to speciation

Olaf Witkowski¹, Geoff Nitschke², and Takashi Ikegami¹
(¹The University of Tokyo, Japan)
(²University of Cape Town, South Africa)

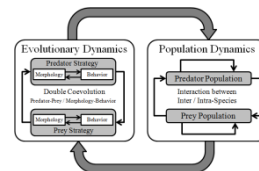
Species diversification is generally thought to emerge from space barriers, which isolate individuals from each other long enough so that they diverge significantly from each other, each adapting to their own ecological niche. However, the search for ecological opportunities alone does not account for all cases of speciation (Schluter 2000, Rundell & Price 2009).

Signaling is observed between individuals of species having an advantage to communicate their identity via species-specific signals, leading to reproductive isolation (Nevo et al. 1987, Carlson & Arnegard 2011).

GS4-3 The effects of genetic operators on eco-evolutionary feedback based on a 3D virtual predator-prey system

Takashi Ito, Marcin L. Pilat, Reiji Suzuki, and Takaya Arita
(Nagoya University, Japan)

We present the results of evolutionary experiments investigating the interaction between the population dynamics and the trait evolution of a predator-prey scenario in a 3D physically simulated environment. The morphologies and behaviors of virtual creatures are evolved using a genetic algorithm based on the predatory interactions, while their population sizes are changed depending on the fitness of individuals. Varying the rates of genetic operators, we analyze their effects on the coevolutionary dynamics. We show the effects of genetic operators which are caused by the interaction between two kinds of factors: the characteristics of genetic operators and the asymmetry between predator and prey.



January 21 (Wednesday), 13:00–14:15

Room B

OS14 Robustness and Complexity of Decentralized Systems

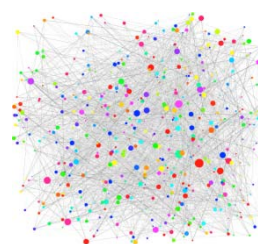
Chair: Takashi Shimada (The University of Tokyo, Japan)

Co-Chair: Hiraku Nishimori (Hiroshima University, Japan)

OS14-1 Complexity and robustness of ecosystem-like systems

Takashi Shimada^{1,2}, Yohsuke Murase^{2,3}, and Nobuyasu Ito^{1,2,3}
(¹The University of Tokyo, Japan)
(²CREST, JST, Japan)
(³RIKEN, AICS, Japan)

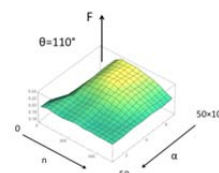
A recently discovered universal mechanism of determining the robustness of ecosystem-like (i.e. evolving open systems) is reviewed and theoretically verified. Using a minimal model for such ecosystem-like systems, we introduce a novel type of relation between the system's complexity (number of links per element) and the robustness. The relation between this very simple model and the more detailed nonlinear dynamical models, and hence the relevance to the real phenomena, are also discussed.



OS14-2 Variations on Error Strategy of Foraging Ants

Hiraku Nishimori¹, Rito Takeuchi¹, Shin I Nishimura¹, and Hiroyuki Nakagawa²
(¹Hiroshima University, Japan)
(²Osaka Prefecture University, Japan)

Foraging efficiency of ant colony is studied along the idea of the strategy of errors. The strategy of errors is a seemingly-paradoxical group tactics proposed by Deneubourg(1983), indicating that error of individual ants in following trail pheromone increases the efficiency of trail-pheromone-mediated group foraging. In this study, we attempt to extend Deneubourg's original idea of the strategy of errors to entrain more realistic foraging behaviors of ants. Specifically, we introduce a multi-agent model in which we incorporate the unsteady supply of food and the non-uniform distribution of errors in following ability of pheromone trail by foraging ants. The obtained numerical results indicate that non-uniform distribution of the degree of errors leads a colony to make an optimal foraging under unsteady foraging environment.



OS14-3 Traffic Simulation of Kobe-city

Yuta Asano¹, Nobuyasu Ito^{1,2,3}, Hajime Inaoka^{1,3}, Yohsuke Murase^{1,3},
Tetsuo Imai^{1,3}, and Takeshi Uchitane^{1,3}
(¹RIKEN, AICS, Japan)
(²The University of Tokyo, Japan)
(³CREST, JST, Japan)

A traffic simulation of Kobe-city is carried out. In order to simulate an actual traffic flow, a road structure was built utilizing a high-quality digital map data, and an origin-destination information of vehicles was estimated by a geographical population data. We found that the adjustment of the speed limit of the road holds the possibility of the data assimilation with traffic census data.

January 21 (Wednesday), 13:00–14:15

OS14-4 A translocation-agent-based epidemic model

Shih-Chieh Wang¹, and Nobuyasu Ito^{1,2,3}
(¹RIKEN, AICS, Japan)
(²The University of Tokyo, Japan)
(³CREST, JST, Japan)

This paper presents an epidemic agent model for studying how the population's density, social interacting and mobility influence the epidemic propagating. In this model, a non-stochastic infected mechanism is established, the researchers (a) can set epidemic and immunization parameters to each epidemic agent, such as how many days of agents been recovered T_{rev} and the virus concentration threshold I_{th} to be infected; (b) and can give a time dependent or a stochastic epidemic propagating network A_{ij} among these agents. In section 2, increasing the threshold of epidemic as the difficulties of propagating and decrease the numbers of neighbor by changing the hexagonal epidemic propagating networks to two-dimensional square one, the increasing speed of population of infected agents $I(t)$ decreases, but $I(t)$ is still in the form of power law $I(t) \sim t^2$. In section 3, a urban-random walking case, higher population's density and faster moving epidemic agents will make epidemic propagates faster and I_{max} rises.

OS14-5 Foraging strategy for mobile food resources

Rito Takeuchi and Hiraku Nishimori
(Hiroshima University, Japan)

Ants communicate with each other using various means. Foraging ants emit recruit pheromone on their way back to the nest, which pheromone leads the nest-mates toward food sources. But some ants trace pheromone inaccurately, and it is believed that this error (inaccurate) strategy is one of keys in the efficient group foraging of ants. In natural environments, living foods may move and try to flee from predators, in which case ants need to cooperate on capturing them. And we suppose that this error strategy make some effect on these cooperation. In this study, we introduce an ant-based multi-agent simulation model that consists of two different types of agents; the highly accurate pheromone followers and the moderately inaccurate pheromone followers. Then, with changing the moving speed of food sources, we investigate the combination of two types of agents for optimal group foraging. Obtained results suggest that the optimal combination strongly depends on the moving speed of foods.

Room C

GS16 Learning

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

GS16-1 iMnem: Interactive Mnemonic Word Suggestion Using Phonetic Algorithms

Orapin Anonthanasap and Teerapong Leelanupab
(King Mongkut's Institute of Technology Ladkrabang, Thailand)

To support language learning by using the principle of a Mnemonic technique, this paper proposes to automatically generate suggested mnemonic words by using "phonetic algorithms", i.e., Soundex and Metaphone. Levenshtein edit distance is employed to compare the phonetic similarity of foreign words and that of words in a known language using the sound transcriptions transformed by the proposed algorithms. Our new interactive cross-lingual system, called iMnem, is also introduced to support the task of searching for mnemonic words with images for better imagination of word association. To the best of our knowledge, this work is the first to apply phonetic algorithms for mnemonic word generation. In this study, we focus on suggesting mnemonic keywords in English for supporting learning of words in Japanese.

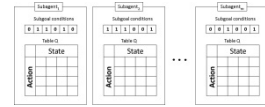


January 21 (Wednesday), 13:00–14:15

GS16-2 Dynamic subgoal generation using evolutionary computation for reinforcement learning under POMDP

Takumi Nomura and Shohei Kato
(Nagoya Institute of Technology, Japan)

In this paper, we will propose a method generating sub-goal for reinforcement learning for POMDP. POMDP is an environment where an agent gets confused by several states even when same information is observed from the environment. To resolve this problem we will propose a genetic algorithm that dynamically generates sub-goal for reinforcement learning. the number of sub-goals are not tuned for our method, and each of the agents has different solutions since they behave independently. We confirmed the effectiveness of our method by some experiments with partially observable mazes with HQ-Learning.



GS16-3 Development of an occupancy simulator for elderly monitoring based on observed data

Youhei Kuroda¹, Noboru Imanishi¹, Tomoharu Nakashima¹, Yumi Higuchi¹, and Yasuko Maekawa²
(¹Osaka Prefecture University, Japan)
(²Kansai University of Social Welfare, Japan)

In this paper, an occupancy simulator of an elderly person functions by using the real observed data. In our previous research, we could not check accurately the validity of our simulated occupancy data. This paper examines the validity of the simulated occupancy data by comparing them with the new real observed data in an elderly home. The problem in the developed occupancy simulator is the optimal design of its parameters. They were manually determined in the experiments of the previous research. This paper investigates how the performance of the occupancy simulator is influenced when the parameters are changed. A concordance rate is used to measure the validity of the simulated occupancy data. A series of computational experiments are conducted to find the combination of parameters that produces the most appropriate simulated trajectory of the elderly person.

GS16-4 Multi-agent learning using mini soccer game

Takayasu Fuchida, Takehiro Egashira, Takuya Ichiki, and Tadanori Hisanaga
(Kagoshima University, Japan)

In recent years, with the rapid development of robot technology and computers, the need for an autonomous robot has been increasing rapidly in activities in hazardous locations and disaster relief. However, there is a problem in the autonomous robot to perform the only action that has been pre-programmed, and that cannot cope with unexpected incidents in the operation. For this reason, expectation is growing in the machine learning which an autonomous robot recognizes an environmental change and learns itself. In particular the reinforcement learning is suitable for learning of such robots so that it can be learned with giving purposes only without giving their behavior. Moreover, while the complicated application which is going to achieve the purpose in cooperation in two or more robots increases, the study using multiple agents attracts attention. In the conventional multi-agent learning, many of them were models in which only one or few agents perform learning. In this study, we propose a model that performs learning at the same time more than one agent while conflict or cooperation. The environment is the mini-game which models the half-field soccer, both defensive and offensive side performs learning at the same time. In this model, learning is performed using multiple agents - defenders and attackers - , defensive person acts for the purpose of pass cut, and attacker acts for goals. We use the general Q-learning as learning algorithm, and the state space is constructed as multi-dimensional space with the angle and the distance to a target goal and ball and other agents. The actions are prepared several types such as the following, depending on the type of agent. Finally, we perform several computer simulations and show the effectiveness of our method.



January 21 (Wednesday), 13:00–14:15

GS16-5 Instable Objects Recognition to Estimate Localization for Autonomous Mobile Robots

Shinji Nakabayashi, Hirokazu Matsui, and Norihiko Kato
(Mie University, Japan)

There are many researches on autonomous mobile robots for sharing spaces with human beings. In the ordinary researches, most of the autonomous mobile robots recognize the environments and localize themselves with using Laser Range Finders (LRFs). But they consider implicitly, not explicitly, instable objects in the environments, that disturb the recognition and the localization. We propose a method that explicitly removes instable objects from LRF scan data in order to localize itself. We design the method that consists of two modes: "Learning mode" and "Distinguishing mode". In the Learning mode, it learns what scan data represent for instable objects off line. In the Distinguishing mode, it removes instable objects from scan data on line, and it localizes itself by using the rest scan data. We experimented whether the method distinguished instable objects at a corridor in a building. As the results, it could recognize human legs as instable objects, and could localize itself correctly.

January 21 (Wednesday), 13:00–14:45

Room D

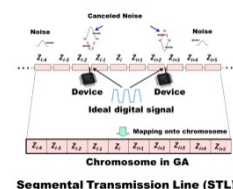
OS1 Bio-inspired theory and applications

Chair: Kunihiro Yamamori (Miyazaki University, Japan)

OS1-1 An Evolutionary Design Methodology of Printed Circuit Boards for High-speed VLSIs

Moritoshi Yasunaga¹ and Ikuo Yoshihara²
(¹University of Tsukuba, Japan)
(²Miyazaki University, Japan)

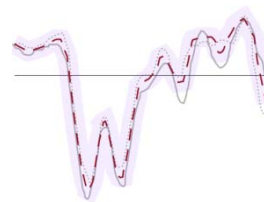
As operation frequencies of the printed circuit boards (PCB) increase with increasing frequencies of VLSIs in the GHz domain, some serious problems occur. High frequency digital waveforms are distorted considerably due to impedance mismatching in PCB traces, or transmission lines, which is called signal integration (SI) degradation problem. And power supply voltages decrease due to high power-ground impedances at high frequency range, which is called power integration (PI) degradation problem. Those problems are barely able to be overcome on a case-by-case empirical design at present. In this paper we newly propose evolutionary design approaches based on the genetic algorithms and show those effectiveness, quantitatively.



OS1-2 Real-time voice adaption from applying pattern recognition to audio stream

Mads Alexander Midtlyng and Yuji Sato
(Hosei University, Japan)

This paper reviews the possibility of creating a real-time "voice adaption" (VA), which changes an inputted voice to a target voice by fitted interpolated curve comparison. Our method is inspired from pattern recognition concepts, with a goal to achieve high speed VA. Previous methods focus on human characteristics to perform VA, and show problems with larger volumes of adaption data, thus we propose a different method for allowing VA that functions real-time in voice-based software. In a preprocessing part, the voice is examined in parts that we define as sounds. The sounds are analyzed and mapped as target data. The incoming stream is also examined and compared against the target data using curve fitting. If the sound from Person A and Person B's fitted curves show high similarity, they can be accepted as the same and output is performed. Paper concludes with discussion of future work.

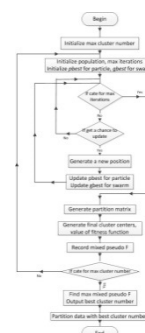


January 21 (Wednesday), 13:00–14:45

OS1-3 Validity Index Mixed Pseudo F for A New Fuzzy Cluster Analysis Algorithm

Shiqin Yang, Jia Guo, and Yuji Sato
(Hosei University, Japan)

In the field of clustering, Fuzzy c-means (FCM) is one of the most popular algorithms. Although FCM is extensively used in literature, it suffers from several drawbacks. To increase its probability of finding the global optimum, a new hybrid fuzzy clustering algorithm (FPO-FCM) is adopted in this paper that combines the Fitness Predator Optimizer (FPO) with the FCM. To determine the optimal number of clusters in the FPO-FCM algorithm, the mixed pseudo F statistic method is also used to evaluate the effectiveness of cluster number analysis. Consequently, the FPO-FCM algorithm with mixed pseudo F index could automatically determine the optimal number of classes. Five benchmark data sets are used to evaluate the effect of the automated classification of the FPO-FCM algorithm. Experimental results show that the proposed approach could demonstrate the desirable performance and avoid the minimum local value of objective function for clustering problems.



OS1-4 Extended 2D mesh network-on-chip for region-based fault-tolerant routing methods

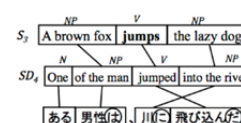
Kenichi Sonoda and Masaru Fukushi
(Yamaguchi University, Japan)

This paper proposes an extended 2D mesh Network-on-Chip architecture which supports region-based fault tolerant routing methods. The proposed architecture has an additional track of links and switches at the four sides of mesh network so that it can partially reconfigure the network around faulty region to provide new detour path. This allows to simplify the complex routing rule of the existing methods and avoid long detour routing paths. Modified routing method is also proposed for the new architecture and the deadlock freeness is proved. Simulation result shows that the proposed architecture with the routing method reduces average communication latency by up to 25% compared to the existing state-of-the-art method at the expense of low hardware overhead.

OS1-5 Natural English-Japanese Translation by Complementing of Proper Particles

Hayato Haraguchi, Kunihiro Yamamori, and Masaru Aikawa
(University of Miyazaki, Japan)

In this paper, we propose a method of complementing Japanese particles on English-Japanese translation. Japanese particles are important to make natural sentence. We try to complement Japanese particles by using English-Japanese parallel corpora database. This database has pair of sentences, details of verbs, particles, “chunks” and “clauses”. Japanese sentences with correct usage of particles in the database give us naturally translated Japanese sentence. To detect the most suitable sentence from database, we search sentences with the same verbs because the verb is the most important word in a sentence. Since some sentences will be retrieved, we evaluate chunk similarity by “Levenshtein length” to select the most suitable sentence.

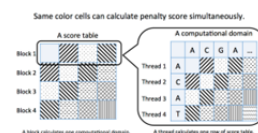


January 21 (Wednesday), 13:00–14:45

OS1-6 Pipelined multi-threading approach for high-speed global alignment on GPGPU

Takayuki Yamamoto, Masaru Aikawa, and Kunihiro Yamamori
(University of Miyazaki, Japan)

Current sequencer gives us a huge number of DNA sequence data, but they do not be analyzed still yet. These data have inherent potential to make works and functions of genes be clear. Sequence alignment such as local alignment and global alignment is the first step of genomic analysis to evaluate similarity of base sequences. Since similarity calculation by sequence alignment takes a long time, these alignments utilize Graphics Processing Unit (GPU) for fast calculation. Most of recent researches focus on local alignment because the length of target sequences are short enough to handle. In this paper, we propose an approach for high-speed global alignment on GPGPU (General Purpose GPU).



OS1-7 A Heuristic and Stochastic Approach for Automatic Music Composition

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

In this paper, we propose a heuristic and stochastic approach for automatic music composition. We utilize pulse-scale concept to generate rhythm, then decide the pitch of each tone. Moreover, we insert a tone according to non-chord tone rules to keep harmony. In addition, we iterate the same melody piece patterns so that melody obtains stable structure. Our automatic music composition consists of 4 stages; (1)decision on chord progression, (2)melody generation by chord tones only,(3)insertion of non-chord tones between chord tones, (4)melody decoration. We evaluate the composed music by a questionnaire survey. As a result, large modulation of beat strength by pulse-scale concept and multiple uses of the same melody piece patterns give us more natural music.



Room F

OS6 Estimation and control of mechatronic systems

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

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

OS6-1 A new control system for the variable incident angle of EMAT

Hideki Wada¹, Katsuhiro Okumura², Keisuke Inomata³, and Masahiro Oya³
(¹Sin-Nippon Nondestructive Inspection Co., Japan)
(²Fukuoka Industrial Technology Center, Japan)
(³Kyushu Institute of Technology, Japan)

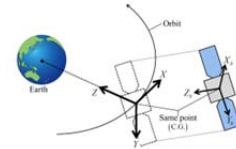
The ultrasonic testing is often used for the thickness measurement of steel plate and the inspection of the steel structure. However, there is the problem that in the conventional probe for the ultrasonic testing, the incident angle of ultrasonic waves cannot be changed easily. To overcome the problem, in the paper, we propose a new EMAT (Electromagnetic Acoustic Transducer) inspection system in which the incident angle can be changed independent of the ultrasonic frequency.

January 21 (Wednesday), 13:00–14:45

OS6-2 Adaptive Attitude Control of Artificial Satellites

Keisuke Inomata¹, Hideki Wada², Jinxin Zhuo¹, and Masahiro Oya¹
(¹Kyushu Institute of Technology, Japan)
(²Shin-Nippon Nondestructive Inspection Co., Japan)

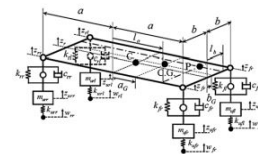
In this paper, we propose a stable adaptive attitude control scheme under the condition that model parameters of the artificial satellites are unknown. Carrying out numerical simulations, it is shown that the control performance can be improved by setting a design parameter in the proposed control scheme. In addition, it will be shown that there exists a good property that the control input signals become smooth when the control performance is improved.



OS6-3 Preview ride comfort control of vehicles

Yutaro Kubo¹, Panfeng Shu¹, Hideki Wada², and Masahiro Oya¹
(¹Kyushu Institute of Technology, Japan)
(²Shin-Nippon Nondestructive Inspection Co., Japan)

In this paper, it is assumed that preview information of road disturbance is available by using sensors and cameras in front of the vehicle. Then, we propose a new robust active suspension control scheme with preview control in order to improve the ride comfort. At first, a new ideal vehicle model with preview control is developed. In this model, the location where the ride comfort becomes best can be easily moved. Next, a robust controller is redesigned so that the actual vehicle can track the ideal vehicle model. Furthermore, to show the effectiveness of the proposed controller, numerical simulations are carried out.



OS6-4 Adaptive Estimation Method for Drivers parameters - Experimental Study Using Driving Simulator -

Yasutaka Yoshihara, Hiroshi Minato, Hidetaka Ohta, and Masahiro Oya
(Kyushu Institute of Technology, Japan)

The authors have been proposed an adaptive online estimation method for the driver parameters in driver-vehicle systems. It has been shown by carrying out numerical simulations that the proposed estimation method is very effective. To show actual effectiveness, however, experimental results have to be shown. Therefore, in this paper, by using driving the simulators, we verify effectiveness of the proposed adaptive online estimation method for the driver parameters.



OS6-5 Development of a master controller for a dual-arm underwater robot

Radzi Bin Ambar and Shinichi Sagara
(Kyushu Institute of Technology, Japan)

Master-slave system is a vital technique for controlling robot motions, especially in underwater robotics applications. This paper describes the development of a novel master controller for an experimental dual-arm underwater robot. By using the proposed master controller, a human operator is able to control an underwater robot movement in 3-dimensional space. The master controller also includes two units of 3-link manipulator controller. Moreover, each end-tips of the manipulator controller are attached with a joystick, one for controlling robot position, while the other controls robot attitude. The uniqueness of the proposed master controller is that a human operator is able to control the motion of robot base and two units of 3-link slave manipulator simultaneously. In this work, the hardware design of the proposed master controller and the structure of master-slave system are presented. The usefulness of the proposed master controller is verified through experiments on controlling an actual dual-arm underwater robot.

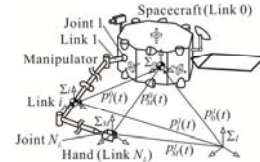


January 21 (Wednesday), 13:00–14:45

OS6-6 Design of an Adaptive Controller for Free-Flying Spacecraft-Manipulator Systems Including Spacecraft Actuator Dynamics

Yuichiro Taira¹, Shinichi Sagara², and Masahiro Oya²
(¹Sojo University, Japan)
(²Kyushu Institute of Technology, Japan)

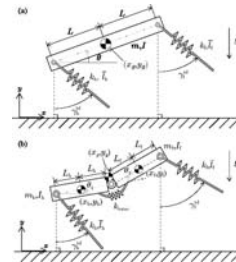
In this paper we develop a motion controller for a robotic manipulator attached to a spacecraft, whose orientation is controlled by (gas jet) thrusters and reaction wheels. The controller consists of two parts. The first one is a controller for its spacecraft by means of the thrusters, whose objective is to keep the amount of the spacecraft's angular momentum within a limit where the reaction wheels can well control the orientation of the spacecraft. The second one is a controller for its manipulator and spacecraft, whose objective is to control their motions coordinately. In this case, the spacecraft's actuators are reaction wheels. It is an adaptive controller developed under the condition that its dynamic parameters are unknown. Furthermore, we design the two controllers by considering the dynamics of the actuators which appear in an equation related to the system's angular momentum.



OS6-7 Investigation of the effect of the flexible body on bounding gait of a quadruped robot

Tomoya Kamimura, Yuichi Ambe, Shinya Aoi, and Fumitoshi Matsuno
(Kyoto University, Japan)

In this paper, we investigate effects of the flexibility of the body on locomotion of a quadruped robot using computer simulation. From the observation of animals, it has been suggested that flexibility of the body is important for dynamic locomotion. We used two types of simple physical models with and without a springy joint in their body to evaluate the importance of the body flexibility on the bounding gait. Our simulation results show that given the same mechanical energy for these two models, the maximum ground reaction force for the model with a body springy joint is smaller than that for the model without a body springy joint even when their locomotion speeds are identical. This suggests that the flexibility of the body can reduce the burden of the robot during the bounding gait.



January 21 (Wednesday), 14:30–15:30

Room A

GS1 Agent-based modelling

Chair: Toru Ohira (Nagoya University, Japan)

GS1-1 Robot models of the cultural evolution of spatial language

Michael Spranger
(Sony Computer Science Laboratories Inc., Japan)

Recently cultural theories of language evolution have gained significant momentum in explaining natural language. This paper reviews agent-based modeling, one of the key methodologies, which is in part responsible for these developments. We discuss the most important challenges for a theory of cultural language evolution and the resulting dominant experimental paradigm. The discussion is framed along examples of experiments conducted within the methodology. We focus, in particular, on spatial language as an example of a complex and cognitively central domain treated in a series of robotic experiments.

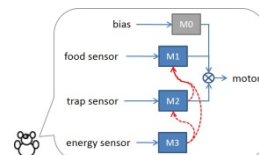


January 21 (Wednesday), 14:30–15:30

GS1-2 Evolutionary emergence of emotion as action selection by mutual projection modules in an agent-based model

Hikaru Kurasawa, Reiji Suzuki, and Takaya Arita
(Nagoya University, Japan)

This paper describes a constructive approach to emergence of emotions from the perspective that emotions are acquired through adaptive evolution. In particular, we focus on the function of action selection based on an individual's evaluation of the current situation. We propose a mutual projection module (MPM) model that focuses on the modularity and integrity of the brain in order to investigate the emergence of emotions. The proposed model consists of multiple modules, each of which projects signals for controlling the promotion and inhibition of other modules. We perform evolutionary simulations using autonomous mobile agents constructed according to the proposed model. It is shown that the agents acquire of moderate short-term risk-taking behavioral patterns when facing risks of varying degrees, including serious long-term risk. We believe that such behavioral patterns are essentially consistent with emotional action selection exhibited by animals.



GS1-3 Agent-based simulation of formation of local third place

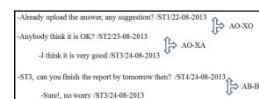
Hiroaki Yamada and Shigeto Kobayashi
(Japan Advanced Institute of Science and Technology, Japan)

The “third place” is any place—except home, which is “first place,” or workplaces and schools, which are “second places,”—providing comfort and opportunities to socialize for people. Third places attracting social-oriented people (those who seek to interact with others) and individual-oriented people (those who come to spend time alone) proved the opportunities for the meeting with others. However third places have the problem that it easily becomes an exclusive community. We construct a simple agent-based to investigate the possibility of the coexistence of social- and individual-oriented people. Simulation results suggest that the communication probability among social- and individual-oriented people is one of the key points to design the coexistence. Moreover, the results suggest that facilitating communication among social- and individual-oriented people is an effective strategy to realize the coexistence of the two types of people because of promoting the mobility of visitors.

GS1-4 Modeling of Collaborative Interaction in Ubiquitous Learning Environment Using Local Dynamic Behavior and Agent Based Modeling

Punnarumol Temdee
(Mae Fah Luang University, Thailand)

Ubiquitous learning (u-learning) provides new mode of learning for 21st century where the learners can learn anywhere and anytime. This paper focuses on modeling collaborative interaction in Ubiquitous Learning Environment (ULE) for promoting team facilitation. The assumption of this paper is that the collaborative interaction can be perceived through interpersonal interactions, which can be studied as local dynamic behaviors of the team. Therefore, the collaborative interaction is coded with 14 participation shift (P-shifts) from 5 tern types to represent the participation status of team members as contributor, target and unaddressed recipient. The interaction data is gathered from 10 student teams having 5 members per team for constructing the model by using agent based modeling. Finally, the constructed model is verified by comparing the actual behavior with the simulated behavior. The comparison result shows that the constructed model can reasonably provide accurate model for modeling collaborative interaction in ULE.



January 21 (Wednesday), 14:30–15:30

Room B

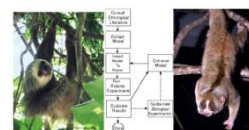
GS6 Bio-robot

Chair: Keigo Watanabe (Okayama University, Japan)

GS6-1 Bio-inspired Slowness for Robotic Systems

Ronald Craig Arkin
(Georgia Institute of Technology, United States)

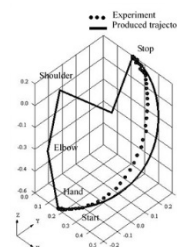
Slowness in robotic systems is a quality that is typically undervalued. It is our contention that as slowness has utility in animal behavior in certain species that it may also provide useful qualities for robotic implementations in appropriate circumstances. In particular we study mammalian behavior as evidenced in the tree sloth and slow Loris as the basis for the behaviors of a robot capable of residing in an arboreal ecological niche, as might be found in certain jungle surveillance applications or agricultural tasks. This concept is explored in the anticipation of the development and deployment of such a robot in the near future.



GS6-2 Control of biomimetic robots based on analysis of human arm trajectories in 3D movements

Tadashi Kashima and Katsuhiro Hori
(National Institute of Technology, Tomakomai College, Japan)

In this study, a biomimetic robot arm with redundancy movable in a three-dimensional (3D) space is taken into consideration. The basic trajectories of all joints are formulated by the minimum angular jerk criterion. Then, a time adjustment of the joint motion of the elbow relative to the shoulder is provided for representing the behavior of dynamic properties of human arm joints. Besides, a systematical scheme for formulating the trajectory has been developed. As the angular trajectories of all joints can be formulated in this manner, the hand trajectory can be uniquely derived once the initial and final states of the arm and a movement duration are given. The trajectories are produced under the proposed scheme as well as other possible schemes applicable to 3D arm movements, and performance of the proposed trajectory formation has been evaluated.



GS6-3 Mechanism designs for bio-inspired flapping wing robots (Withdrawal)

Palakorn Tantrakool and Eakkachai Pengwang
(King Mongkut's University of Technology Thonburi, Thailand)

GS6-4 Design and control of a ray-mimicking soft robot based on morphological features for adaptive deformation

Kenji Urai, Risa Sawada, Natsuki Hiasa, Masashi Yokota, and Fabio DallaLibera
(Osaka University, Japan)

Underwater tasks are diversified and articulated. The environment in which they must be accomplished is often unconstrained and unpredictable. Operating AUVs assuring safety of the robot and of its surrounding is therefore very difficult. On the other hand, many fishes are able to easily move in the same environments. A crucial factor for this capability is their body, which consists primarily of elastic and soft structures that enable both complex movement and adaptation to the environment. Among the most efficient swimmers we find rays, which show abilities like high speed turning and omnidirectional swimming. In this paper we propose an underwater soft robot based on the morphological features of rays. We mimic both their radially skeletal structure with independent actuators for each bone and the compliance of their fins. This flexibility of the structure provides an adaptive deformation that allows our robot to swim smoothly and safely.



January 21 (Wednesday), 15:45–16:45

Room A

GS7 Cognitive science

Chair: Shohei Kato (Nagoya Institute of Technology, Japan)

GS7-1 Investigation of Centering Theory Effectiveness for Pronoun Resolution in Thai Short Stories

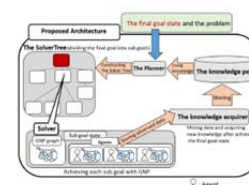
Patipan Wikaha and Ponrudee Netisopakul
(King Mongkut's Institute of Technology Ladkrabang, Thailand)

Pronoun resolution is one of a standard difficult problem in natural language processing. This paper implements a well-known centering theory (CT) as an algorithm to automatically resolving pronouns and experimenting with 40 Thai short stories. We measure two types of correctness. First, how the algorithm assigns the types of pronoun references transition comparing to a human. Second, how much correctness the algorithm resolves pronouns with and without quote phrases, comparing to a human. The results show that, for transition assignment correctness, the automatic assignment achieved average recalls of 74-78% and average precisions of 49-52%. The automatic pronoun resolution achieved percentage of correctness from 53% to 66% comparing to the correctness of 65% assigned by a human.

GS7-2 Agent-based architecture with distributed evolutionary computation that self-acquires and applies knowledge

Shingo Morita and Shohei Kato
(Nagoya Institute of Technology, Japan)

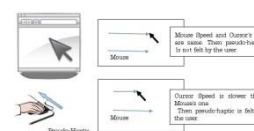
There are many studies based on cognitive architecture. It is used for a wide variety of purposes and offers a lot of functions, for example, problem solving, planning, machine learning and so on. In our study, we propose an agent-based architecture based on the framework of cognitive architecture. The architecture makes subgoals out of the final goal by using planning and solves a given problem whole by archiving subgoals and acquires new knowledge from the data which is observed on solving the problem. In this paper, we validate efficacy and robustness towards environmental changes of the architecture by experiments using a maze shaped environment.



GS7-3 Analysis of brain activity in perception of pseudo-haptic using NIRS

Keiji Sakagami, Kosuke Tanino, Yuki Seto, Shumpei Ako, Hirokazu Miura, Noriyuki Matsuda,
Masato Soga, and Hirokazu Taki
(Wakayama University, Japan)

This paper describes analysis of the cognitive condition in perception of the pseudo-haptic. The pseudo-haptic is a phenomenon of illusory perception which the human feel the haptic from the difference between his/her controlled mouse speed and the display its cursor speed. Since the pseudo-haptic can provide force only by the visual stimulus, the pseudo-haptic system can be better than conventional haptic devices in the presentation of haptic from the viewpoint of cost and convenience. The pseudo-haptic method is useful for the force feedback interface and is used easily and has cost advantage in order to generate haptic feedback. However, it is necessary to evaluate the effect of pseudo-haptic to apply the pseudo-haptic phenomenon to the system. So, we used the wearable NIRS to measure the brain activities when the human recognizes haptic and pseudo-haptic.



January 21 (Wednesday), 15:45–16:45

GS7-4 Effect of the Symmetry Bias on Linguistic Evolution

Hiroki Sudo, Ryuichi Matoba, Cooper Todd, and Akira Tsukada
(National Institute of Technology, Toyama College, Japan)

In this paper, we investigated the effect of the symmetry bias on linguistic evolution. For this task, we constructed Meaning Selection Iterated Learning Model based on the Simon Kirby's Iterated Learning Model, and simulated with three strategies which are Perfect Matching Symmetry Bias, Imperfect Matching Symmetry Bias, and Random strategies. As a result of applying Imperfect Matching Symmetry Bias, an agent acquired more expressive and more similar to the parent's language than an agent that has selected the meanings randomly. On the other hand, as a result of applying Perfect Matching Symmetry Bias, language of an agent did not change so much. Our experimented results showed that the effect of Imperfect Matching/ Symmetry Bias accelerates linguistic evolution, whereas Perfect Matching Symmetry Bias disturbs linguistic evolution.

Room B

OS15 Soft Computing with Soft Data

Chair: Kiyota Hashimoto (Osaka Prefecture University, Japan)
Co-Chair: Tomoharu Nakashima (Osaka Prefecture University, Japan)

OS15-1 Word Sentiment Estimation Using Ising Model

Akane Yoshimura, Hidekazu Yanagimoto, and Michifumi Yoshioka
(Osaka Prefecture University, Japan)

In this study we construct a sentiment analysis system which automatically classifies stock market news into positive news, negative news, and neutral news. We determine sentimental polarities of stock market news using a sentimental polarity dictionary, which consists of terms and their sentimental polarities. We use adjectives, adverbs, verbal, and compound words consisting of some nouns and verbal as candidates registered in the polarity dictionary. We use the Ising model to predict sentimental polarity of a word because it is easy to combine a corpus with other language resources, for example thesaurus dictionaries, to construct the polarity dictionary. In this paper we propose an automatic dictionary construction approach and sentiment prediction of stock market news using the dictionary.

OS15-2 Phrase Evaluation for Sentiment Analysis Using Ising Model

Mika Shimada, Hidekazu Yanagimoto, and Michifumi Yoshioka
(Osaka Prefecture University, Japan)

Sentiment analysis determines a polarity of a sentence according to opinions included in the sentence. In the study the polarity means positive, negative, and neutral. The sentiment analysis is very useful because of understanding enormous documents roughly from the viewpoint of author's opinions. Usual sentiment analysis systems use a sentiment polarity dictionary including a pair of a word and its sentiment polarity. But the systems have a big drawback. It is difficult to determine a polarity of a sentence using only word's polarity because a context often affects a word polarity. To deal with the context in our proposed method we focus on a subject-predicate phrase. We present relation among the phrases with a network, called the Ising model and predict their polarities using Gibbs sampling. Finally we confirm performance of the proposed method using real stock market news.

January 21 (Wednesday), 15:45–16:45

OS15-3 Document Similarity Based on Neural Network Language Model

Hidekazu Yanagimoto
(Osaka Prefecture University, Japan)

These days many researchers pay attention to distributed word representation with a neural network language model since the distributed representation can capture semantic and syntactic similarity between words. However, it is not clear how to make a document vector using the distributed word representation. Hence, I proposed a document vector as a distribution of words using the distributed word representation and document similarity using Earth Mover's Distance. The proposed method can recognize synonyms in a corpus and capture semantic similarity between sentences without other language resources, for example thesaurus dictionaries. In an evaluation experiment I confirm that the proposed method superior to cosine similarity to calculate similarity considering synonyms.

OS15-4 A study on the on-line learning of fuzzy classifiers for multi-class problems

Tomoharu Nakashima and Julien Piera
(Osaka Prefecture University, Japan)

On-line learning for fuzzy classifiers are investigated in this paper. Confidence-weighted learning is focused as an online learning method. Since it is assumed that there are only two classes in the training patterns, the mathematical formulation is specialised based on this assumption. This paper extends this assumption by allowing more than two classes in the pattern classification problems. One-vs-all scheme is employed for tackling multiple-class problems. Computational experiments are conducted to show the high-performance of the fuzzy classifiers with the confidence-weighted learning.

January 22 (Thursday), 09:15–10:30

Room A

GS3 Artificial life

Chair: Shinjiro Umezu (Waseda University, RIKEN, Japan)

GS3-1 Emergence of adaptive behaviors for artificial creature using a combined artificial neural network

Keita Nakamura
(Gunma National College of Technology, Japan)

This study proposes a method to acquire adaptive behavior for artificial creature which has a lot of joints using a combined ANN (Artificial Neural Network). Experiment in this study focuses on artificial fish model, which has a lot of joints, tracking towards a light source in the virtual water environment. In order to control motions of joints, a combined ANN is implemented with the model. At first, one ANN is prepared to control specific joints so as to swim basically in response to minimal input information using evolutionary computation in preliminary experiments. And a new network is constructed by combining its network and the other network. In order to acquire complicate behavior for artificial creature, weights of combined ANN are optimized. Experiment result shows the model which has many joints acquire adaptive swimming behavior towards a light source by optimizing combined network.



GS3-2 Emergence of communication among recurrent-Q learning agents in a collision avoidance game (Withdrawal)

Takashi Sato
(Okinawa National College of Technology, Japan)

GS3-3 Evolving 3D virtual creatures through exaptation triggered by environmental change

Atsushi Asakura, Reiji Suzuki, and Takaya Arita
(Nagoya University, Japan)

“Exaptation” is a trait originally had been shaped for a particular function or as a byproduct and then came to serve to another. Characters of organisms have been shaped by natural selection while there are many factors that prevent organisms from achieving an optimal design. Exaptation can be considered as an important process to deal with these factors. We approach the process and the mechanism of exaptation triggered by an environmental change using 3D virtual creatures. In the computer experiments, fitness measure is replaced by another as an environmental change in the course of evolution. The results show relatively good performance especially for difficult tasks in the exaptation experiments. The creatures exapted their characters and evolved novel strategies, which were not observed in the experiments without an environmental change. We quantify the complexity of both morphology and behavior and compare the measurements extracted from evolved virtual creatures before and after the environmental change. It is suggested that some virtual creatures exapted morphology and others exapted behavior.

January 22 (Thursday), 09:15–10:30

GS3-4 Abstract Chemical Reactions for Noise Canceling

Yasuhiro Suzuki
(Nagoya University, Japan)

We have developed Molecular Robots in Molecular Robotics Research Group in the Systems and Information Division of the Society of Instrument and Control Engineers (SICE) from 2010 and Grant in Aid for Scientific Research for Innovative Area, since 2012 (FY2012-16) by MEXT (Ministry of Education, Culture, Sports, Science and Technology, JAPAN). Molecular Robots require various sensors to sense its environment and one of the basic and important challenges is to develop Noise Cancelling techniques. We propose abstract chemical reaction for Noise Canceling.

Room B

GS21 Robot vision and image processing

Chair: Tomoharu Nakashima (Osaka Prefecture University, Japan)

GS21-1 Watermark Extraction Algorithm Design by Graph-Based Genetic Algorithm for Detecting Illegally Replicated Two-Dimensional Barcodes

Kazunari Minami, Yuki Shiba, and Satoshi Ono
(Kagoshima University, Japan)

Two-dimensional barcodes (2D codes) have been widely used as an authentication of electronic tickets such as boarding passes of aircrafts, train tickets and so on. However, illegal replication of such 2D code has been worried about. Therefore, this study proposes a method for designing digital watermark extraction algorithm, which maximizes the semi-fragileness of the watermark. To design an extraction algorithm which works well for various mobile phone models, the proposed method represents the watermark extraction algorithm as a graph consisting of simple known primitive image filters and their connections, and optimizes the graph structure by graph-based genetic algorithm. Experimental results have shown that the proposed method successfully designed the designed watermark extraction algorithm, which showed better performance than the handmade algorithm used in the previous work.

GS21-2 Real-time traffic sign recognition system using PCA

Youngkyu Park, Jekang Park, and Dongjoong Kang
(Pusan National University, Republic of Korea)

Autonomous vehicle may be added to the information acquired by communication or electronic map, and to obtain various information, even on the road. Among them, traffic signs, to provide very important information in the setting of the predicted path of the road the previous environment. Because, in this paper, we provide can be mounted in the car unattended, a traffic sign recognition system of real-time. An important element of the traffic sign recognition system of driverless car is a recognition accuracy and real-time processing. In this paper, we provide a traffic sign recognition system using PCA and (Principal Component Analysis) SVM and (Support Vector Machine) in order to satisfy all of the elements of this two. The PCA, to analyze trends between the sample images in the concept that often appears in statistics. The results of the analysis are used for feature extraction through a dimensionality reduction of the sample image. Data that has been learned, because it is expressed in the dimension that has been reduced, feature extraction of new data is very fast. Also, since there is no change in the shape or position of the image within a static one, traffic signs, can the nature of the PCA that is used as the raw data of the image, to expect a high recognition accuracy.

January 22 (Thursday), 09:15–10:30

GS21-3 A Comparative Study of Feature Point Matching versus Foreground Detection for Computer Detection of Dairy Cows in Video Frames

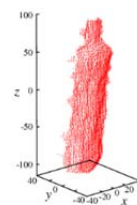
Suthasinee Nopparit, Nattapon Pantuwong, and Kitsuchart Pasupa
(King Mongkut's Institute of Technology Ladkrabang, Thailand)

Behaviors of dairy cows reflect their health and emotions. Behavioral analysis by video surveillance is an accepted technique for helping cow-keepers to spot their cows' health problems. To perform a behavioral analysis, the presence and location of the cows need to be detected first. In this study, we used feature point matching method and foreground detection method to detect them. Two experiments were conducted in a dairy farm to detect cows in video frames recorded by a video camera installed over the top of a free-stall barn. A total of 800 frames of recorded cows' activities were captured. True and false positive and negative results were statistically confirmed by t-test. We found that the accuracies of the feature point matching and foreground detection methods were 38.55% and 75.95%, respectively; hence, for our setup, the foreground detection was a better method.

GS21-4 Point Cloud Matching Using Singular Value Decomposition

Shinji Oomori, Takeshi Nishida, and Shuichi Kurogi
(Kyushu Institute of Technology, Japan)

We propose a simple, fast 3D (three-dimensional) matching method that determines the best rotation matrix between non-corresponding PCs (point clouds) with no iterations. An estimated rotation matrix can be derived by the following two steps. 1) The SVD (singular value decomposition) is applied to a measured data matrix, and a database matrix is constructed from the PC datasets. 2) The inner product of each left singular vectors is used to produce the estimated rotation. Through experimentation, we demonstrate that the proposed method executes 3D PC matching with less than 4% of the computational time of the ICP (iterative closest point) algorithm with nearly identical accuracy.



Room C

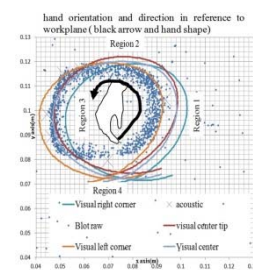
GS14 Identification and Estimation I

Chair: Takayasu Fuchida (Kagoshima University, Japan)

GS14-1 Verification of finger contact area on paper

Yeng Weng Leong^{1,2}, Hiroaki Seki¹, Yoshitsugu Kamiya¹, and Masatoshi Hikizu¹
(¹Kanazawa University, Japan)
(²Universiti Tenaga Nasional, Malaysia)

The previous research focused on the localizability of triboacoustically emitted signals (TES), a byproduct from finger tracing on various surfaces, utilizing Time-Difference-of-Arrival (TDOA) based localizing system was found to have discrepancies of $\pm 0.01\text{m}$ when compared against a visual system despite no obvious error in the TDOA. It is suspected that this is caused by the varying contact surface of the distal phalanx which could not be captured by the camera. This was verified using a stamp pad and paper. Results show the average difference between the acoustically attained coordinates and the mean of the ink blot coordinates was found to be 0.004m which were small. It was tentatively proven that the contact surface of the distal phalanx changes during a trace. An interesting relationship between the blot numbers and blot average areas with the speed of the distal phalanx was discovered.

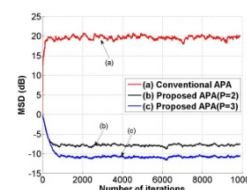


January 22 (Thursday), 09:15–10:30

GS14-2 An improved affine projection algorithm for both measurement noise and impulsive noise

JunWoong Hur, JinWoo Yoo, and PooGyeon Park
(POSTECH, Republic of Korea)

This paper proposes an improved affine projection algorithm (APA), which is characterized by its robustness against both the measurement noise and impulsive noise. The proposed algorithm is based on a modified optimization criterion that minimizes the summation of each squared Euclidean norm of difference between the present weight coefficient vector and previous weight coefficient vectors. Due to this modified optimization criterion, our proposed algorithm ensures the enhancement of filter performance in aspect of the steady-state estimation error with high power of the measurement noise. Moreover, to overcome the performance degradation caused by the impulsive noise, the concept of step-size scaler is adopted. Simulation results verify that the proposed APA improves the filter performance in a system-identification scenario with high measurement-noise power in the presence of impulsive noises.



GS14-3 A proposed model of e-marketplaces success for small and medium enterprises in Thailand (Withdrawal)

Singha Chaveesuk¹, Krist Khaimook¹, and Prachuab Vanitchatchavan²
(¹King Mongkut's Institute of Technology Ladkrabang, Thailand)
(²Dhurakij Pundit University, Thailand)

GS14-4 A structural model of B2C e-commerce on repurchase intention

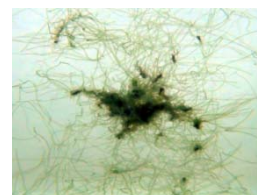
Singha Chaveesuk and Saowakhon Homsud
(King Mongkut's Institute of Technology Ladkrabang, Thailand)

The growth of Internet users are a key enabling e-commerce in Thailand. Prior research shows that website is important for e-business in driving successful business. Research shown that perceived website quality can make positive on customer satisfaction and customer buying. There is limited research demonstrating on factors influencing on customer buying intention in B2C e-commerce. This study aims to build a structural model of customer repurchase intention in B2C e-commerce. This structural model is based on DeLone and McLean's IS success model. Single-factor congeneric model and structural model are designed to examine validity and to test hypotheses. This structural model demonstrates that system quality has strong relationship on hedonic shopping value. Information quality shows significant impact on utilitarian shopping value. Service quality has a significant impact on both utilitarian and hedonic shopping value. Furthermore, customer repurchase intention is directly positive influenced by utilitarian shopping value, customer trust, and customer satisfaction.

GS14-5 Water Flow Control for Inhibiting Seaweed Twist in Real Environment and Physical Simulation

Jun Ogawa¹, Hiroyuki Iizuka¹, Masahito Yamamoto¹, and Masashi Furukawa²
(¹Hokkaido University, Japan)
(²Hokkaido Information University, Japan)

To avoid forming the twists of seaweed is one of challenges for cultivating the seaweed. In particular, the twists formed by string-shaped seaweeds have a complex structure and is hard to be detangled and there is no way to control or avoid the twist formation in the current cultivation techniques. Therefore, our aim of this study is 1) to develop a physical simulation that can model the fluid dynamics and the behaviors of the seaweeds in a water flow, 2) to propose a method to control the seaweed twist formation by analyzing the fluid motion characteristics that can avoid the seaweed twist formation in the simulation, and 3) to apply our established method to a real world environment and to show the effectiveness of our method. From the stirrer experiment, these findings also prove that our simulation model is useful to simulate the behaviors of the seaweeds in a water flow.



January 22 (Thursday), 09:15–10:30

Room D

OS2-A Biomimetic Machines and Robots

Chair: Keigo Watanabe (Okayama University, Japan)

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

OS2-1 Position and Attitude Control for a Quadrotor by Using a Tether

Yusuke Ouchi, Keisuke Kinoshita, Keigo Watanabe, and Isaku Nagai
(Okayama University, Japan)

A Quadrotor is expected to be applied to various applications. Especially, in Japan, aging of infrastructures is a serious problem, and study of a Quadrotor is about to be used for the inspection of infrastructures. It needs to control the position of the Quadrotor, if it is used for the inspection of infrastructures, such as bridges etc. Therefore, we propose a method for controlling a Quadrotor using a tether. We suggested in previous research a control method of the relative position of a Quadrotor to the operator using the tether, and conducted an experiment. However, influences of the tether were not considered in the model of the extended Kalman filter to estimate the state of the Quadrotor. In this paper, the dynamical model of a Quadrotor is derived so as to consider the influence of a tether, and the position and attitude control experiment is conducted.



OS2-2 Stabilization of Nonholonomic Mobile Robot Using Controllers Based on an Invariant Manifold Theory

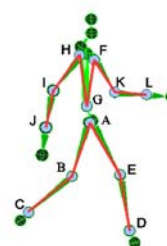
Yin Yin Aye, Keigo Watanabe, Shoichi Maeyama, and Isaku Nagai
(Okayama University, Japan)

The problem of stabilizing controller design for point-to-point control of a four-wheeled nonholonomic mobile robot is considered in this paper. The stability of the proposed control system is analyzed by using Lyapunov theory. Finally, simulation results are given to illustrate the effectiveness of the proposed method.

OS2-3 An Application of ANNs to Human Action Recognition Based on Limbs' Data

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

An application of Neural Network in human action recognition is presented in this paper. This paper is conclusion of previous work which is the part of a human behavior estimation system. This system is divided into two parts: human action recognition and object recognition. First we will do brief introduction on this estimation system, next we will discussion about the human action recognition which is the important part of the system. In this section we use Microsoft Kinect to capture human joint data. And calculate the limb angles. And we will discussion about the Neural Network which we designed most fit for this model. The ANN is separated in two big stage. First stage is using to exclude the noise data from capturing. The second stage of ANN is using to exclude the limb angles which is non-related to current action.



January 22 (Thursday), 09:15–10:30

OS2-4 Comparative experiments for a robotic manta by some different fin shapes

Masaaki Ikeda¹, Keigo Watanabe², Kota Mikuriya², Shigeki Hikasa², Yukito Hamano², and Isaku Nagai²
(¹University of Sultan Zainal Abidin, Malaysia)
(²Okayama University, Japan)

This paper experimentally investigates the influence on the propulsive performance by the difference in the fin shape of a robotic manta. Five kinds of fin shapes, i.e., a rectangle, a triangle, a trapezoid, and two right triangles, are used in experiment to measure the forward velocity of the robot, where two types of right triangle are discriminated, depending on the arrangement of the right angle part and each fin area is assumed to be approximately equal, and the number of fin-rays is the same at all the fins. It is proved that a significant difference in propulsive velocity arises depending on the difference in the fin shape.



OS2-5 Pose, Dimensions and Shape Extraction of Workpieces on a Machining Table

Mamadou Ngom and Fusaomi Nagata
(Tokyo University of Science, Yamaguchi, Japan)

This paper is part of a research dealing with the integration of computer vision to engraving numerically controlled machines. We treat the extraction of dimensions and orientations of workpieces on a machining table, together with their shapes and positions. Standard engraving machines require their operator to guide their tools toward workpieces to start any process. The integration of a vision system to the engraving machines gets rid of this lack of autonomy by an automatic workpiece position extraction. Moreover, the identification of several workpieces on a machining table along with their specifications is possible, i.e., dimensions, positions and shapes.



Room E

OS7 Intelligent control and applications

Chair: Kuo-Lan Su (National Yunlin University of Science and Technology, Taiwan)

Co-Chair: Chung-Wen Hung (National Yunlin University of Science and Technology, Taiwan)

OS7-1 Multiple Searching Algorithms Based Multi-Target Search Using Multiple Mobile Robots

Chih-Hung Chang, Cheng-Yun Chung, and Kuo-Lan Su
(National Yunlin University of Science and Technology, Taiwan)

The article develops a search method for the multi-robot system, and fuses Flood-fill algorithm and various search algorithms to detect environment and construct the map. Through the human nature guiding design and the search region allocation to eliminate worse and invalid path, and get the better searching moving route. Besides, compared to single robot has the low cost. Multiple robots can cooperate to finish the assigned tasks with each other and are suitable for repetitive work. Through the communication and the exchange of information can reduce search time and enhance accuracy. Each mobile robot can record the searching status, route and direction and feedback information to exchange and save each other. Using multiple mobile robots can verify the proposed method to be right.



January 22 (Thursday), 09:15–10:30

OS7-2 Chaos synchronization based on radial basis function neural network with adaptive annealing learning algorithm

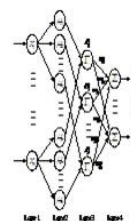
Chia-Nan Ko¹, Yu-Yi Fu¹, and Li-Chun Lai²
(¹Nan Kai University of Technology, Taiwan)
(²National Pingtung University, Taiwan)

Abstract: In this article, radial basis function neural network (RBFNN) is proposed to synchronize chaotic systems. In the proposed RBFNN, an adaptive annealing learning algorithm (AALA) is adopted to optimize the structure of neural networks for chaos synchronization. In the evolutionary procedure, first, support vector regression (SVR) method is adopted to determine the number of hidden layer nodes and the initial structure of the RBFNN. After initialization, AALA with time-varying learning rate is then applied to train RBFNN. The AALA-based RBFNN (AALA-RBFNN) can overcome the stagnation in searching promising solutions. Due to the advantages of SVR and AALA-RBFNN (SVR-AALA-RBFNN), the proposed SVR-ARTVLA-RBFNN has good performance for synchronizing chaotic systems. Simulation results using MATLAB are illustrated to validate the chaos synchronizations of Chen system and Genesio system with known parameters for the proposed SVR-AALA-RBFNN.

OS7-3 Image recognition using adaptive fuzzy neural network based on lifting scheme of wavelet

Chia-Nan Ko and Cheng-Ming Lee
(Nan Kai University of Technology, Taiwan)

This article proposes an adaptive fuzzy neural network (AFNN) based on lifting scheme of wavelets to recognize image with noise/blur. In the research, first, the image with noise/blur is completed the gray level transformation to discrete space, then the discrete sequence is classified using lifting wavelet transformation. The image processing is performed by the AFNN in which a time-varying adaptive learning algorithm is adopted. The root-mean-square error (RMSE) is used to evaluate the efficiency of image recognition. Meanwhile, comparisons of the lifting adaptive fuzzy neural network with fuzzy neural network are made to verify the performance of the proposed adaptive fuzzy neural network.



OS7-4 A NIOS based colonoscopy navigation system

Chung-Wen Hung, Ke-Cheng Huang, and Yan-Ting Yu
(National Yunlin University of Science and Technology, Taiwan)

Abstract: The paper describes the implementation of NIOS based colonoscopy navigation system. The navigation system is designed to help doctor to make a better colonoscopy. During the process of inserting the endoscope into patient's intestine, this system could guide the doctor to adjust the endoscope's angle. The system generates instructions based on the cavity of intestine and the orientations of colon folds. A field programmable gate arrays (FPGA) platform is used to implement this system. Verilog is adopted to design the circuits to calculate the cavity direction. And the system on programmable chip (SoPC) is built in the system, and then it runs the C code for calculating the colon folds' orientations. After all calculations are done, the navigation system displays the guiding instruction on a screen with the original video. The system's implementation is discussed in this paper. The system output image shows the system workable.

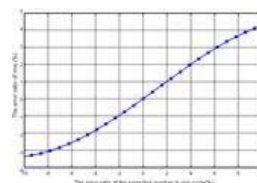


January 22 (Thursday), 09:15–10:30

OS7-5 The frequency accuracy requirement analysis for power meters

Chung-Wen Hung
(National Yunlin University of Science and Technology, Taiwan)

As green power issue is getting important, and the smart grid is more and more popular. However, the smart power meter build in communication function is key component in a smart grid. Compared with traditional analog measurement, to perform the communication network, the digital processors and digital measurements are used to realize the smart meter. One of key parameters in smart power meter is the root mean square, rms, value of voltage and current of AC power. To calculate the rms value in digital processors, the number of sampling in a cycle is necessary to perform the mean calculation of squared samples. However, the fundamental frequency information of the AC power is necessary. Therefore, the accuracy of fundamental frequency measurement will decide the correction of the smart power meter. The accuracy requirement and the formulation is discussed. Simulation results show the analysis is workable.



January 22 (Thursday), 10:45–12:00

Room A

GS23 Swarm intelligence

Chair: Satoshi Ono (Kagoshima University, Japan)

GS23-1 The Bee Colony Life Cycle Algorithm for Flexible Job Shop Scheduling Problem

Ajchara Phu-ang and Arit Thammano
(King Mongkut's Institute of Technology Ladkrabang, Thailand)

The flexible job shop scheduling problem (FJSP) is an NP-hard combinatorial optimization problem. This paper proposes a modified version of the marriage in honey bee optimization (MBO) algorithm for solving FJSP. First, to gain more diverse solutions, we divide a brood into two types; a male brood and a female brood. Second, the worker bees are divided into 3 groups. One of the groups is assigned a foraging behavior; this can help improving the local and global search capabilities. The foraging bee which found the best food source is given an opportunity to lay egg. Third, to move away from a local optimum, we devise a new concept based on parasitic takeover behavior of invading workers from other nests. This proposed algorithm is tested with a well-known benchmark, the Brandimarte data set. The test shows that the proposed algorithm clearly outperforms the compared algorithms in overall performance.

GS23-2 Enhanced Particle Swarm Optimization for Flexible Job-Shop Scheduling Problem

Wannaporn Teekeng¹, Arit Thammano², Pornkid Unkaw³, and Jiraporn Kiatwuthiamorn²
(¹Rajamangala University of Technology Lanna Tak, Thailand)
(²King Mongkut's Institute of Technology Ladkrabang, Thailand)
(³Rajamangala University of Technology Phra Nakhon Bangkok, Thailand)

This paper proposes an enhanced particle swarm optimization (EPSO) algorithm for Flexible Job-Shop Scheduling Problem. The original particle swarm optimization algorithm was enhanced by 3 new added features to expand the problem's solution space and avoid premature convergence to local optimum. These 3 features are as follows: 1) enhanced particle's reproductive behavior by adding male courting call to attract better mates for better offspring; 2) enhanced particle's flight behavior; and 3) enhanced fitness of successive generations of particles by replacing weaker particles. One objective of incorporating all of these enhancement features was to minimize makespan. Benchmarking this algorithm with 20 well-known benchmark instances showed that our EPSO performed equally well or better than other reported optimization methods.

January 22 (Thursday), 10:45–12:00

GS23-3 Optimization algorithm inspired by the life cycle of an ant colony

Jiraporn Kiatwuthiamorn and Arit Thammano
(King Mongkut's Institute of Technology Ladkrabang, Thailand)

The aim of optimization algorithm is to find the best solution from a set of feasible solutions. Swarm intelligence is one of the most recent meta-heuristic methods for solving optimization problems. This paper proposes a new swarm intelligence algorithm based on life cycle of ant colony. The proposed algorithm mimics the natural behavior of ants such as mating, feeding and foraging in order to find the best solution. The performances of our algorithm were tested against those of genetic algorithm (GA). Out of the 10 benchmark functions tested, our algorithm found the 9 exact global optimums while GA found only 8.

GS23-4 A hybrid bat algorithm with natural-inspired algorithms for continuous optimization problem.

Sakkayaphop Pravesjit
(University of Phayao, Thailand)

This paper proposes a hybrid bat algorithm with natural-inspired algorithms for continuous optimization problem. In this study, the proposed algorithm combines the reproduction step from weed algorithm and genetic algorithm. The re-production step is applied to clone each bat population by fitness values and then genetic algorithm is applied in order to expand the population. The algorithm is evaluated on six benchmark problems. The computational results compare with the self-adaptive DE, traditional differential evolution (DE) algorithm, intersection mutation differential evolution (IMDE) algorithm, and the JDE self-adaptive algorithm show that the proposed algorithm can produce optimal solutions efficiently. The experiment shows that, to solve other optimization problem in the literature, the algorithm should be improved in this direction.

GS23-5 An algorithm of cuckoo search with correction term for accuracy improvement

Sota Ito, Takahiro Hino, Tao Liu, and Michiharu Maeda
(Fukuoka Institute of Technology, Japan)

This paper presents a novel algorithm of the position update in cuckoo search (CS) with a correction term. CS is one of metaheuristics and is based on the brood parasitism in the cuckoo of bird. CS determines the position of next generation between two candidates of the best position ever and the selected position randomly. In conventional approach, CS with correction term (CSC) increases a candidate position using the correction term. For brood parasitism, a new position is generated with the correction term and the position of the next position is determined among the three candidates. We propose a modification of the correction term in CSC (CSC2). For the proposed approach, a new position is generated by adding a correction term to the best position. In order to show the effectiveness, we compare the proposed approach with the existing algorithms by using test functions.

January 22 (Thursday), 10:45–12:00

Room B

OS3 Complexity and Ultimacy

Chair: Ken Naitoh (Waseda University, Japan)

Co-Chair: Toru Ohira (Nagoya University, Japan)

OS3-1 Prognostic medicine based on six molecular group equations

Hiroshi Takashima, Masahito Saiki, Shuntaro Iyoda and Ken Naitoh
(Waseda University, Japan)

During the life time from fertilization to death, the mechanism underlying aging process, which induces illness or death, is still veiled in mystery. By roughly classifying all molecules inside a living body into six molecular groups and also by using the differential or finite-difference equation, we qualitatively simulate the morphogenetic and aging processes of the human body. In this study, by widely varying the parameters in the differential or finite-difference equation, we examine how humans lead to illness or death. As a result, we find that the density ratio of molecular groups is an important factor when humans are lead to illness or death. It is stressed that, by checking whether or not the density ratio of molecular groups exceeds a critical value, we can find a foretaste of apparent death. The new medicine found by us shows a possibility to prevent disease.

OS3-2 Millenary genius: producing seminal works on computers (2nd report)

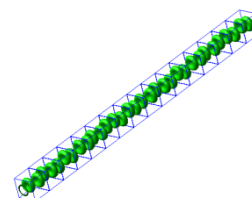
Masahito Saiki and Ken Naitoh
(Waseda University, Japan)

The composite cycle model of two standard neural networks derived based on statistical physics, which is proposed in our previous reports, reveals the mechanism of comfort generating. The composite cycle model demonstrates mysterious temporal oscillations, with frequencies including 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 a brain, which leads to comfort. In this report, we conduct more detailed examination of relation between the model's output and comfortable chord of music. As a result, conformity between the model's output and chord is observed. This means that we will be able to predict the combination and arrangement of comfortable sound, which leads to producing creative works including comfortable music on the computer.

OS3-3 Parallelized fusion visualization system

Hideo Miyachi¹, Sachiko Hayashi¹, Naohisa Sakamoto², and Koji Koyamada²
(¹CYBERNET SYSTEMS CO., LTD., Japan)
(²Kyoto University, Japan)

The speed-up of supercomputers has increased the complexity of simulations. To analyze such kind of data, we believed that new types of visualization software are needed. So, we have been developing a visualization system called "Fusion Visualization". The progress was reported in the AROB 18th and 19th International Symposium. We introduced the overall concept at the AROB 18th International Symposium and demonstrated a sample of flow visualization in a blood vessel in the AROB 19th International Symposium. To extend our system to be able to apply larger data, we have implemented the system on a parallelized visualization system; AVS/Express PCE (Parallel Cluster Edition). This paper describes the implementation and the benchmark result.



January 22 (Thursday), 10:45–12:00

OS3-4 Control of cell growth area by movement of magnetic particles utilizing magnetic particles and magnets

Shinjiro Umezu
(Waseda University, RIKEN, Japan)

Recent days, nano biotechnologies those are based on iPS cells and ES cells are highly focused because the stem cells have possibility to fabricate perfect organs. To fabricate 3 dimensional (3D) organs, new cultivation process is necessary because when the common cultivation process is applied for cells in the dish, then only 2D cell structure is fabricated due to gravity force of cells. Multicellular spheroid was fabricated with the specially surface-treated dish or by the flow in the medium. When the flow in the medium was controlled, cells are affected by the altered hydrodynamic force of the flow in the medium and 3D cell structure will be fabricated. The author fabricated cell structure with cave utilizing originally developed 3D printer with living cells and scaffolds those were gelatin, collagen, and alginate gel. When the small magnetic particles were set in the cave and the electromagnets were set outside of the fabricated 3D structures, medium with Nutrition was flowed in the cave by the movement of the magnetic particles those were controlled by the switches of the electromagnets. Because of the generated flow of the medium and nutrition, growth of the cells those were attached inside of the cave was promoted. In this paper, the author demonstrated another cell growth method with the magnetic particles and the electromagnets. Firstly cells were set on the dish that was filled with the medium and the nutrition. The small magnetic particles were also set in the dish. The amount of the magnetic particles was 0.001 g. The diameter of the magnetic particles was from several tens micron meters to 100 micron meters. The electromagnets were set under the dish. When the switches of the electromagnets were altered, the magnetic particles were transported by the altered electromagnetic force. The transportation speed was controlled by the switching speed of the electromagnets. Cells attached on the place where the generated flow was weak and cells did not attach on the place where the generated flow was strong. Because the flow was strong, cells were not able to remain on the place because the strong flow was over the attachment force between cells and the dish, then the place that had no cells was generated. ...

OS3-5 Chases and Escapes, and Optimization Problems

Toru Ohira
(Nagoya University, Japan)

We propose a new approach for solving combinatorial optimization problem by utilizing the mechanism of chases and escapes, which has a long history in mathematics. In addition to the well-used steepest descent and neighboring search, we perform a chase and escape game on the "landscape" of the cost function. We have created a concrete algorithm for the Traveling Salesman Problem. Our preliminary test indicates a possibility that this new fusion of chases and escapes problem into combinatorial optimization search is fruitful.

Room C

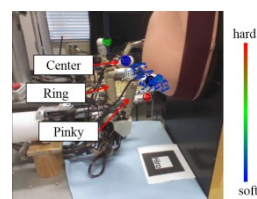
GS15 Identification and Estimation II

Chair: Takayasu Fuchida (Kagoshima University, Japan)

GS15-1 Study on stiffness visualization and safety control based on will-consensus building for tele-palpaton robot system

Satoshi Ueki¹, Tetsuya Mouri², Takahiro Endo², and Haruhisa Kawasaki²
(¹Toyota National College of Technology, Japan)
(²Gifu University, Japan)

This paper proposes a method for visualizing the stiffness of a soft object for a palpation-support information system by the teleoperation of a robot hand. It is important for a palpation system to display a body's shape and stiffness. The stiffness of the contact area between the soft object and the robot finger is estimated by forgetting factors and a recursive least squares method that uses an impedance dynamics model. With the estimated stiffness and direction of contact force, we calculate the scalar parameter for visualization of stiffness. Moreover, we propose a safety control method for the palpation system, which is part of a tele-control method based on will-consensus building. The system configuration, estimated algorithm, and experimental results are presented.



January 22 (Thursday), 10:45–12:00

GS15-2 A Proposed Model for Measuring ERP Implementation Success

Sitthiros Hongsuwan and Singha Chaveesuk
(King Mongkut's Institute of Technology Ladkrabang, Thailand)

Enterprise Resource Planning (ERP) system is globally implemented and grown rapidly in recent years for increasing efficiency of organizations and gaining firm's competitive advantage. However, much research showed that few of them are found successful and many cases face problems until lead to failure in implementing ERP systems in the past. This is important to identify and understand critical success factors as significant enablers to drive ERP implementation success in organizations in Thailand. Thus, this paper presents a proposed model of ERP implementation success which is initially determining potential factors to implement successful ERP system based on DeLone and McLean's information systems success model. The proposed model adapted from IS success model includes important constructs which consist of system quality, information quality, service quality, user satisfaction, software configuration, IT structure, internal/external service, organizational context and ERP implementation success.



GS15-3 Understanding a Model of Business Intelligence Adoption in Thailand Logistics

Singha Chaveesuk and Suparut Horkondee
(King Mongkut's Institute of Technology Ladkrabang, Thailand)

This study aims to build a model of BI adoption in logistics firms in order to investigate factors influencing BI adoption in relation of logistics organizations. This model bases on Technology-Organization-Environment (TOE) framework which generated by Tornatzky and Fleisher. The research model examines the influence of technological context (relative advantage, compatibility, and complexity), organizational context (organization size, organization readiness, and top management support), and environmental context (competitive pressure, and government support). A survey research with quantitative approach is used in this study in order to validate the research model. Data is gathered from 164 managers and logistics employee out of 851 logistics companies in Thailand to test the relationships between the research model constructs applying structural equation model (SEM). The results and implications in this study provide contribution to an expanded understanding of the determinants affecting BI adoption in the logistics companies.

GS15-4 A hybrid ABC algorithm for vehicle routing problem with time windows

Krittika Kantawong¹, Rounsang Chaisricharoen¹, and Rong Qu²
(¹Mae Fah Luang University, Thailand)
(²University of Nottingham, United Kingdom)

A new hybrid ABC algorithm for Vehicle routing problem with time windows (VRPTW) is proposed in this paper. The triangular fuzzy member and local search methods are combined into the ABC algorithm. In this study, the proposed algorithm has been evaluated and compared with other four algorithms and best known solutions in the literature. The computational results show that the algorithm can produce efficient solutions in the shortest time. In addition, the proposed algorithm provides more evolution and spends less computational time compared to other algorithms. It shows that the algorithm is very effective and has a promising approach for vehicle routing problem with time windows and it seems to indicate that the algorithm is an alternative to solve the problem.

January 22 (Thursday), 10:45–12:00

Room D

OS2-B Biomimetic Machines and Robots

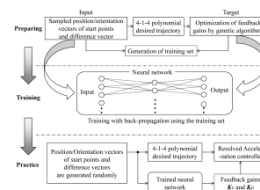
Chair: Keigo Watanabe (Okayama University, Japan)

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

OS2-6 Adaptive Gain Tuning to Various Desired Trajectories by Neural Network

Akimasa Otsuka and Fusaomi Nagata
(Tokyo University of Science, Yamaguchi, Japan)

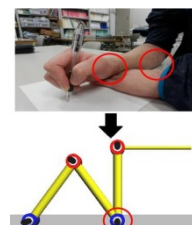
Recently, polystyrene machining by a manipulator is desired to make a lost-pattern used in a full-mold casting process. Even if the robot is controlled with the resolved acceleration controller using constant feedback gains, the robot follows the trajectories. However, the robot can move better when more suitable feedback gains are tuned for the trajectory. An auto gain-tuning method for trajectory following control was already developed based on neural network in previous study. The method consists of three phases, preparation of training set, training neural network and practice of the neural network. However, the previous method was not applicable to various trajectories whose initial positions/orientations do not have the same values. To extend the method, in this study, the number of inputs for neural network is increased from six to twelve. The effectiveness of the proposed method is evaluated through a dynamic simulation of PUMA 560 manipulator.



OS2-7 Energy-efficient and precise trajectory-tracking with bracing manipulator

Daisuke Kondo, Mamoru Minami, Xiang Li, and Akira Yanou
(Okayama University, Japan)

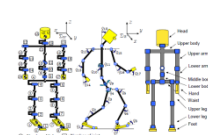
Considering that humans perform handwriting task with small powers by contacting elbow or wrist on a table, it is reasonable to deem that manipulators can save energy and simultaneously accomplish trajectory tracking tasks precisely like humans by bracing intermediate links. First this paper discusses equation of motion of robot under bracing condition, based on the robot's dynamics with constraint condition including motor dynamics. Then this paper propose to control simultaneously bracing force and hand's trajectory tracking, followed by optimization of the elbow-bracing position that minimizes energy consumption.



OS2-8 Dynamical Analyses of Humanoid's Walking by using Extended Newton-Euler Method

Taoran Feng, Jumpei Nishiguchi, Xiang Li, Mamoru Minami, Akira Yanou, and Takayuki Matsuno
(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, and it's like monkey walking because of knee-bended walking profiles. 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 human-like natural walking. In this paper, walking model of humanoid including slipping, bumping, surface-contacting and point-contacting of foot is discussed, where dynamical equation is derived by Newton-Euler method with constraint condition, which is named as "Extended Newton-Euler Method". Then, we further discuss walking stabilizer named "Visual Lifting Stabilization" to enhance standing robustness and prevent the robot from falling down. Simulation results indicate that this strategy helps stabilize pose and bipedal walking even though ZMP is not kept inside convex hull of supporting area.

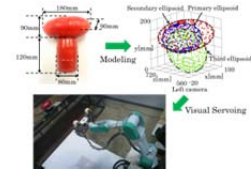


January 22 (Thursday), 10:45–12:00

OS2-9 Modeling of Arbitrary-Shaped Objects by Evolving-Ellipsoids Approximation for Visual Servoing

Kenta Nishimura, Yusuke Sunami, Takayuki Matsuno, Akira Yanou, and Mamoru Minami
(Okayama University, Japan)

The model-based visual servoing defines the object and the pose of the model is used for servo controller. But the model-based method needs to use the artificial 3-D model definition in the pose tracking computer system. In order to overcome this problem, automatic 3-D model generation mechanisms for arbitrary-shaped target objects should be created before detecting the designated target. In this paper, a 3-D modeling method of arbitrary shape objects is proposed and the performance is examined by modeling experiment of arbitrary shape objects and visual servoing experiment.



January 22 (Thursday), 10:45–12:30

Room E

OS8 Intelligent Control System and Artificial Life

Chair: Kuo-Hsien Hsia (Far East University, Taiwan)

Co-Chair: Hong-Ming Chen (Chienkuo Technology University, Taiwan)

OS8-1 Intelligent security system based on power line Communication

Kuo-Hsien Hsia¹, Jr. Hung Guo², Kuo-Lan Su², and Lee-Wei Chang²
(¹Far East University, Taiwan)
(²National Yunlin University of Science and Technology, Taiwan)

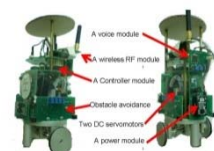
Because of the reliance of the electrical apparatuses, appliances and devices in our daily life, the power line system has been well established for a long time. The network organized by the power lines is the most convenient network around us. In this paper, we developed a communication network using the power line as the media and established a security system by using the power line communication (PLC) network. To communicate via power line, the high-frequency signal is transferred over the AC power signal, which is transmitted in 50/60 Hz, via modulation technology. We use the mechanism of Multi-tone carrier modulation (MTCM) and carrier detection to realize the function of automatically dispensing identification number to a connected device. With these designs, the probability of communication collision on the power line will be relatively low. ...



OS8-2 Motion Planning of the Multiple Robot System with Collision Problem

Cheng-Yun Chung¹, Kuo-Hsien Hsia², and Kuo-Lan Su¹
(¹National Yunlin University of Science and Technology, Taiwan)
(²Far East University, Taiwan)

The article develops motion trajectories and avoids collision paths, and presents the movement scenarios of the chesses using mobile robots on the grid based platform. Users play Chinese chess game using the mouse according to the game rules on the user interface. The user interface controls mobile robots that move on the platform according to the programmed motion paths via wireless RF interface, and solve the collision problems of the motion paths for two chesses simultaneously. Mobile robots present the movement scenarios of the chesses on the grid based chessboard platform. The chess (Attacker) will take the chess (Dead) of the other side. The user interface will program two motion paths for two chesses (Attack and Dead). The motion paths of "Attacker chess" and "Dead chess" have collision problem. "Attack chess" will wait for "Dead chess" to pass through collision paths. Then "Attack chess" moves to the assigned position. We uses enhance A* searching algorithm to solve the shortest path problem of the chess. Then we use simulation method to display the motion paths of the assigned chesses on the user interface. ...



January 22 (Thursday), 10:45–12:30

OS8-3 The neural sliding mode controller design of fan-plate system

Huann-Keng Chiang, Chun-Chiang Fang, and Feng-Jui Hsu
(National Yunlin University of Science and Technology, Taiwan)

This paper proposed a sliding mode angle control with neural network estimator design for a fan-plate system. The neural network estimator is based on radial basis function and it estimates the unknown lumped bounded uncertainty of parameter variations and external disturbances in real-time. The abilities of anti-disturbance and anti-chattering are better than conventional sliding mode controller. The Lyapunov stability theorem is employed to ensure the stability of the proposed controller. The convergence and signal tracking properties are better than the conventional sliding mode controller. Finally, we employed the experiment to validate the proposed method is feasible.

OS8-4 The adaptive sliding mode angle control of a fan-plate system

Huann-Keng Chiang, Chun-Chiang Fang, and Kuo-Jheng Fan
(National Yunlin University of Science and Technology, Taiwan)

This paper proposed an adaptive sliding mode angle control design for a fan-plate system. The parameter variations and external disturbances are considered in proposed nonlinear fan-plate system. Not only uncertainty problem of a fan-plate system is solving but also the chattering phenomenon is reduced by the adaptive sliding mode controller. The Lyapunov function guarantees the stability of system. Eventually, we employ the experiments to validate the proposed method.

OS8-5 Implementation and Control of a 360 Degree Rotating Cylindrical LED Full Color Display

Hong-Ming Chen and Wen-Yi You
(Chienkuo Technology University, Taiwan)

This study used single-chip micro control unit PIC32MX 795F512H as the control core to implement the design and production of full color LED rotating display. The display of this system is based on human vision. For the eye storage characteristic generated by high speed dynamic images, the single-chip micro control unit controls single-row RGB colors LED display lamp bank, carried and rotated by the rotating platform, in order to implement the full color display of dynamic scan. This rotating full color display characteristics is the image acquisition and real-time transmission technology of this work can use camera lens to shoot various objects or persons. The image display codes are transmitted instantly to the single-chip micro control unit of console display by the self-developed image acquisition program and wireless transmission packet technology. The design of the real-time full color LED rotating display for pictures is completed by video scan technique. The test result of the self-made rotating machine shows that any pictures can be displayed on the display machine completely, and the performance is good.



Fig. 1 A practical Full Color LED display

OS8-6 The relevant relationship among the brand image, purchase intention and perceived risks of green food

Shang-Hui Li
(Far East University, Taiwan)

Nowadays, consumers' consciousness is increasing, nearly two years of serious food security problems, whether it is toxic starch, evil oil or plasticizing agents etc., are not cut out of the evil-minded businessman manufactured foods have tumbled consumer food market confidence when consumers for safe and healthy food gradually attention, but also increasing acceptance of green food. This study investigated the green consumer brand image, purchase intention and perceived relevance of risk. Consumers to purchase over the green object in Taiwan 500 questionnaires distributed a total of 409 valid questionnaires. SPSS 12.0 statistical software for analysis, the results showed green consumer brand imagery has a positive effect on purchase intention, perceived risk of green food has negative effects on purchase intention, brand imagery of green has a negative impact on perceived risk and perceived risk and brand purchase intention in green imagery has mediating effect.

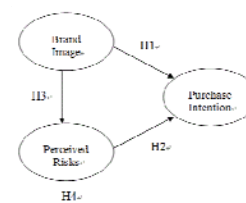


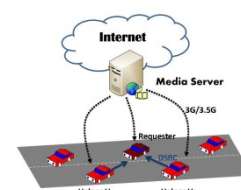
Chart 1. Research Framework

January 22 (Thursday), 10:45–12:30

OS8-7 An enhancing video streaming scheme over hybrid VANET

I-Hsien Liu, Chun-Kai Lin, and Jung-Shian Li
(National Cheng Kung University, Taiwan)

With the rapid evolution of wireless communication technologies, VANET has become a greatly popular. From a technological point of view, wireless communication and compression techniques make great improvement in brand-new network services, e.g., multimedia streaming service. In this paper, we seek to establish under what condition for video streaming across a VANET. In our scenario, supposed most of vehicles request the same video streams, they probably pull streams from server using 3G network simultaneously. We adapt the scalable video coding for a solution that deals with both video coding and network challenges. Because the topology of vehicle networks changes rapidly, it causes overlay link unstable. We consider the problem how to distribute video streaming from a source node to a potentially large and highly dynamic population of interested clients. The simulation results show that our proposed scheme can improve video quality in highly dynamic topology of vehicular networks.



January 22 (Thursday), 12:00–13:00

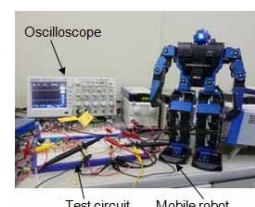
Room F

Poster Session

PS1 Simple sound localization circuits based on the biological auditory system and its application to mobile robot

Toshiya Namba, Mitsuo Aoyama, and Kimihiro Nishio
(National Institute of Technology, Tsuyama College, Japan)

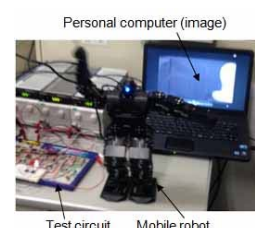
We proposed in this study the simple circuit for detecting the sound localization based on the biological auditory system. The test circuit was fabricated on the breadboard with discrete metal oxide semiconductor (MOS) transistors. The test circuit was connected with the mobile robot. The robot could operate by using the signal of the test circuit. It was clarified from the measured results that the proposed circuit can control the mobile robot. The circuit was evaluated by the simulation program with integrated circuit emphasis (SPICE) using the parameter of 90 nm complementary metal oxide semiconductor (CMOS) process in order to design the integrated circuit. The simulation results showed that the circuit can detect the position of the sound source. In the future, the novel compact target tracking sensor can be achieved by applying the proposed circuits.



PS2 Simple motion detection circuits of low power consumption and its application to mobile robot

Yuki Nishi, Ryosuke Kusano, and Kimihiro Nishio
(National Institute of Technology, Tsuyama College, Japan)

We proposed in this study the analog-digital circuit of low power consumption for motion detection based on the biological vision system. The test circuit was fabricated on the breadboard with discrete metal oxide semiconductor (MOS) transistors. The test circuit was connected with the mobile robot. The robot could operate by using the signal of the test circuit. It was clarified from the measured results that the proposed circuit can control the mobile robot. By applying the proposed circuits, we can expect the realization of the novel low power system such as monitoring system, collision avoidance system and robotics vision system in the future.



January 22 (Thursday), 12:00–13:00

PS3 Conceptual design of an upper limb power-assist robot for meal rehabilitation

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

Main topics of the present paper relate to conceptual design of an upper-limb power-assist robot for meal rehabilitation of the elderly and the weak or rehabilitation patients who have relatively weak muscular strength or for active meal rehabilitation training during which a movement intention of a user is reflected, and a method of controlling the rehabilitation robot. In detail, a sensing member, to which the upper limbs of a user are fixed, is mounted on a multi-joint robot, and motion of the upper limbs is sensed by using the sensing member to generate a control signal by using a motion control unit based on the sensed motion. The present system relates to an upper limb rehabilitation robot for meal assistance or meal rehabilitation training, wherein the upper limb is driven by using the multi-joint robot according to the generated control signal, and the multi-joint robot guides movement of the upper limbs and provides assistance force to the upper limbs so that the user may have meal properly.



PS4 Biodegradable nanofibrous metformin-eluting membranes for diabetic wound repair

Cheng-Hung Lee^{1,2}, Ming-Jer Hsieh¹, Shang-Hung Chang¹, Yu-Huang Lin¹, and Shih-Jung Liu²
(¹Chang Gung Memorial Hospital-Linkou, Chang Gung University College of Medicine, Taiwan)
(²Chang Gung University, Taiwan)

This work developed biodegradable nanofibrous drug-eluting membranes that provided sustained release of metformin for repairing wounds associated with diabetes. To prepare the biodegradable membranes, poly-D-L-lactide-glycolide (PLGA) and metformin were firstly dissolved in 1,1,1,3,3,3-hexafluoro-2-propanol (HFIP) and were spun into nanofibrous membranes by electrospinning. An elution method and an HPLC assay were utilized to characterize the in-vivo and in-vitro release rates of the pharmaceuticals from the membranes. The biodegradable nanofibrous membranes released high concentrations of metformin for more than three weeks. Moreover, nanofibrous metformin-eluting PLGA membranes were more hydrophilic and had a greater water-containing capacity than virgin PLGA fibers. The membranes also improved wound healing and re-epithelialization in diabetic rats relative to the control. The experimental results in this work suggest that nanofibrous metformin-eluting membranes were functionally active in the treatment of diabetic wounds and very effective as accelerators in the early stage of healing of such wounds.

PS5 Technology diffusion for cloud computing: system dynamics approach

Shiu-Wan Hung¹, Juin-Ming Tsai², and Min-Jhih Cheng¹
(¹National Central University, Taiwan)
(²National Taipei University of Nursing & Health Science, Taiwan)

There has been a variety of technology diffusion models proposed. However, these studies normally relied upon sales data to assume possible rates of technology diffusion, but failed to make a comprehensive exploration of the factors affecting technology diffusion. This study proposes a 2-stage diffusion model of cloud computing to strengthen the objectivity of system dynamics in numeric prediction. The results indicate that the main factors affecting the diffusion of cloud computing are service quality, the degree of maturity of the infrastructure, price, the degree of technological maturity, etc. This paper also proposes a prediction about the diffusion of cloud computing in the coming decade to provide guidance for future technology planning and strategic deployment.

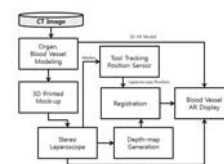
January 22 (Thursday), 12:00–13:00

PS6 A Laparoscope Surgery Training System using Organ-vessel Model and AR Navigation

Ho-chul Shin and Jae-il Cho

(Electronics and Telecommunication Research Institute, Republic of Korea)

In this study we represent a blood vessel navigation system based on sensor and image registration during laparoscopic surgery training. For most laparoscopic surgery, blood vessel treatments such as finding important artery, cutting and clipping are very important. So providing blood vessel information during the surgery is quite useful for surgeon. We are developing a laparoscopic training system that provides blood vessel navigation. First using patient CT images, we reconstructed patient specific 3d virtual organ and blood vessel model. With this virtual model, we made plastic organ and blood vessel mock-up using 3d printer and installed this model to laparoscopic training dummy. A training surgeon performs laparoscopic surgery using tool tracking marker attached laparoscope and tools. By position sensor and laparoscope image registration, current position is identified and important blood vessel position is AR (Augmented Reality) represented during the training.

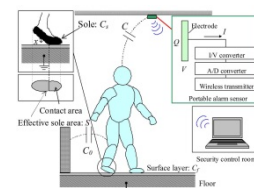


PS7 Analysis of electrostatic induction current generated due to walking motion

Koichi Kurita

(Kinki University, Japan)

In this study, an effective noncontact technique for the detection of human physical activity is proposed. The technique is based on detecting the electrostatic induction current generated by the walking motion under non-contact and non-attached conditions. By comparing the obtained electrostatic induction current with the theoretical model, it becomes obvious that this model effectively explains the behavior of the waveform of the electrostatic induction current. The normal walking motions are recorded using a portable sensor measurement located in a passageway of office building. The obtained results show that detailed information regarding physical activity such as a walking cycle can be estimated using our proposed technique. This suggests that the proposed technique, which is based on the detection of the walking signal, can be successfully applied to the detection of human walking motion in a secured building.

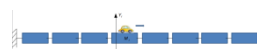


PS8 Structural damage detection using singular spectrum analysis

Takashi Nakamura and Preston Thompson

(British Columbia Institute of Technology, Canada)

An overall scheme for damage/anomaly detection for structures is discussed. Our scheme uses the Singular Spectrum Analysis (SSA), to extract meaningful features from inherently very noisy vibration data. Some researchers have already explored the possibility of using SSA for the purpose of structural damage detection, however, in the existing literature, SSA is often used instead of Fourier analysis only to obtain vibration spectra, and the eigenvectors of SSA, which are extracted features, have not been utilised for anomaly detection. In our damage detection algorithm, eigenvectors obtained from the SSA algorithm are actively used in order to extract and identify features in the vibration data. The output of the SSA is then categorized and compared to previously processed data sets. The algorithm is demonstrated using a simulated bridge with random traffic.



January 22 (Thursday), 12:00–13:00

PS9 A Model to Form Friendship Networks Based-on Social Network Analysis

Atsuko Mutoh¹, Ryumaru Kato¹, Tohgoroh Matsui², and Nobuhiro Inuzuka¹
(¹Nagoya Institute of Technology, Japan)
(²Chubu University, Japan)

It is important for teachers to understand the characteristics of forming and changing of friendship networks in order to manage their classes effectively. Many studies have analyzed friendship networks using agent-based models. However, most of the models used were specialized for a particular purpose like bullying or were simply for capturing basic phenomena. In this paper, we present an agent-based friendship-network model based on our analysis of friendship networks among university students. Agents make friendship decisions on the basis of a cost-benefit analysis. With our modified model, the benefit is calculated on the basis of their cluster property and the benefit function is modified accordingly. The results with the modified model better matched the actual friendship networks. The clique size in the modified model approached that in the actual friendship networks, and the values of several network properties approached those of the actual friendship networks.



PS10 A trial to calculate the second Feigenbaum constant with high precision.

Masanori Shiro
(AIST, Japan)

A purposes of this work is to reveal the value of second Feigenbaum constant "alpha" with high precision. The constant is an universal value between simple chaotic models and fractals. Many digits of it will provide more correct information whether the values is rational or not, transcendental or not, finding a clue of series expansions, and so on. The work is started in Briggs' thesis in 1997. He found in 110 digits of the constant by determined coefficients of expanded universal function $g(x)$, although the explicit form of series expansion of $g(x)$ is not known yet today.

Strogatz wrote in his textbook that $g(x)$ has following properties,

* $g(x)$ is continuous defined in $[0,1]$.

* $g(\alpha x)/\alpha = g(g(x))$, $\alpha=1/g(1)$.

* $g(0)=1$.

Actually, shapes of $g(x)$ is likely quadratic with convex upward. It is well known that $g(x)$ is a monotonically decreasing function.

PS11 Determination of the earthquake disaster area by object-based analysis using a single satellite image

Jonggeol Park
(Tokyo University of Information Sciences, Japan)

This study presents a novel approach for collapsed building detection by single image analysis. Our approach is based on object segmentation and texture analysis of high resolution GeoEye-1 image acquired after earthquakes. Image segmentation was initially performed in order to extract analytical objects for subsequent texture analysis. Thus, collapsed buildings were discriminated from other ground objects by analyzing the difference of the Dissimilarity, Homogeneity, Number of sub-objects, Area, Length of longest of edge and Length. The merit of the proposed approach is that no data before earthquakes or other auxiliary data is needed, thus the time for data collection and processing can be reduced considerably compared to existing methodologies, and this is critically important for an early stage information collection after earthquakes. A high resolution GeoEye-1 image, acquired in 13 Jan 2010 just after the Haiti earthquake, was analyzed in this study, and the proposed approach presents satisfactory results and shows great potential for practical use.

January 22 (Thursday), 12:00–13:00

PS12 Multi-Robot Task Management Software for Pipe Installation in an Offshore Plant

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

This paper proposes a 1:N (1: number of operators, N: number of robots) teleoperated method that consists of an operator and several slave robots for improving the efficiency of pipe installation in an offshore plant. In particular, this paper introduces a multi-robot task management (MRTM) software for allocating roles to the slave robots and creating autonomous motion commands for robots when the pipe installation is done by the 1:N teleoperation method. This is a progression on the current 1:1 teleoperation method, which is inappropriate for pipe installation. A graphical user interface (GUI) of the task management software is also proposed. The GUI of the task management software includes functions for observing the connections and conditions of channels, confirming communication linkages between the master device and the slave robots, as well as monitoring and validating data in real time through each device. The paper presents a detailed description of an experimental method for verifying the aforementioned software based on a pipe installation work scenario.



PS13 Long-term monitoring of the affected area using a time-series MODIS -FFT Profile Correction -

EuiChul Jung, Jonggeol Park, and Ichio Asanuma
(Tokyo University of Information Sciences, Japan)

In the land cover change extraction research is widely used by remote sensing data which have characteristics such as wide range, homogeneity and periodicity, specifically NOAA/AVHRR or Terra/MODIS etc. often used in NDVI (Normalized Difference Vegetation Index) which has obtained from the wide area observation satellite. NDVI is closely related with the "greenness" of the photosynthetic activity of plants because there are many using of influence assessment of continental-scale, dangerous global climate, monitoring of tropical forest, range of vegetation mapping, global carbon cycle, water cycle analysis. This research used by satellite series data (MODIS: resolution 250m) is compared to EVI (Enhanced Vegetation Index) affected before (2003-2010) and after (2011-2013). After correcting FFT (used low-pass filter) by EVI data, Phenology Information was extracted and compared to the vegetation Onset time, Max value and Duration. In addition, it is seen that the state of the reconstruction of the affected areas from 2011 through 2013 was an outcome extraction from the land change (farmland) with the land cover change extraction method (OMD).

PS14 Mapping of fractional coverage of paddy fields over Hokkaido using MODIS data

YoungHwan Kim, Jonggeol Park, and Ichio Asanuma
(Tokyo University of Information Sciences, Japan)

Remote sensing technology has been used in land use and land cover classification. Especially paddy fields is an important cultivated area Asia. To accurately extract the area is the important indicator to estimate the food production. In this research Rice paddy classification in Hokkaido was performed using the climate, geographical feature and the separating feature and later it was compared with a vegetation map of the Ministry of the Environment. The method proposed by this research, Topographical features (DEM), Climatic features (accumulated temperature), Spectroscopic features (MODIS), elements of these three features were used to abstract rice paddy. By this, we can think it is very effective to solve a problem by only using optical sensor. From now on I am thinking to use the method I proposed in this result for the abstraction of rice paddy in the scale of whole Japan along with the conformation of the stability of this method and I am also thinking to make rice paddy classification map in the scale of whole Japan.

January 22 (Thursday), 12:00–13:00

PS15 Consideration of the subjective complexity estimate method focused on brain activation and hemodynamics

Yuki Nakamura¹, Hirotoishi Asano², and Akio Nozawa¹
(¹Aoyamagakuin University, Japan)
(²Kagawa University, Japan)

In our previous study, assessing subjective complexity for auditory stimuli by analyzing Δ oxyHb in prefrontal lobe was attempted. Correlations between Δ oxyHb and complexity was demonstrated, however, subjects have classified into three groups which differs in activation regions of the brain. This study aimed at clarifying why they have different tendencies. The authors focused on listening style for auditory stimuli, and attempt to discuss the difference in hemodynamics among three groups. As a result, significant differences of hemodynamics were indicated on mean blood pressure and heart rate. These results suggest the possibility that hemodynamic response for auditory stimuli affects Δ oxyHb in prefrontal lobe.

PS16 Evaution of correlation between physiologic and psychological data on photographing

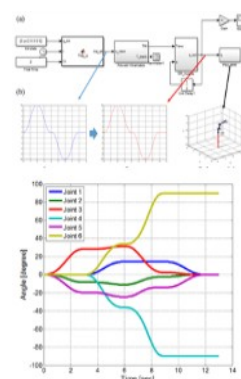
Masashi Koike and Akio Nozawa
(Aoyama Gakuin University, Japan)

In recent years, it is expected that the role of a photograph as communication media will increase because of having come to be able to upload a photograph easily. A transmitter of photograph cannot just convey the sensitivity of a photographer to a receiver without common sense of values and beauty. The authors have advocated "Affective Photography"(AP) as a totally new concept about an emotional phenomenon and the communication in all of photograph, camera and photographing. The present study is objected to evaluate affective state of photographer in photographing by physiologic index of emotions toward application of AP. From this, in comparison on photographing still life in overall photographing, it is supposed that a stress menstruation reply develops when I photograph a moving object. In this way, the possibility that feeling of strain could be measured as one of the sensitivity of the photography was shown.

PS17 MATLAB/Simulink-based kinematics verification library of auto part assembly robots

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

This paper proposes a MATLAB/Simulink-based library to derive the design parameters of links and joints for developing auto part assembly robots or performing kinematic verification of the designed robots. This library consists of several blocks: "robotic path generation" for determining the rotation angles (robot manipulator joint) or positon and orientation (robot end-effectors) of target robots from user input, "kinematics" for corelating the positon (with orientation) of the robot end-effector in Cartesian space and the joint parameters of the robot, "graphic output" for representing a target robot in thre dimensions, and "conversion" for representing the relation between the positon (with orientation) and transformation matrix. The motions of pending or already developed robots were simulated using this library, and the simulation results were applied to verifying various kinematic properties, such as singularites or the task capabilities of the robots.

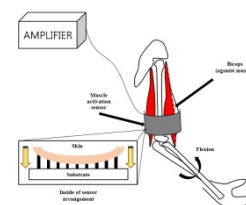


January 22 (Thursday), 12:00–13:00

PS18 Design plan of muscle activation sensor based on polyimide film for active rehabilitation robot

Heungki Kim, Seungyeol Lee, Sunghoon Eom, Daejin Kim, and Jeon Il Moon
(Daegu Gyeongbuk Institute of Science and Technology, Republic of Korea)

This paper proposes design plan of muscle activation sensor based on polyimide film which can be used for rehabilitation robot. The design plan what measure the muscle activation is reflected by Logic Tre which is based on Critical to Quality (CTQ) analysis data. Sensor design plan is suggested which is basis of solution plan that convenience to use, easy to wearability and easy to manufacturing. As in mentioned prior to the proposed design condition, this paper introduce to sensor design plan and muscle activation measurement illustration.



PS19 Efficient and reliable corner detectors through analysing CPDA

Rafi Md Najmus Sadat¹, Asiful Hossain¹, Mohammad Nabeel¹, and Naurin Afrin²
(¹University of Asia Pacific, Bangladesh)
(²Swinburne University, Australia)

This paper analyses two aspects of the popular CPDA corner detector, namely the use of multiple chords and the accumulation of chord-to-point distances. We demonstrate that it is possible to obtain better performance in corner detection using a single chord, instead of multiple chords. Our experimental results demonstrate that using a single chord to calculate the accumulated chord-to-point distance, it is possible to outperform the CPDA corner detector in terms of corner repeatability, with a 20% gain in speed. We also demonstrate that it is possible to leave out chord-to-point distance accumulation, and just calculate the distances of middle points with a single chord, and obtain performance comparable to CPDA also with a 20% gain in speed. We also demonstrate that not only our proposed changes result in better corner detection, but also results in more corners being detected more reliably.

PS20 Application of a LabVIEW for Adaptive Position Control System Based on Sliding Mode for Hydraulic Cylinders (Withdrawal)

Adisak Khaengsarigid and Jiraporn Kiatwuthiamorn
(Rajamangala University of Technology Rattanakosin, Thailand)

PS21 Following control design of moving targets for an intelligent vehicle combined with computer vision

Geng-Tza Wu, Hung-Ching Chen, and Jung-Shan Lin
(National Chi Nan University, Taiwan)

This paper develops the design of an intelligent vehicle system with computer vision to achieve the purpose of moving-target following. The design of this system includes three major parts, namely target following, color image processing, and collision prevention. The proposed system using image processing can analyze and follow the moving-target with the interested color, so the intelligent vehicle has the potentials to move appropriately and reach the desired destination. During the procedure of following desired target, whenever the moving-target is lost, it can apply the useful image information to retrieve the actual target position by camera. In addition, the infrared sensor is employed to return the distance information of moving-target in order to maintain an appropriate following distance between them for avoiding collision. As a result, some practical experiments are given to illustrate that the purpose of moving-target following has been indeed achieved successfully.

January 22 (Thursday), 15:30–16:30

Room A

GS12 Human-machine interaction and collaboration I

Chair: Koichi Kobayashi (Japan Advanced Institute of Science and Technology, Japan)

GS12-1 A study on human interface system using the direction of gaze and face for persons with disabilities

Kazuhiko Inami, Keiko Sakurai, Mingmin Yan, Hiroki Tamura, and Koichi Tanno
(University of Miyazaki, Japan)

Establishing an efficient alternative channel for communication without overt speech and hand movements is important for increasing the quality of life for patients lacking correct limb and facial muscular responses. This paper is prepared to present eye movement tracking system using cross-channels electrooculogram signals. In addition, we used Kinect sensor (RGB-D sensor) for face tracking. Thus, gaze estimation system can be established by both eye movement and face tracking. A simulation experiment was designed in order to confirm the effectiveness of the proposed system. As the results of simulation experiments, gaze position estimation is recognized under an accuracy of 100% in our system.

GS12-2 User Experiences and Perceptions of Thermal Feedback in the Tropics

Kittawan Janjeng and Teerapong Leelanupab
(King Mongkut's Institute of Technology Ladkrabang, Thailand)

Thermal feedback provides a novel emotive and private communication channel between human and computer. This paper presents the first investigation of how environmental factors affect the use of thermal feedback in a tropical area. We also studied the effect of sudden change of ambient temperature that often happens in daily life situations of tropical users. Furthermore, the learning of the use of thermal feedback was examined as well as subjective comfort and intensity of each stimulus. Experimental results showed that thermal stimuli have potentials to be used for providing feedback to the users in the tropics. In addition, the transition of ambient temperatures has very little effect on thermal perception of the same stimuli. Within this context, strong stimuli with respect to intensity and rate-of change are reported to be more suitable than other weak stimuli. Moreover, the cold feedback is preferred to the warm.



GS12-3 Primary Experiment on a Prototype Hardware of a Supporting System for Visually Impaired People Operating Touchscreen

Tatsuya Hamachi, Akira Yamawaki, and Seiichi Serikawa
(Kyushu Institute of Technology, Japan)

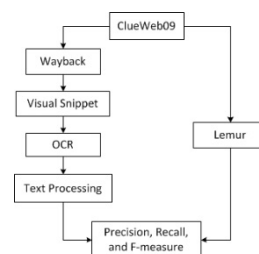
Visually impaired people is hard to use the electronic products with touchscreen. Although various supporting systems for operating touchscreens by visually impaired people are proposed until now, there are some problems about the training for operation, the previous constraints before using and the replacement of a conventional machine. Thus, we have proposed the wearable supporting system to solve these problems. In a proposal system, the icon on a display is transposed to a color barcode, it is recognized with user's fingertip camera, and an audio assist is performed. In this paper, prototype hardware of our proposal is developed. Then, primary experiments about the angle and the speed of the finger and the button regions are performed. The results demonstrate that our proposed supporting system can be used by visually impaired people practically. Moreover, the working speed and the circuit scale of prototype hardware are confirmed through an implementation to FPGA.

January 22 (Thursday), 15:30–16:30

GS12-4 Extracting Visual Snippets for Query Suggestion in Collaborative Web Search

Hannarin Krueajirayu and Teerapong Leelanupab
(King Mongkut's Institute of Technology Ladkrabang, Thailand)

This paper proposes an approach to generate query suggestions by employing information from user-created visual snippets. In order to generate query suggestions, we apply the optical character recognition (OCR) technique to extract a set of words presented in the visual snippet. The natural language processing (NLP) is used to identify the words that might be relevant to users' information need. The goal of this paper is to compare the accuracy of terms extracted by our approach with that by a Lemur search toolkit. In our experiment, we use 1,000 English web pages from a dataset in category B of ClueWeb09. The visual snippets are created from the web pages. Then, their important terms are extracted by our approach. Outcomes of extracting terms for query suggestions are evaluated by using Precision, Recall, and F-measure. The experimental results indicate that our approach effectively identifies and generates useful terms for query suggestion.



Room B

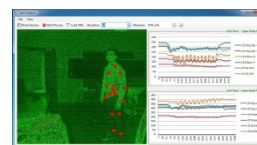
GS2 Artificial intelligence

Chair: Michiharu Maeda (Fukuoka Institute of Technology, Japan)

GS2-1 Human Gait Analysis based on Biological Motion and Evolutionary Computing

Dipak Gaire Sharma, Rahadian Yusuf, Ivan Tanev, and Katsunori Shimohara
(Doshisha University, Japan)

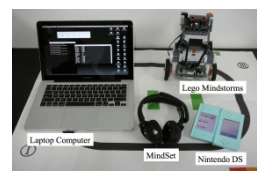
Human motion has already revealed and has left numerous imprints in many aspect of psychological and social research. On the other hand, due to the huge challenge and new dimension of its extreme applications, this field has always been the inspiring arena for the computer scientist to explore boundless possibilities in the field of human or nature-inspired computing. In this research we tried to investigate a novel approach of identifying individuals based on their gaits. Furthermore, we tried to open up a new alley in the research towards the biometric identification of humans that involves classification of human gaits using the power of Genetic Programming (GP). Moreover, along with this study, we also purposed an approach of applying collaborative filtering in order to address the problems of non-determinism and lack of generality in GP.



GS2-2 Designing a robot controller by using a simple brain-wave sensor and a machine learning technique

Hironori Hiraishi
(Akita National College of Technology, Japan)

We designed a robot controller that can use unstable data, such as brain waves. The controller analyzes brain waves from a simple electroencephalograph. A user can concentrate to make the robot move faster, and relax to make it move slower. In order to judge the user's state by his brain-wave data, we adopt a machine learning technique called SVM (Support Vector Machine). We investigated improving the classification accuracy by increasing the number of data sets used to make the user concentration model. We increased the data sets from 30 to 180; consequently, the accuracy increased, with a maximum of about 80 percent with 150 data sets. This indicates that our controller is able to accurately classify unstable data and can control a robot using brain waves from a simple electroencephalograph.

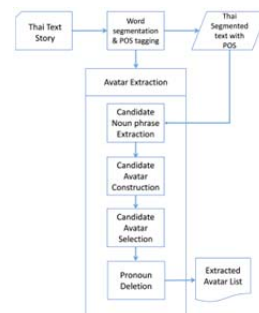


January 22 (Thursday), 15:30–16:30

GS2-3 Robust avatar extraction for unreliable low-level preprocessors

Ponrudee Netisopakul and Patipan Wikaha
(King Mongkut's Institute of Technology Ladkrabang, Thailand)

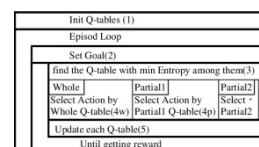
Avatar extraction is a task of automatically identifying or constructing a list of main characters from a novel text or a story. For a long novel containing named characters, techniques such as looking for a group of words or phrases that are not listed in a dictionary can be effectively applied. However, in short children stories, characters are not necessary have names. Hence, name entity extraction techniques have limited use here. This problem is more complicated when working with a non-boundary language such as Thai, because the result of word segmentation pre-processor contains many mistakes. This paper proposed a simple avatar extraction algorithm, taking a result from unreliable low-level language pre-processors and applying simple noun phrase matching and frequency counting techniques to extract avatars. Despite the obstacles, it achieved the best result about 78% recall for main characters extraction when experimented on 40 Thai children stories.



GS2-4 Reinforcement learning with multiplex learning spaces - Consideration of the learning inefficiency in a case that all the partial spaces are ineffective and are not similar each other -

Chioko Nishizawa, Hirokazu Matsui, and Yoshihiko Nomura
(Mie University, Japan)

We propose a reinforcement learning method with multiplex learning spaces, that can learn appropriate actions by fewer experiences. We have confirmed that a reinforcement learning becomes more efficient with multiplex learning spaces, a whole and one and two of agents learning spaces. In this paper, we investigate the learning efficiency in a case that all the partial spaces are ineffective and are not similar each other in experimental simulations. As a result, we confirmed that multiplexing became only slightly inefficient by adding even ineffective learning spaces. We found that more multiplexing becomes more efficient for the learning by only one effective partial learning space, even if the others are ineffective.



January 22 (Thursday), 15:30–17:15

Room C

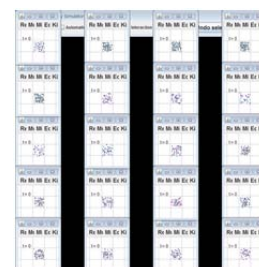
GS19 Multi-agent systems

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

GS19-1 Investigating Stigmergic Coordination of Autonomous Robotic Swarms Controlled by Heterogeneous Interaction Properties

Naoki Nishikawa, Reiji Suzuki, and Takaya Arita
(Nagoya University, Japan)

This paper is concerned with a framework to design self-organizing, self-reconfigurable robotic systems. We focused our attention on the algorithm of a multi-agent model called Swarm Chemistry, proposed by Sayama. In Swarm Chemistry, a number of agents coalesce into an excellent diversity of spatial structures and/or emergent behaviors, depending on the kinetic parameters provided. Therefore, we expect some possibilities that applying the generic swarming algorithm to the control of autonomous robots will allow for complicated task operations flexibly in real-world deployment. However, such bottom-up nature cannot be easily applied to the conventional top-down artifacts design. This paper presents a method of designing the heterogeneous robotic swarms and finding solutions through the genetic algorithm. Simulation results with a few simple task examples demonstrate that the proposed framework allows us to acquire appropriate recipes, creating swarm structures to perform a given task more effectively and efficiently.

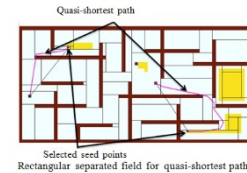


January 22 (Thursday), 15:30–17:15

GS19-2 Control Cooperative Multi-robot Systems for Covering Fields with Unknown Obstacles

Hidemi Yamachi, Yasuhiro Tsujimura, and Yasushi Kambayashi
(Nippon Institute of Technology, Japan)

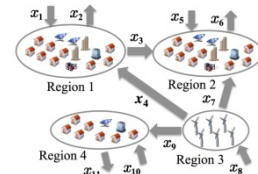
In the previous research paper, we have proposed an algorithm for the cooperative multi-robot coverage simulation. If a robot has completed its assigned coverage area, the robot calculates the quasi-shortest path to the next point to restart the coverage so that the moving cost becomes minimal. Even though the method for obtaining the quasi-shortest path works effectively, it takes too long time for very complex fields. In addition, some isolated coverage target areas appear and robots have to make long trip to the areas that degenerate the performance of our coverage algorithm. In order to deal with such problems, we propose the method that utilizes the path the robot has taken from its initial position to current position. We scrutinize the characteristics of our algorithm for the single robot case and apply the method to multi-robot cases.



GS19-3 Distributed Optimization based on Networked Multi-agent Systems and Its Application to Negotiation-based Real-time Pricing

Kazunori Sakurama and Masashi Miura
(Tottori University, Japan)

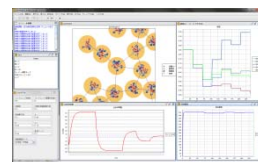
This paper deals with a distributed optimization problem with constraints for networked multi-agent systems. First, we propose a distributed algorithm based on the Lagrangian method, where a new distributed estimator of the Lagrangian multiplier is designed. This estimator enables each agent to obtain the value of the Lagrangian multiplier in a distributed manner without supervisors. Next, we derive a necessary and sufficient condition that the proposed algorithm is feasible over a given graph. Finally, we apply the proposed method to power grid control via negotiation-based real-time pricing to maintain the demand-supply balance in a power grid.



GS19-4 Graphical and Scalable Multi-Agent Simulator for Real-time Pricing in Electric Power Grid

Masashi Miura, Yuta Tokunaga, and Kazunori Sakurama
(Tottori University, Japan)

With growing of the great interest in the energy problems, real-time pricing(RTP) for power systems has attracted attentions in the world. In our research, the new distributed optimization method is proposed for RTP. It is based on negotiations between players (consumers, suppliers and distributors) through information networks. Then we developed a graphical and scalable multi-agent simulator for RTP which is named "RTPsim" for further investigations. RTPsim enable us to conduct numerical simulations in various conditions and various scales. This paper shows the new distributed optimization method based on negotiations, the features of our graphical and scalable RTP simulator and examples of simulation results.



January 22 (Thursday), 15:30–17:15

GS19-5 Hardware Implementation of Lottery Controllers for Real-time Pricing

Taichi Kitao, Ichiro Maruta, and Shun-ichi Azuma
(Kyoto University, Japan)

In recent years, a power shortage problem has been getting worse. As a solution to this problem, real-time pricing has been proposed. For real-time pricing, it is known that lottery controllers, which stochastically determine whether to use the electricity, are useful. In this paper, we report its hardware implementation and experimental results. From the result, it is confirmed that the lottery controllers are effective in controlling the electricity consumption.



GS19-6 Strategy Analysis of Soccer Teams from Kick Records

Tomoharu Nakashima, Jordan Henrio, and Satoshi Mifune
(Osaka Prefecture University, Japan)

RoboCup is a global project, started in 1997, whose aim is to create a team of robots which are able to win against human being in a soccer game before 2050. This research is interested in further research in fields of robotics, machine learning and multi-agents systems. There are several categories in RoboCup such as real soccer robots, simulated soccer robots, real rescue robots, and simulated rescue robots. The focus of this paper is on RoboCup simulated soccer. There are two sub-leagues in RoboCup simulated soccer category. One is 2D league where every object including players and the ball is described by two dimensional vector. The other is 3D league where simulated humanoid robots are used in the competition. RoboCup soccer simulation 2D league is used in this paper. Every year the world championship opposes teams from around the world. Then, each team works hard to be the winner of the following edition of the competition. To be the first you have to construct strong strategies which defeat your opponent. In order to do this it is important to find the team type of your opponent during the match in order to adaptively determine the strategy to adopt. Analysis of the team behaviour of RoboCup Soccer Simulation 2D is shown in this paper. The aim of the research is to present a method to determine the team types. After a game its log data are available. The log data contains the velocity and the position of the objects (players and balls), actions, players' status, etc. Among them the kick records are used to analyse the behaviour of a team. The position of the kick and the length of the pass including dribble are used to characterise the team behaviour. Thus the kick records are compiled as a series of kicks made during the game. As the number of kicks is different teams by teams and games by games, it is difficult to measure the difference between two kick records from different teams and different games. In order to address this problem, earth mover distance is used to measure the similarity between them. Earth mover distance allow to calculate the difference between two different sets of objects where each object has a weight and the number of objects can be different from each other. In this research, the object has the information on a kick position as attributes and the length of the ball feed as weight. After agglomerative clustering, it is shown that the team behaviour can be characterised by kick records that do not contain any time information.

GS19-7 Simulated Human Feelings Based on Desire Driven Process

Roungsan Chaisricharoen
(Mae Fah Luang University, Thailand)

One common function of mind is the generation of feeling which is an aspect that defines humanity. However, psychologists or scientists are still not able to define an operation of feeling without any reasonable doubts. Commonly, function of feeling has no certain rules as human can be both happy and suffer with any events. Therefore, uncountable scenarios indicating contradictory presentation of feelings can be expected from any individual during his/her life. The proposed system is based on the Buddha's teaching that divides feeling into three states of happiness: happy, neutral, and suffering. Feeling simulation is developed based on multiple desire agents that continuously generate point of satisfaction contributed to level of suffering. The threshold in suffering plane is also adjusted based on experience on goal satisfactions which can effectively simulating effect from chain of spoiled events. Simulation results provide reasonably distributed pattern of feeling over different scenarios.

January 22 (Thursday), 15:30–17:15

Room D

GS10 Data mining

Chair: Hidekazu Yanagimoto (Osaka Prefecture University, Japan)

GS10-1 Finding division points for a time series corpus based on the sequential probability ratio test

Hiroshi Kobayashi and Ryosuke Saga
(Osaka Prefecture University, Japan)

This study describes a method of finding the proper points for dividing a corpus with time series information to extract local and frequent keywords. Previous works proposed the corpus separating method for extracting keywords from a corpus. However, this method divides a corpus at equal intervals so that it cannot consider the topic changes. The present study utilizes the idea of the topic model and the topic extracted through latent Dirichlet allocation (LDA) to consider the topic change. This study identifies the points at which large topic changes occur to divide the corpus using the sequential probability ratio test (SPRT). An experiment involving newspaper articles with five-year topics confirm that the points at which the topics of each document change are detected to find the division points by applying SPRT to the topic distribution outputted from LDA and by comparing keywords extracted from the previous method, LDA, and SPRT.

GS10-2 Developing Mobile Wallet Services acceptance model: A proposed model

Lumyai Cotsopa and Singha Chaveesuk
(King Mongkut's Institute of Technology Ladkrabang, Thailand)

A number of smartphone users are significantly increasing. Technological advance in smartphones has created many opportunities for mobile commerce, especially for mobile payment services (MPS). Mobile wallet services (MWS) is a new application form of MPS. MWS is relatively new to Thailand and the quantity of consumers conducting mobile financing activities is very low compared to neighboring countries. It could be implied that the MWS technology is unfamiliar in Thailand. Thus, this study aims to build a proposed model of mobile wallet services acceptance in Thailand to investigate potential factors influencing the MWS adoption. This model proposes a framework to enhance TAM incorporating with; 1) perceived usefulness, 2) perceived ease of use, 3) perceived security and privacy, 4) perceived trust, and 5) location-based service. This proposed model extends a current framework of the technology acceptance and provides better understanding of potential factors influencing mobile wallet services acceptance.

GS10-3 An Enhanced Incremental Association Rule Discovery with a lower minimum support

Araya Ariya and Worapoj Kreesuradej
(¹King Mongkut's Institute of Technology Ladkrabang, Thailand)

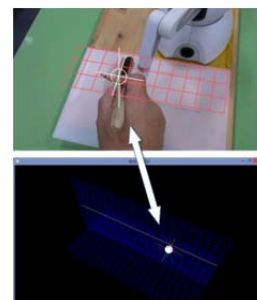
In the real world of data, a new set of data has been being inserted in to the existing database. Thus, the rule maintenance of association rule discovery in large databases is an important problem. Every time the new data set is appended to an original database, the old rule may probably be valid or invalid. This paper is the extension work of Mining Dynamic Databases using Probability-based Incremental Association Rule Discovery Algorithm. The idea is applying the normal approximation to the binomial for calculating the lower minimum support for collecting the expected frequent itemsets. This proposed idea can reduce a process of calculating probability value for all itemsets that unnecessary. In addition, the confidence interval is also applied to ensure that the collecting of expected frequent itemsets is properly kept.

January 22 (Thursday), 15:30–17:15

GS10-4 A Training Support System of Brush Coating Skill with Haptic Device for Technical Education at Primary and Secondary Schools

Shimpei Matsumoto, Masaru Teranishi, and Hidetoshi Takeno
(Hiroshima Institute of Technology, Japan)

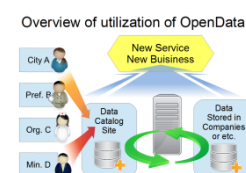
In Japan, many primary and secondary school students have been feeling high awkward consciousness to manufacturing in manual training class, and the awkward consciousness would be caused by the shortage of lecturer's manufacturing skill. Previously there have been some research efforts supporting to obtain implicit manufacturing skill. On the other hand, a manufacturing skill training system for primary and secondary educational fields has not been developed enough. Therefore this study aims to develop a system for supporting manual training class in primary and secondary schools, and especially focuses on brush coating skill, a traditional manufacturing skill with high necessity to success. To develop the system, firstly an equipment to measure brush coating motion is developed by using PHANTOM Omni. This paper aims to evaluate each one's brush coating movement and relationship between users by using torus self-organization map.



GS10-5 A proposition of judging method among the five stages of open data in local government

Tadanori Hisanaga, Takayasu Fuchida, Ryutaro Sueyoshi, and Kyoshiro Hirata
(Kagoshima University, Japan)

In recent years, the policies of utilization of open data by the Japanese government is promoting, and movement to take advantage of open data in local government in response to this has been activated. Under the present situations, the statistically processed data are published, but raw data is not open to the public most. As can be seen from the use case of recent big data, by processing an enormous amount of raw data using a machine learning, methods of utilization of information that has not been seen so far become apparent. The purpose of this study is to investigate the possible use of open data that the national and local governments have published. For this purpose, we propose a method to judge which stage it belongs to among five stages of open data. The five stages of open data is an index of the evaluation of open data proposed in the W3C by Tim Berners-Lee [1]. As a preliminary experiments, we calculated utilization of open data based on extension about five local governments where they promote to publish the open data positively. From this results, it is said that the opening to public of open data in the local governments is insufficient of promoting in Japan.



GS10-6 Comparative analysis of genetic based approach and Apriori algorithm for mining maximal frequent item sets (Withdrawal)

Mir Md Jahangir Kabir, Shuxiang Xu, Byeong Ho Kang, and Zongyuan Zhao

GS10-7 LDA-Based Path Model Construction Process for Structure Equation Modeling

Ryosuke Saga and Rikuto Kunimoto
(Osaka Prefecture University, Japan)

This paper proposes a novel approach to generate and analyze path model by structure equation modeling (SEM). SEM is an important technique to carry out causal analysis based on path model. As such, constructing path models, which result in reliable analysis, is important in SEM. LSA-based method, which is used to build a path model from text data, is proposed. However, this method requires each document to belong to one topic; thus, the model cannot express natural variables and relationships. Therefore, this paper extends the existing approach to latent Dirichlet allocation (LDA) and generates a path model from the extracted topics by LDA. Experiments using review text data can confirm the feasibility and applicability of the proposed process.

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Room E

OS4 Construction Engineering and Management

Chair: Yan-Chyuan Shiau (Chung Hua University, Taiwan)

Co-Chair: Kuo-Lan Su (National Yunlin University of Science and Technology, Taiwan)

OS4-1 Applying Interpretive Structure Modeling on the Interactive Correlations on Factor Analysis of Natural & Cultural Scenic Area at Taiwan

Yee-Chaur Lee, Yan-Chyuan Shiau, and Wei-Ling Hsu
(Chung Hua University, Taiwan)

The planning evaluation criteria for natural and cultural scenic areas of indigenous tribes in Taiwan has not yet been enforced. This study was conducted in a protected indigenous area with an evaluation and feedback system. Research methods included qualitative and quantitative analyses comprising a literature review on government policies, statutes and laws, and research articles. A participative action plan, focus group interviews, and the fuzzy Delphi method were used to depict and interpret the evaluation framework, characteristics, and factors. To reduce the errors caused by personal preferences of expert group members, interpretive structure modeling (ISM) was applied to interpret the correlations between policy decision processes to identify the causes and effects, criteria and factors, and decisions and action plans for the problems raised by this article. The purpose of this article was to identify the correlations of the social and economic subfactors that a complicated ecolandscape system would contain. The results of this article are presented as four factors: environmental, economic, social-cultural, and political, with 12 subevaluation factors. A decision structure system for the ecolandscapes of indigenous tribes was proposed through the application of ISM. Keywords: Natural and cultural scenic area, Indigenous tribe, Eco landscape, interpretive structure modeling (ISM), fuzzy Delphi method (FDM)

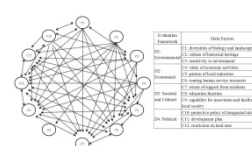
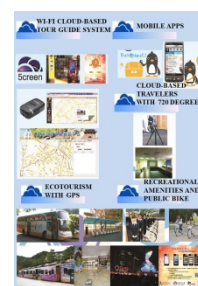


Fig. 1. Interdependencies of the evaluation indicators established through ISM

OS4-2 Information and Communication Technology in Smart Touring

Hung-Nien Hsieh, Hsin-Wen Chang, and Chiu-Yao Chou
(Chung Hua University, Taiwan)

The Hsinchu Technopolis in Taiwan is widely recognized as the Silicon Valley of Asia. To assist the science-based industrial city in hosting a major event (i.e., the Taiwan Lantern Festival), a high-tech guiding system was experimentally implemented to support meetings, incentives, conferences, and exhibitions tourism and event management. During the 2-week Lantern Festival holiday, more than 150,000 tourists used the Wi-Fi guiding system. Because cell phone roaming charges for foreign tourists are typically substantial, a free Wi-Fi environment was created, which also assisted in promoting the Lantern Festival. Therefore, technological solutions were focused on satisfying the needs of international and domestic tourists. The results of this research provide a valuable and beneficial reference for tourism and city marketing in the public and private sectors.



January 22 (Thursday), 15:30–17:30

OS4-3 Research for train station reconstruction and associated tourist development – a case study of Dongshan train station

Ching-Jung Chang and I-Chen Wu
(Chung Hua University, Taiwan)

Dongshan Station in Taiwan is the Taiwan's first leisure-purposed rebuilt station, a multi-objective strategy station combining innovative concepts, humanities and arts, historical and cultural preservation, urban design, transportation and tourism services. This study explored the influence of sightseeing and transport functions after the station reconstruction and analyzes the benefit of resident to the local economic activity and urban development after the completion of the station's reconstruction with questionnaire survey; and explores non -resident knowledge of the locality and recreation satisfaction. This study adopts the Likert-Scale five-point measure questionnaire to survey the scene. In the beginning, collect relative information, design the questionnaire and analyzes the results, meanwhile, interview with experts. This study explored the variance of tourism development after the station reconstruction surveyed from residents and non-residents by statistical analysis and ANOVA. Screen the questionnaire variables into factor constructs by principal component analysis (PCA) which could briefly and concisely express user appeal. This result of study could provide government and the planner the real demand on user in addition to the integration of expert advices.

OS4-4 Investigation of Bikeway Utilization and User Satisfaction – A Case Study of Taichung City

Ching-Jung Chang and Chun-Hsien Chen
(Chung Hua University, Taiwan)

The world has put much effort at promoting energy conservation and carbon reduction in recent years and been developing mass transportation and green traffic. The use of bicycle in lieu of part of the vehicles becomes a strategy in many cities. This paper explores whether residents use bicycles for purpose of transportation vehicle or sports from the perspective of setup of bike lane facilities and environment for cyclist's use. It is hoped to provide reference in the planning and design of bike lane facilities setup, to make more people intend to use bicycles as short-distance transportation vehicle and sports goods. In the beginning, this study used site survey, data collection, expert interview and sort out information. From the result designed the questionnaire and analyze by descriptive statistics and ANOVA to get the variations of the different cyclist's. users in the bike lane facilities and satisfaction. Variables of opinion were simplified by Principal components analysis (PCA) into constructs of demand, which is able to concisely express user's demand for basic bike lane facilities. The paper provided the clear intention of the cyclists' and closed with expert opinions, it could be useful information to the planner and designer.

OS4-5 Investigation of Correlation between Construction Cost Indices and International and Domestic Commodity and Financials Indices

Ching-Jung Chang and Shan-jung You
(Chung Hua University, Taiwan)

The price of a construction project which often fluctuates with the changes in the domestic consumer price index, international commodities or financial environment has always been the concern of the construction industry and researchers; in Taiwan, the construction project price index which is officially published by the government is the only basis on which the adjustment of project prices is made and therefore, this study aims to establish a mode for forecasting this index. By applying the economic theory of Keynes on supply and demand, this article establishes a forecasting mode through the collection and analysis of the data regarding the supply and demand sides affecting the construction price and this mode is validated on the basis of subsequent data. This paper summarized by smaller principal components reduced the data from 22 variables to 10 variables and establishes a regression model. Using the regression model to forecast the immediately following 12 months, it has been proven to reach an average accuracy of 99.38% in the validation of the forecasting model.

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OS4-6 Study on Constraint Time Construction Model for Replacement of Air Handling Unit in Department Store

Yan-Chyuan Shiau, Hui-Wen Chuang, and Chun-Feng Chang
(Chung Hua University, Taiwan)

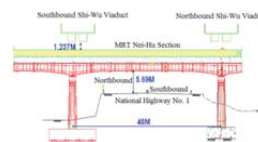
The replacement of air handlers in department stores must be conducted and completed within a 12-h time frame outside normal working hours to avoid interrupting normal business operations, which is an extremely difficult task. The researchers of this study employed a work-breakdown structure to develop a replacement regime for air handlers. Based on the tasks listed in the proposed regime, the researchers determined the relationships among the various tasks, calculated the start and finish times of the various tasks in conventional construction projects and constraint time construction projects, and determined the labor distribution for each task according to these times. Gantt charts were used to schedule construction progress and critical paths and to analyze the increase in crashing costs when a constraint time construction model is employed. The researchers examined four already-completed construction projects and compared the start and finish times of the various tasks calculated in this study with those of the four projects. The comparison results were then used to analyze the root causes for variation and to formulate related countermeasures. An expert interview was conducted to verify the correctness of the proposed countermeasures. The required times and labor distribution for the various tasks in constraint time construction projects were revised according to the opinions of the experts. The findings of this study can serve as valuable references in air handler replacement projects.



OS4-7 Risk management of MRT viaduct construction across highway

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

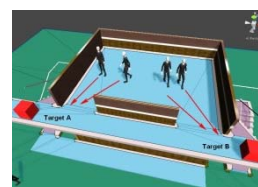
The risk management process involves quite a few decision-making steps. This research tries to establish a risk management process by incorporating the Delphi method in its decision making, and then a viaduct construction project study case employed the established risk management process by the construction management team is presented to verify this process. For the study case, four potential risks, traffic maintenance, hoisting operation, clearance height control, bridge deck construction, are identified first, and then they are assessed, and finally the strategies to reduce the threats related to the identified risks are proposed. This research has found that the initial risk matrix indicated that the identified risks rank from “high” to “very high”. However, after adopting the response strategies, the identified risks have been reduced substantially.



OS4-8 Study on Applying Unity Software in Fire Evacuation Simulation for Older Person

Yung-Piao Chiu^{1,2}, Yan-Chyuan Shiau², and Yi-Hsuan Lai²
(¹Hwa Hsia Institute of Technology, Taiwan)
(²Chung Hua University, Taiwan)

Whether residents of the buildings on fire can be timely and successfully evacuated is the key to protect the life of people and the safety of property. The Study aims to investigate the challenges that are caused by group moving behavior and speed when the elderly pass through the doors of different widths in the living rooms during evacuation based on the literature regarding the horizontal and vertical movement speed of Taiwanese elders. The evacuation simulation model which is developed by the Unity software is applied and the result obtained is proven to match with the data in research literature, showing that Unity can be used as the basis for the evacuation equipment design and safety performance inspection of nursing homes. The result can be exported to become a mobile platform and downloaded to mobile phones and tablets. It can be used to simulate evacuation of people if the environment needs to be changed, such as adjustment of partitions or furniture arrangement.



January 22 (Thursday), 16:45–18:00

Room A

GS13 Human-machine interaction and collaboration II

Chair: Ken Saito (Nihon University, Japan)

GS13-1 Effect of mood transition for characterizing KANSEI robot reflecting the tendency of treatment from user

Hiroki Ogasawara and Shohei Kato
(Nagoya Institute of Technology, Japan)

Recently, communication robots have been popularized and utilized for various scenes of daily life. Robots designed for human-robot interaction are expected to have the ability of communicating with human smoothly. In our previous study, we confirmed the effect of the character giving model for *KANSEI* robot. This model makes robots individual-beings that are varied with each user. Robots dynamically get their own characters based on the tendency of user's behaviors which are classified into two dimensions: dominance-submission and acceptance-rejection. In this paper, we propose the mood transition model. Robots transition to various mood and robots' mood is expressed by the strength of facial expressions. We aim to develop more humanly and empathetic robots by using this model. Through the interaction experiments between human and the robot with the proposed model, we confirmed that proposed model could give various characters to the robot, and the character, which was given through the communication with a user, suited for each of the users.

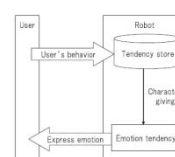


Fig. 1. Overview of character giving model

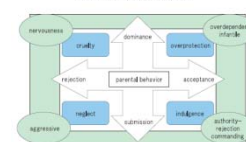


Fig. 2. Relationship between parental behavior and children's character

GS13-2 Mental tension enhancement using abdominal breathing restriction and transcutaneous electrical nerve stimulation

Ippei Nakayama, Haoyu Qin, and Jun Kobayashi
(Kyushu Institute of Technology, Japan)

This paper presents two methods that adjust the state of autonomic nerve activity for mental tension enhancement. One is the Abdominal Breathing Restrictor (ABR) that compels you into costal breathing. The other method is transcutaneous electrical nerve stimulation (TENS). In this study, a TENS of 100Hz in frequency was applied in the paravertebral ganglionar region of subjects. Although the efficacy of the ABR and TENS is similar, their physiological mechanisms are different. The authors conducted experiments to confirm the efficacy of the ABR and TENS in coordination of autonomic nerve activity. In addition, we investigated synergy between the ABR and TENS experimentally by applying them simultaneously. The ABR and the integrated method showed the expected results in the experiments. However, the enhanced activity levels were almost indistinguishable from each other. The apparent indication of the synergy did not found in the experiments. The authors explain the cause from a physiological perspective.



GS13-3 Design of 33-D.O.Fs Android Robot Head EveR-4 H33

Dongwoon Choi, Dong-wook Lee, Duk Yeon Lee, and Byeong Kyu Ahn
(Korea Institute of Industrial Technology, Republic of Korea)

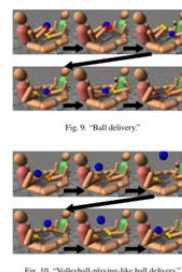
In this paper, we propose 33-D.O.Fs android robot head EveR-4 H33. There are several characteristics which can make android robots be more like humans than humanoid robots. An artificial skin, a face like humans face, human like body shape are those characteristics. Humans can make their emotional expressions by using skin and muscles. The android robot also can make emotional expressions by its human like shape, but by an artificial skin and actuators instead of skin and muscles. There are no actuators can substitute human muscles in terms of a size and a power, so the number of actuators must be limited and this can be a problem to have enough actuators for emotional expressions. To solve this problem, anatomic researches for muscles to find minimum numbers of actuators to make each emotional expressions. The EveR-4 H33 is a head for an android robot EveR-4. This head has 33 actuators and 33-D.O.Fs is one of the highest D.O.Fs among android robots. The size of head is Asian female's head and this means there are small spaces inside, so an optimal design for spaces and efficiently placed actuators are required. The largest part in the head is an eye module, so compact 3-D.O.Fs eye modules are developed. ...

January 22 (Thursday), 16:45–18:00

GS13-4 A Ball Game Typed Human-Robot Interaction Based on All-Combinatorial N-grams

Takuto Sakuma and Shohei Kato
(Nagoya Institute of Technology, Japan)

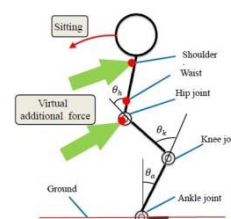
We focused our attention on human-robot interaction for the purpose that is users can really enjoy it. We believed that it is necessary to reflect the preferences of users so as to let them to have more positive impressions on robot through doing interactions. This research was aimed at developing a robot that can reflect preference of users after receiving and analyzing the rewards that was provided by users during the interaction dynamically, and create a better interaction for them. Thereby, users' impression of robot can be improved. In order to assess the effectiveness of our robot, we conducted an experiment, in which we applied a ball game as the interaction between user and robot. And according to sensitivity evaluation, our robot gained the best impression of users.



GS13-5 Perception-Assist for Sitting Using a Lower-Limb Power-Assist Robot

Yutaka Yokomine and Kazuo Kiguchi
(Kyushu University, Japan)

This paper proposes a method to prevent falling down during sitting motion using a lower-limb power-assist robot. The lower-limb power-assist robot is necessary for physically weak persons to sit or squat down. However, if a person tries to sit on a chair which is not located in the proper position, the person may fall down backward, because the environment perception ability is sometimes deteriorated also. This paper proposes a perception-assist method that the robot monitors interaction between the user and the surrounding environment and modifies the user's motion if it is necessary. In the case of sitting on the chair which is not located in a proper position, the robot performs perception-assist to modify falling motion to squatting motion by adding the additional force from behind. The effectiveness of the proposed method was evaluated by performing the experiments.



Room B

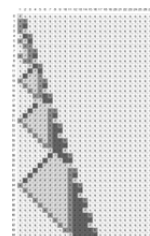
GS8 Complexity

Chair: Ken Naitoh (Waseda University, Japan)

GS8-1 A Note on Five-States Fibonacci Sequence Generator

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

A model of cellular automata (CA) is considered to be a well-studied non-linear model of complex systems in which an infinite one-dimensional array of finite state machines (cells) updates itself in a synchronous manner according to a uniform local rule. Thereafter the CA have been studied in many fields such as complex systems, computability theory, mathematics, and theoretical biology. A sequence generation problem on the CA has been studied and many scholars proposed real-time sequence generation algorithms for a variety of non-regular sequences such as prime, Fibonacci, and $\{2^n \mid n = 1, 2, 3, \dots\}$ sequences etc. In this paper, we propose a five-states real-time generator for Fibonacci sequence, and give a formal proof of the algorithm.



January 22 (Thursday), 16:45–18:00

GS8-2 Sentiment analysis of Thai children stories on support vector machine

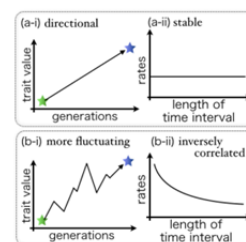
Rathawut Lertsuksakda, Kitsuchart Pasupa, and Ponrudee Netisopakul
(King Mongkut's Institute of Technology Ladkrabang, Thailand)

Recently, Sentiment Text Tagging System (STTS) with Thai sentiment resource has been developed and used to tag emotions directly to words and sentences in Thai children stories. The Thai sentiment resource, developed from SenticNet2 resource, groups emotions into four independent but concomitant dimensions: pleasantness, attention, sensitivity and aptitude. The measure of each dimension is called a sentic value of that dimension. Thai sentiment resource stores each word's sentic value and polarity value, a value calculated from the sentic value, in the form of floating point number. The resource was constructed from bi-directional translation of 14,244 English terms in SenticNet2 into 16,584 Thai terms. The main purpose of this study was to implement a sentiment analysis of Thai children stories system with support vector machine using a set of proposed discriminating features for classifying emotions. It was found that the system can achieve 72.14% of accuracy.

GS8-3 Directional effects between language and biological evolution in gene-culture coevolution of language

Tsubasa Azumagakito, Reiji Suzuki, and Takaya Arita
(Nagoya University, Japan)

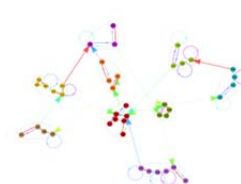
Understanding the origin and evolution of language is key to understanding humans. In this paper, we focus on the problem that how do we get a comprehensive understanding of language evolution including biological evolution although the evolutionary relationship between genes and language is complex and shrouded in controversy. Especially, we try to investigate the directional effects between gene-culture coevolution of language by using a simple computational model with an integrated framework of gene-culture coevolution. We conduct evolutionary experiments and an analysis of transfer entropy for quantitative discussion of directional effects. The results show that the biological evolution seems to be unable to keep pace with language evolution in short time scales while the directional effects of each other are in the same range in long time scales, which implies that language and biological evolution could coevolve.



GS8-4 PajaroLoco: A suite of programs to study the grammatical structure of bird songs

Héctor Manuel Sánchez¹, Edgar E. Vallejo¹, and Charles E. Taylor²
(¹Instituto Tecnológico y de Estudios Superiores de Monterrey, Mexico)
(²University of California, United States)

Bird songs may serve as models of complex adaptive systems, similar to human language. Recent interest in analyzing acoustic sequences of animal communication has led to development of several software tools for identifying the elements of such sequences, but few for actually analyzing them. Previous work in our laboratories showed that graphs representing phrase transitions in songs of California Thrashers (*Toxostoma redivivum*) are helpful to analyze their structure, which may include comparison to expectation from Markov models and "small worldness". Subsequent work has shown that the songs of Southern House Wrens (*Troglodytes musculus*) and Common Nightingales (*Luscinia megarhynchos*) also show such structure. It seems likely that sequential vocalization in other groups can be similarly analyzed using measures derived from network-based models of social networking. We have developed a suite of programs, PajaroLoco, to aid such analyses.



January 22 (Thursday), 16:45–18:00

GS8-5 Methodological Framework for Evaluating Risk levels of Cascading Failures of the Global Network

Kazuko Yamasaki
(Tokyo University of Information Sciences, Japan)

The recent economic crisis has shown that different economic sectors are interconnected. The importance of evaluating potential risk levels of the crisis has been increasing but the methods quantifying vulnerabilities of complex systems have not been developed. Using worldwide Input-Output table during the period 1995-2011, we simulate a collapse of an industry in a given country. The discontinued cash flow from the collapsed industry causes other industries' failures when the cash inputs are under a tolerance level. The critical tolerance levels at the cascading failure sensitively describe the status of the industry network. Using these measures, we show the evolution of the importance of the countries and mention innovation of the industry structure of countries.

January 23 (Friday), 09:00–10:45

Room A

OS9 Intelligent Robotics and Bioinspired Technology

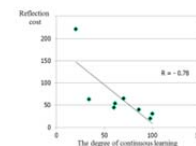
Chair: Maki K. Habib (American University in Cairo, Egypt)

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

OS9-1 Analyzing human's continuous learning ability toward the intelligent robotics

Tomohiro Yamaguchi¹, Kouki Takemori¹, Yuki Tamai¹, and Keiki Takadama²
(¹Nara National College of Technology, Japan)
(²The University of Electro-Communications, Japan)

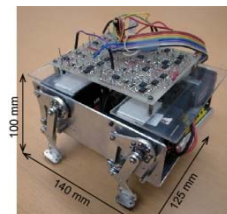
This paper presents the way to design the continuous learning process model based on general reinforcement learning framework. The objective of this research is to bring the learning ability of the learning robot close to that of a human. We focus on both the reinforcement learning framework for the learning robot and the continuous learning model of a human. To fill in the missing piece of reinforcement learning, we add two mental learning processes, awareness as pre-learning process and reflection as post-learning process. We designed the continuous learning task as 54 stages in ascending order of difficulty. To analyze the experimental results, there are interesting correlations on the quality of reflection. Then we define the reflection cost as the measurement to evaluate the quality of reflection. Therefore, the continuous learners truly work smart with a small reflection cost and a high tendency to accept failures.



OS9-2 Development of quadruped robot with locomotion rhythm generator using pulse-type hardware neural networks

Ken Saito, Yuki Ikeda, Minami Takato, Yoshifumi Sekine, and Fumio Uchikoba
(Nihon University, Japan)

This paper discussed about development of quadruped robot which could perform the quadruped animal-like locomotion. Locomotion rhythm of the quadruped robot was generated by using the pulse-type hardware neural networks (P-HNN). Quadruped robot had mechanical components and electrical components. The mechanical components of the quadruped robot consists by the body frame, link mechanisms, 4 legs and 4 servo motors to realize the quadruped animal-like locomotion. The body frame, link mechanisms, 4 legs were made from aluminum base alloy. The electrical components of the quadruped robot consist by control board, battery and P-HNN. P-HNN generates the locomotion rhythms using synchronization phenomena such as biological neural networks. The control board actuates the servo motors according to the generated locomotion rhythms. As a result, constructed quadruped robot could perform the quadruped animal-like locomotion using the generated locomotion rhythm was shown in this paper.

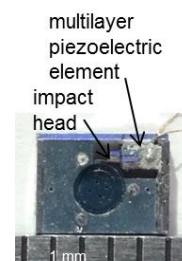


Constructed 100, 125, 80 mm, width, length, height in size miniaturized quadruped robot system. Robot could locomote using locomotion rhythm generated by pulse-type hardware neural networks.

OS9-3 Development of impact-type rotary actuator and application for MEMS microrobot by bare chip IC of hardware neuron model

Minami Takato, Yuka Naito, Kazuaki Maezumi, Yuki Ishihara, Yuki Okane, Hirozumi Oku, Masaki Tatani, Ken Saito, and Fumio Uchikoba
(Nihon University, Japan)

This paper proposes an impact-type micro electro mechanical systems (MEMS) rotary actuator and application for a millimeter scale MEMS microrobot. The rotational motion of the actuator was generated by vibration of a multilayer piezoelectric element. The size of the fabricated actuator was 1.0 mm × 4.4 mm × 3.2 mm. The fabricated actuator was controlled by the pulse-type hardware neuron model (P-HNM) as the biomimetics technology, and it was integrated in a CMOS IC. The maximum rotational speed was 65 rpm when an applied neuron frequency was 39.6 kHz and an input voltage was 3.48 V. The actuator showed the low power consumption of 96.4 mW. The fabricated actuator and the fabricated control circuit that included the P-HNM were built in the MEMS microrobot. The size of the fabricated microrobot was 4.0 mm × 4.6 mm × 4.8 mm.

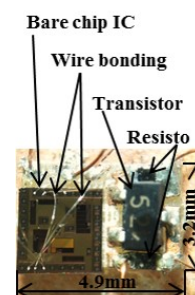


January 23 (Friday), 09:00–10:45

OS9-4 IC design of driving circuit of MEMS microrobot using pulse-type hardware neuron model

Yuki Ishihara, Yuka Naito, Kazuaki Maezumi, Yuki Okane, Hirozumi Oku, Masaki Tatani,
Minami Takato, Ken Saito, and Fumio Uchikoba
(Nihon University, Japan)

This paper presents the driving circuit which could generate the driving waveform of the piezoelectric element impact-type micro electro mechanical systems (MEMS) microrobot. The driving circuit consists of a bare chip IC of the pulse-type hardware neuron model (P-HNM) using CMOS process and peripheral circuit. The microrobot was made from silicon wafer fabricated by MEMS technology. The size of the fabricated robot was $4.0 \times 4.6 \times 3.6$ mm. The mechanical system of the robot equipped with millimeter size rotary-type actuator, link mechanisms and 6 legs. P-HNM has the same basic features of biological neurons. Therefore, P-HNM outputs the driving waveform using electrical oscillation such as biological neuron. As a result, we showed that driving circuit could generate the driving waveform for the rotary-type actuator of piezoelectric element impact-type MEMS microrobot without any software programs.



OS9-5 Vibrational Motion Control for Foamed Polystyrene Machining Robot and Extraction of Radius of Curvature for Fuzzy Feed Rate Control

Maki K Habib¹, Fusaomi Nagata², Tomoya Nagatomi²,
Shohei Hayashi², Akimasa Otsuka², and Keigo Watanabe³
(¹American University in Cairo, Egypt)
(²Tokyo University of Science, Yamaguchi, Japan)
(³Okayama University, Japan)

A cast metal is generally produced by using a sand mold. A foamed polystyrene mold is used as the master mold for making the corresponding sand mold. Recently, the development of a flexible machining robot for foamed polystyrene materials is expected in the cast metal industries because of the high cost and inefficiency of conventional large-sized CNC machine tools. To cope with the need, we already presented a machining system based on an industrial robot for foamed polystyrene materials. The developed robotic CAM system provided a simple interface without using any robot languages between a CAD/CAM system and the machining robot. In this paper, a vibrational motion control is proposed for the endmill of the machining robot in order to suppress the occurrence undesirable cusp marks. In addition, the calculation of radius of curvature along discrete CL data is introduced. The radius of curvature is important information as a fuzzy input for the fuzzy feed rate controller. The designs are shown.

OS9-6 Mechatronics Practices and Creative Thinking Skills

Maki K. Habib¹ and Fusaomi Nagata²
(¹American University in Cairo, Egypt, Egypt)
(²Tokyo University of Science, Yamaguchi, Japan)

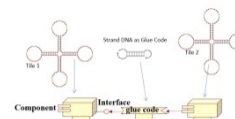
Recently, many studies and efforts on developing mechatronics educational experimental systems are conducted. In this paper, unique mechatronics educational experimental systems are proposed to enhance learning and creative thinking capabilities for undergraduate students. The first experimental system focuses to learn input/output port operations, periodically flashing LED lights with different timing and the control of stepping motor. The second experimental system aims to learn the operational principle and the use of A/D conversion associated with the use of analog sensor information, D/A conversion to control DC motor and applying PID control technique to enhance motor dynamic behavior. While, the third experimental system is designed by having a 4-DoF robot arm as a main platform to learn PWM (Pulse Width Modulation) for speed control of a DC motor and to learn force control associated with robot's end-effector. Finally, the fourth experimental system is designed to facilitate an efficient way to learn the conceptual structure and usage of multiple mobile robots in which the subsumption control architecture is incorporated within the system to support programming behavior based tasks. Each of these systems has its own important factor in which students should acquire through the hand on learning process, so that it is expected that the combination of all developed experimental systems and project based learning approach yield the desired promising results that enhances learning and creative thinking skills.

January 23 (Friday), 09:00–10:45

OS9-7 Controlling the Reversible Assembly/Disassembly Process between Components using Molecular Recognition in Molecular Robots

Wibowo Adi^{1,2} and Kosuke Sekiyama¹
(¹Nagoya University, Japan)
(²Diponegoro University, Indonesia)

In this paper, we report a multicomponent assembly and disassembly processes using DNA strand displacement to construct molecular robots. The framework for molecular robotics development designates the components as a part of the robot. Molecular recognition is used to control the reversible assembly and disassembly processes of multicomponent. The molecular recognition system identifies not only a single strand DNA but also a micro-ribonucleic acid (miRNA) as molecular stimuli in controlling the processes. The processes were experimentally demonstrated by gel electrophoresis, fluorescent observations and AFM observation.



Room B

OS12 Protocomputing

Chair: Moto Kamiura (Tokyo Denki University, Japan)

Co-Chair: Kazuto Sasai (Tohoku University, Japan)

OS12-1 An Exploring Model of True Slime Mold Based on Prediction and Anticipation

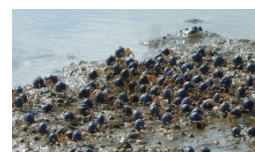
Iori Tani¹, Masaki Yamachiyo², and Yukio-Pegio Gunji¹
(¹Waseda University, Japan)
(²Kobe University, Japan)

We suggest an automata fashioned model of *Physarum plasmodium* exploring on the bland agar plate. In this study, we focus on the two levels of information usage. The local level information is called prediction and global level one is called anticipation. These concepts are used to localize the cell movement to a particular direction and self-accelerate the cell motility in different levels. According to the behavior of our model, it is suggested that the cooperation and balance of these two levels of information usage is necessary to achieve active exploring behavior.

OS12-2 Collective behavior of soldier crab swarm in both ring- and round-shaped arenas

Hisashi Murakami¹, Takenori Tomaru¹, Takayuki Niizato², Yuta Nishiyama³, Kohei Sonoda⁴,
Toru Moriyama⁵, and Yukio-Pegio Gunji⁶
(¹Kobe University, Japan)
(²Tsukuba University, Japan)
(³Osaka University, Japan)
(⁴Shiga University, Japan)
(⁵Shinshu University, Japan)
(⁶Waseda University, Japan)

To investigate collective foraging, we recorded behaviors of soldier crab swarms with 10, 20, 30, 40 individuals in experimental arenas. Thanks to markers attached to crabs' shells and image-processing software, we obtained time series of individuals' position during thirty minutes. We found the collective swarms show a type of foraging behavior in which the time interval between direction changes of swarms follows power-law distribution.

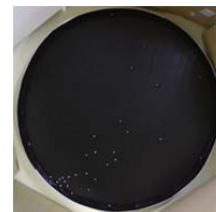


January 23 (Friday), 09:00–10:45

OS12-3 Information flow in a swarm of soldier crabs

Takenori Tomaru¹, Hisashi Murakami¹, Yuta Nishiyama², Kohei Sonoda³,
Toru Moriyama⁴, and Yukio-Pegio Gunji⁵
(¹Kobe University, Japan)
(²Osaka University, Japan)
(³Shiga University, Japan)
(⁴Shinshu University, Japan)
(⁵Waseda University, Japan)

Collective animal behaviors that have been observed in groups of insects, birds and fish. Scientific investigations, theoretical studies and field observations, have revealed possible underlying principles based on local interaction among individuals in a group without global information from conductors or leaders. Information flow transferred among individuals would play a key role to understand it. In this study, investigating how soldier crabs *Mictyris guinotae* use a history of its own behavior as information memory, we analyzed a behavior of soldier crabs in a circular-shaped arena.



OS12-4 Crossmodal audio-visual effects in motion prediction

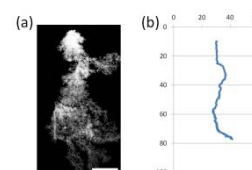
Tomoaki Nakamura¹ and Yukio-Pegio Gunji²
(¹Kobe University, Japan)
(²Waseda University, Japan)

Recently it has been reported that auditory stimuli effects visual information. However, what kind of a situation (environment) contributes to the audiovisual interactions is still incompletely understood. We hypothesized that auditory system works dominantly when visual continuity is lost. To investigate this hypothesis, we examined whether motion prediction (cognition) could be effected by auditory information when continuity of motion is lost. Results indicated that auditory dominance over vision needs to integrate visual information and auditory information perceptually or imaginably in advance. In other words, in crossmodal audio-visual effects (in motion prediction) it was suggested that it was necessary to correspond the visual information to the auditory information in advance.

OS12-5 A power law in the exploratory behavior of the *Physarum plasmodium*

Tomohiro Shirakawa, Hiroshi Sato, and Miharuru Nishida
(National Defense Academy of Japan, Japan)

The plasmodium of *Physarum polycephalum* is a unicellular giant amoeba that grows up to macroscopic scale under appropriate condition, and is known to its computational abilities. In this study, we tried to observe the long term exploratory behavior of the plasmodium in an open environment and to evaluate its efficiency. For this purpose, we developed an experimental system with an extendable substrate. As a result of the experiment, we found the presence of power law in the exploration by the plasmodium. By simulation, we further tried to estimate the efficiency of the exploration implemented with the patterns from the plasmodium, and confirmed that it is actually effective.



January 23 (Friday), 09:00–10:45

OS12-6 Collective behavior in the agent-based market model with framing heuristics

Kazuto Sasai¹, Yukio-Pegio Gunji², and Tetsuo Kinoshita¹
(¹Tohoku University, Japan)
(²Waseda University, Japan)

The behavioral models for economic systems are thought to be useful for the design of cooperation mechanism in the autonomic agent systems. In the recent topics, the market based collaboration mechanisms for the autonomic control system in the renewable energy plants. Behavioral economics suggests human cognitive biases are critical factor of economic behaviors, however, it is statistically incorrect. On the other hand, the extremely rational decisions such as artificial agents in the mathematical models induce a strong equilibrium state corresponding that the people do not have the courage to decide. In this paper, we discuss about the positive meaning of framing heuristics in an agent-based market model. The model tries to show some collective behaviors induced from interplay between local / global.

OS12-7 Analysis of used car market based on web scraping

Moto Kamiura^{1,2}, Hiroki Takano¹, and Yu Murata¹
(¹Tokyo Denki University, Japan)
(²Tohoku University, Japan)

Progress of information technology, such as increase of storage size, improvement of CPU performance and communication speed, has derived digitization of economic information. It is important to develop procedures for handling and analyzing the digitalized data. In this context, second-hand articles have useful feature for analyzing micro data on markets of the ones: i.e. a second-hand article has unique state, although a new article has a lot of the same of it. New articles may have multiple prices for identical ones, but each of second-hand articles has an intrinsic price appropriate to the state. Used car market which provides much information via internet is one of good sources of such micro data. Over 300,000 cars data can be found in Japanese used car market on World Wide Web. In the present study, we develop a web scraping system for web page acquisition and data reduction on used car market, and research statistical features of the market. The web scraping system consists of web crawler and HTML parser coded by Java. Used car data are collected by the following procedure: (1) Web crawler collects HTML files containing the used car data from web sites, and it saves the files into local storages. (2) HTML parser extracts types, model years, prices, mileages, addresses of retailers etc. of the HTML files and outputs a table as a CSV file. (3) We analyze data on the generated tables. Our system automatically do the processes (1) and (2) once per day. An ID number is assigned for data of one used car, to avoid double count. Used car stock changes day after day, although update ...

January 23 (Friday), 09:00–10:00

Room C

GS11 Evolutionary computations (Genetic algorithm)

Chair: Kazuko Yamasaki (Tokyo University of Information Sciences, Japan)

GS11-1 An approach to set-based particle swarm optimization with status memory for knapsack problem

Takahiro Hino, Sota Ito, Tao Liu, and Michiharu Maeda
(Fukuoka Institute of Technology, Japan)

Knapsack problem is one of combinatorial optimization problems. Particle swarm optimization (PSO) is an optimization approach that achieves the social model of bird flocking and fish schooling. Discrete PSO (DPSO) operates on binary space. For DPSO, a lot of studies have been done and memory binary PSO is decided a position according to the previous position, in which mechanism is simple and effective. Set-based PSO (S-PSO) operates on discrete space by using a set. S-PSO can solve combinatorial optimization problem with high quality and is successful to the large-scale problem. In this paper, we propose a novel algorithm of S-PSO with status memory to decide the position based on the previous position for solving knapsack problem. As some operators are redefined for the proposed approach, it is possible to search effectively and to simplify the algorithm. The proposed approach shows high qualities in experimental results.

January 23 (Friday), 09:00–10:00

GS11-2 Simulation Optimization Using A Genetic Algorithm With A Nitrogen Fertilizer Nutritional Knowledge Base for Rice Crops.

Pannavich Ariyatanakatawong and Worapoj Kreesuradej
(King Mongkut's Institute of Technology Ladkrabang, Thailand)

A nitrogen fertilizer is one of the important nutritional elements for the productivity of rice crops. Optimizing an application rate of nitrogen fertilizer is a key factor for increasing yields and reducing costs. This proposes using a genetic algorithm with a nitrogen fertilizer nutritional knowledge base for rice crops to search for an optimum application rate of nitrogen fertilizer. The proposed technique can search for an optimum application rate of a nitrogen fertilizer faster than typical genetic algorithms. In order to be profitable, farmers need to consider not only the rice crop yield but also cost of Nitrogen fertilizer and the labor cost of applying Nitrogen fertilizer. Therefore, the optimization strategy in this paper also considers the cost of nitrogen fertilizer and the labor cost of applying nitrogen fertilizer. The simulation results suggest that the purposed technique is a promising technique for optimizing an application rate of a nitrogen fertilizer.

GS11-3 Using novelty search to improve evolvability of physically simulated, developmental multicellular soft-robots

Michał Joachimczak, Reiji Suzuki, and Takaya Arita
(Nagoya University, Japan)

Novelty search is an evolutionary search algorithm based on the superficially contradictory idea that abandoning objective, goal focused fitness function altogether can lead to the discovery of higher fitness solutions. In the course of our work we have developed a highly biologically inspired, artificial development system that can automatically design, through the process of evolutionary search, complex morphologies and controllers of multicellular, soft-bodied robots. The system has been shown to be capable of evolving, through the use of objective fitness function driven evolutionary algorithm, complex, multicellular solutions that can walk, run and swim. In this work we compare the evolvability of swimming soft-bodied robots when using objective fitness function to the novelty search based approach and find that novelty search produced significantly better performing solutions.

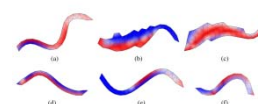


Figure 1: Example morphologies of individuals evolved using 2 evolutionary algorithms. All of 10 novelty search runs resulted in streamlined, snake-like morphologies (def). Best individuals obtained with NEAT had similar snake-like morphologies (a), but different morphologies (bc) were also observed. Colors indicate contraction of a body region (blue) or expansion (red). Motion videos can be accessed online: <http://youtu.be/a62P1U4yk8>

GS11-4 Evolving Emotion Recognition Module of Intelligent Agent based on Facial Expression and Gestures

Rahadian Yusuf, Dipak Gaire Sharma, Ivan Tanev, and Katsunori Shimohara¹
(Doshisha University, Japan)

The main research being conducted is focusing on designing computer agent capable of discerning user's emotion based on face expression and gestures, such as movement of head, nodding, shaking head, stillness, and so on. The computer agent also uses pervasive sensors in order to obtain more reliable data. Acquired data were not from single images, but from video input captured by Microsoft Kinect. This paper discusses on the Emotion Recognition Module of the said agent. The Emotion Recognition Module is evolved using in-house Genetic Programming Engine called XGP, that uses XML-based genotypic representations of candidate solutions, XML-schema to determine the allowed syntax of the genotypes, and UDP channel to communicate between fitness evaluator and the XGP manager to perform evolution on the individuals. The experiments showed that XGP could be used to evolve classifier, voting system improves the result, and that people might express emotions differently.

January 23 (Friday), 09:00–10:15

Room D

OS16 System Sensing and Its Applications

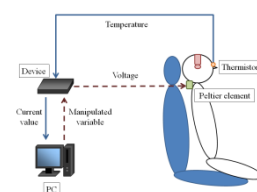
Chair: Masafumi Uchida (The University of Electro-Communications, Japan)

Co-Chair: Hirotohi Asano (Kagawa University, Japan)

OS16-1 Experimental Assessment of Drowsiness Inhibition System by Autonomic Nervous System Activity Monitoring and Adaptive Cooling Stimulation

Yasutaka Kajiwara¹, Hirotohi Asano¹, Shusaku Nomura², Shizuka Bando³, Tota Mizuno⁴,
Shigeaki Ogose¹, and Akio Nozawa³
(¹Kagawa University, Japan)
(²Nagaoka University of Technology, Japan)
(³Aoyama Gakuin University, Japan)
(⁴The University of Electro-Communications, Japan)

The overall aim of the study is to develop the ambient drowsiness control programs based on driver's physiological states. The purpose of this study is development and verification of a system that control driver's drowsiness by a stimulus too small to notice. Most studies of a driver's drowsiness have focused the detections or evaluations of psychological states in some way. Our system assumes that a small temperature stimulus affects on a peripheral thermoreceptor and the afferent fiber from the receptor is transmitted to a cerebral center by the spinal nerves. In order to evaluate the system, we constructed the virtual reality system for automobile driving. The experimental method we adopted was borrowed from our previous studies. In this study, we collected experimental data about subjects controlled drowsiness by our system and the effectiveness of the system is tested through experiment. In conclusion, it was suggested that our method for controlling a driver's drowsiness is efficient.



OS16-2 Evaluation of the autonomic nerve activity using a facial thermal image

Tota Mizuno¹, Shunsuke Kawazura¹, Hirotohi Asano², Kazuyuki Mito¹,
Yuichiro Kume³, and Naoaki Itakura¹
(¹The University of Electro-Communications, Japan)
(²Kagawa University, Japan)
(³Tokyo Polytechnic University, Japan)

This study has been carried out to evaluation of Mental Work-load with facial thermal image. In previous research activities about MWL, Research activities about MWL, there is the method using nasal skin temperature. These part that is reflect autonomic nerve activity well can be measured by non-contact thermometer easily. But the method needs to measures time-series data at all process of experiment. In addition, if subject is out of focus of infrared thermography, it is difficult to estimate MWL. In this study, new method are proposed to estimate of the autonomic nerve activity with facial thermal image. In experiment, facial thermal images of full face was taken when a subject solved the issue of a mental arithmetic calculation. And the proposed method has been analyzed by facial thermal images. As result of this experiment, proposed method is more sensitive than past technique with nasal temperature.

OS16-3 Interrelation Analysis of Vehicle Operating Data and Respiration

Shizuka Bando and Akio Nozawa
(Aoyama Gakuin University, Japan)

The objective of this paper is to clarify a mechanism of interrelation between VOD and physiological responses to a different psychological state. Multidimensional directed coherence analysis was applied to the human machine system observed by a vehicle operating data and physiological indices in order to reveal a mechanism of interrelation. This analysis is the way to visualize the information flow between an arbitrary number of time series signal in the frequency domain. It was found that the influence quantity of each index to the other changed according to an autonomic nervous system activation. As a result, physiological indices had more impact than VOD. In particular, the respiratory influence to the other indices were the highest in the four. The influence from the each index to the other changed according to an autonomic nervous system activation.

January 23 (Friday), 09:00–10:15

OS16-4 Classification and Estimation of Indoor Human Behavior by Heart Rate Variability

Takuya Watanuki¹, Akio Nozawa¹, Yoshimitsu Aoki², Tsuyoshi Moriyama³, and Kouhei Nomura⁴
(¹Aoyamagakuin University, Japan)
(²Keio University, Japan)
(³Tokyo Polytechnic University, Japan)
(⁴Osaka University, Japan)

In this research, indoor human behavior was classified and estimated by heart rate variability and 2D location information. As a physiological index, an autonomic nervous system was assessed by R wave interval and high-frequency component of HRV. As a behavioral index, 2D location information was assessed. As a result, fourteen indoor human behaviors were extracted. Those indoor human behaviors were classified in patterns of four actions which is TV/Talk, Eat, Sleep, and PC/Phone/Book. It was found that those four actions can be estimated by an autonomic nervous system index. Moreover, it was assumed that new group of indoor human behavior can be classified by adding 2D location information.

OS16-5 A Consideration of Fluctuation Features in Repetitive Handwriting

Yuki Oshima¹, Akio Nozawa², Tota Mizuno¹, and Masafumi Uchida¹
(¹The University of Electro-Communications, Japan)
(²Aoyama Gakuin University, Japan)

This study investigates the association between repetitive voluntary movement and mental load in an everyday repetitive action; namely, handwriting. To examine this association, we adopted a dual task method involving tapping and handwriting. Electrocardiogram readings were collected as a physiological index. For subjective evaluation, the subjects profiled their mood states and completed visual analogue scale questionnaires. These indexes comprehensively estimated the connection between repetitive voluntary movement and mental load.

Room F

OS5 Educational Technology and Applications

Chair: Kenneth J. Mackin (Tokyo University of Information Sciences, Japan)

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

OS5-1 Automatic verification method for semantic correctness of source codes fragmented by structure-oriented method and sorted by students.

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

In this 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 23 (Friday), 09:00–10:15

OS5-2 Teaching materials development of the natural environmental education for the junior and senior high school students using satellite data

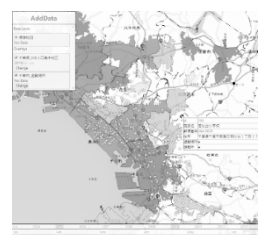
Jonggeol Park, Eiji Nunohiro, and Kenneth J Mackin
(Tokyo University of Information Sciences, Japan)

Global warming is the rise in the average temperature of Earth's atmosphere and oceans since the late 19th century and its projected continuation. The climate system can respond to changes in external forcing. As part of a large-scale instructional intervention research, this study examined students' science knowledge and awareness of social activism with regard to an increased greenhouse effect and global warming. The study was based on the analysis of students' responses to a writing prompt addressing an increased greenhouse effect and global warming at the beginning of and at the completion of instruction over the school year. In this study, we develop the teaching-materials of natural environment and global warming education for the junior and senior high school student using satellite data such as MODerate resolution Imaging Spectroradiometer (MODIS) and SCanning Imaging Absorption spectroMeter for Atmospheric CHartography (SCIAMACHY) by SIDAS system. To do natural environmental education in the elementary and secondary education based on the remote sensing engineering education.

OS5-3 Knowledge presentation using geographical maps on Web GIS

Shinya Iwasaki, Takashi Yamaguchi, and Eiji Nunohiro
(Tokyo University of Information Sciences, Japan)

We have developed a satellite image visualization web system that called Satellite Image Data Analysis System (SIDAS). SIDAS represents the satellite images derived from the sensor data of Earth Observation Satellite over eastern Asia, and provides these images via World Wide Web. Users can easily access to satellite images and it has been used for the education. However, non-expert users cannot understand the knowledge of environmental researches from satellite images without appropriate explanation. Therefore we have been started the development of Open Gaia System (Open Geographic information And Image Analysis System) that is an open accessed web knowledge base system for geographic information. The goal of Open Gaia System is the actualization of supporting environment for the knowledge discovery process in various geographic information. In this paper, we proposed and implemented a knowledge presentation function for the creation of own educational contents related to the geographic maps.



OS5-4 Practical use of the Tablet type Terminal by the Cloud type Education System

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

In this research, information literacy education in information systems educational institutions have been carried out using a conventional PC, replaced application development exercises, system settings, the elementary education, such as network settings to tablet devices and cloud-based education system, and the effect measurement I consider the possibility. The use of tablet type terminal in this research, not only electronic textbooks, teaching aids that have become common as how to use the tablet-type terminal, application development exercises, system settings, such as network settings conventional PC can be unless to support was not what was achieved in combination with a cloud educational system to perform the evaluation. In addition, I will discuss the future of the education system that was based on the evaluation.

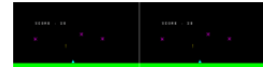


January 23 (Friday), 09:00–10:15

OS5-5 Stereoscopic video support for programming education

Kenneth J Mackin
(Tokyo University of Information Sciences, Japan)

Stereoscopic video, enabling the viewer to view video images in 3-dimensional depth, is a natural and intuitive form of human-computer interaction (HCI), and naturally stimulates the interest and imagination of students in computer programming classes. However, graphical applications can be difficult for beginner programmers, and stereoscopic video control requiring further complicating display coordinate calculations is usually too difficult for early learning stages in programming education. This research proposes using stereoscopic video programming for introductory level programming education. The aim of using stereoscopic video is to stimulate the interest in students and strengthen the learning motivation. In order to facilitate the stereoscopic image calculation, a very simple API is proposed. Using the proposed API, beginner programmers can develop stereoscopic video applications simply by specifying the depth of objects to be drawn, without worrying about graphic threads, event handlers, or stereoscopic image calculations.



January 23 (Friday), 11:00–12:15

Room B

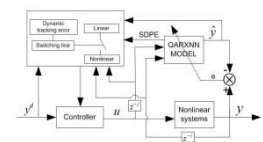
OS10 Learning and Control

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

OS10-1 The State-Dynamic-Error-Based Switching Control under Quasi-ARX Neural Network Model

Mohammad Abu Jami'in^{1,2}, Imam Sutrisno^{1,2}, and Jinglu Hu¹
(¹Waseda University, Japan)
(²Politeknik Perkakapalan Negeri Surabaya, Indonesia)

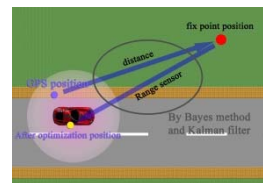
In our previous research, an error-based switching control has already used for controlling nonlinear system. However, the switching function is not work e ciently, because it is di cult to obtain more information from error vector to determine the stability of the control system. Hence unnecessary switching to linear controller will be longer and more often that causes the accuracy of the control system become poor. In this paper, a new switching rule based on Lyapunov stability theorem is proposed which is derived from the state dependent parameter estimation (SDPE). Not only error but also one up to p-th differential error will be available as the switching variable. Thus the proposed control method is able to keep the stability and improve the accuracy of the control system. A numerical simulation reveal that the proposed control gives satisfactory tracking and disturbances rejection performances.



OS10-2 An Automated Driving Positioning based on Bayesian Method

Yukun Zhang and Heehyol Lee
(Waseda University, Japan)

With the development of automotive technology, Driverless technologies have appeared in this world increasingly. Many people began to trust driverless cars, and desire to own them. In the driving process, the most indispensable of driverless cars is to accurately determine the car's location. Whether it's absolute position of the GPS signal or the relative position on the road should be very accurate in order to ensure the safety of vehicles. In this research, first, using Kalman filter updates the Automated Driving Position in the One and Two-dimensional Space. Then, propose a new method for improving Automated Driving Position. This method is a decentralized method based on the Bayesian approach, which combine the vehicle's GPS data and range between the vehicles and fix points. Furthermore, in order to update the new method effect, the Kalman filter has been employed to filter the dynamics trajectory of the vehicle.



January 23 (Friday), 11:00–12:15

OS10-3 Low cost sensor system for position and orientation control of an omni-directional mobile robot

Xiaoyu Wang and Heehyol Lee
(Waseda University, Japan)

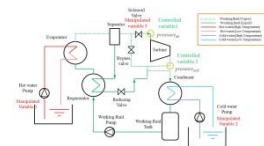
This paper presents a low-cost sensor fusion system for real-time position and orientation control of omni-directional mobile robot. An Inertial Measurement Unit called MPU6500 and incremental magnetic encoders on the motor provide all the data required for the sensor fusion system. Moreover, the proposed sensor system includes the compensation of the time-varying bias drift error in both gyroscope and accelerometer. The mobile robot we use 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 sensor fusion system is evaluated on our mobile robot.



OS10-4 Design of Decouple PID control system for Ultra-Compact Binary Power Generation Plant

Kunyoung Han and Heehyol Lee
(Waseda university, Japan)

A ultra-compact binary power generation is to generate electricity by low-temperature difference between hot water and cold water. In this paper, Three inputs and Two outputs Decouple PID control system that has a larger number of manipulated variables than the number of controlled variables is considered to increase the control performance. First, linearized transfer function models for the ultra-compact binary power generation plant are deduced. Then, a decouple PID control system is designed to remove the interaction between manipulated variables and controlled variables. Finally, its control performance is investigated through comparison with conventional Two inputs and Two outputs Decouple PID control system.



OS10-5 Stochastic optimal control for traffic signals of irregular intersection

ChengYou Cui¹ and HeeHyol Lee²
(¹YanBian university, China)
(²Waseda university, Japan)

In this paper, real time stochastic optimal control method for traffic signals of irregular intersection (number of lanes is asymmetrical) is proposed. A modified Cellular Automaton (CA) traffic model and Bayesian Network (BN) model are used to predict the traffic jams. Here, the calculation for prior probabilistic of outflows at different traffic signals is modified based on the actual situation. In addition, PSO algorithm is used to search optimal traffic signals based on the stochastic model. Finally, the effectiveness of the proposed method is shown through simulations at an irregular intersection using a micro traffic simulator.



January 23 (Friday), 11:00–12:15

Room C

GS9 Control techniques

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

GS9-1 H_2 state-feedback LPV controller design with multiple parameters for the nonlinear inverted pendulum problem

Nam Kyu Kwon and PooGyeon Park
(POSTECH, Republic of Korea)

This paper proposes continuous-time H_2 state-feedback LPV controller with multiple parameters for the inverted pendulum on a moving cart. Using this controller, we stabilize the inverted pendulum on a moving cart problem. Based on the LPV model with multiple parameters (LPV-MP), we first formulate the stabilization conditions in terms of parameterized linear matrix inequalities (PLMIs) and design the state-feedback LPV controller using multiple parameters dependent Lyapunov function (MPDLF). Then, these inequalities are converted into linear matrix inequalities using parameter relaxation technique. The simulation results show the effectiveness of the proposed controllers.

GS9-2 A Novel Lateral Control System Using Real-time Steering Angle with Field Test

EunSeong Pak, ChangHo Yu, and JaeWeon Choi
(Pusan National University, Republic of Korea)

In this paper, a novel lateral control system is proposed for the purpose of improving lane keeping performance which is independent from GPS signals. The lane keeping is a key function for realization of unmanned driving systems. For the purpose, we employ a data fusion algorithm along with a real-time steering angle of the test vehicle to improve lane keeping performance. The fused direction data come from an IMU sensor and a vision sensor. The performance of the proposed system was verified by computer simulations along with field tests using MOHAVE, a commercial vehicle of Kia Motors of Korea.

GS9-3 An Improved Resizing Method for Accurate Movement Imitation in a Humanoid Robot

Yoshitaka Sakai, Toru Kadoya, 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, we have been studying an approach called learning by imitation. In this approach, a human teacher shows his/her own movement to a robot, and the robot acquires a new movement by imitating it. In our previous study, we have built an imitation system in which the human teacher's movement is captured by a three dimensional camera. The captured movement is resized to the size of the imitating robot. Although the resizing worked well for various kinds of movements, it caused inaccurate imitation for some movements. In the present study, we improve the resizing method so that the imitation becomes accurate.

January 23 (Friday), 11:00–12:15

GS9-4 Optimal Real-time Pricing for Energy Management Systems Based on Switched Interval Markov Chains

Koichi Kobayashi and Kunihiro Hiraishi
(Japan Advanced Institute of Science and Technology, Japan)

Real-time pricing plays an important role in energy management systems. In real-time pricing, electricity conservation is achieved by changing the price in real-time. In this paper, the optimal real-time pricing method is proposed based on switched interval Markov chain (SIMC) models. First, the SIMC model is introduced as a mathematical model of consumers. Next, the pricing problem is formulated as a finite-time optimal control problem, and a solution method is derived. In the proposed method, a small difference between consumers is expressed by interval probabilities. Hence, the computational complexity of the pricing problem does not depend on the number of consumers. Therefore, the proposed method provides us a scalable real-time pricing algorithm.

GS9-5 On the discrete-time modeling for efficient OHT scheduling

Ryosuke Nakamura¹, Kenji Sawada¹, Seiichi Shin¹, Kenji Kumagai^{1,2}, and Hisato Yoneda²
(¹The University of Electro-Communications, Japan)
(²Murata Machinery, Ltd., Japan)

It is well known that the routing problem is recast as a binary integer linear programming in Overhead Hoist Transport (OHT) vehicle systems. This paper proposes two kinds of discrete-time state space modeling of the routing problem, which reduce the redundant constraints and the binary variables. First, a Petri Net method is applied for reducing the redundant constraints. Second, a DF automaton method is applied for reducing binary inputs of the state space equation of OHT systems. Finally, some numerical examples are shown to verify the validity of the proposed methods.

January 23 (Friday), 11:00–12:00

Room D

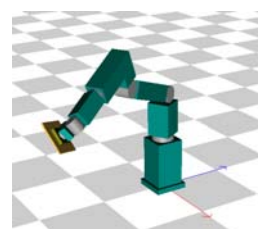
OS13 Robot control and computer vision

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

OS13-1 Optimization of module assemblage for the multi-purpose serial link manipulator

Yasunobu Hitaka¹, Masao Mori², and Hiroshi Hamamatsu¹
(¹Kitakyushu National College of Technology, Japan)
(²Reif Co., Ltd., Japan)

The module manipulator proposed by us is a typical serial link manipulator. However, it consists of some modules which can be changed easily. Several different types of modules are prepared and this manipulator can obtain appropriate power or operation space according to requests of users by selecting and assembling these modules. For the manipulator, it is necessary to decide the appropriate module assemblage automatically for requests. In this paper, we focus the efficiency of the motion of the module manipulator and achieve it by the meta-heuristic optimization algorithm. We present the details of our method and the effectiveness of our method is demonstrated by numerical simulations.

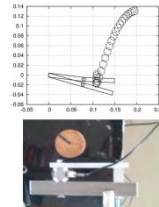


January 23 (Friday), 11:00–12:00

OS13-2 Analysis of the two-link-manipulator in consideration of the horizontal motion about object

Asaji Sato¹, Osamu Sato², Nobuya Takahashi², and Masahiro Yokomichi²
(¹National Institute of Technology, Miyakonojo College, Japan)
(²University of Miyazaki, Japan)

In this paper, equations of motion of two-link-manipulator are derived in consideration of characteristics of driving source. By considering for horizontal motion about object, 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 fundamental experiment.



OS13-3 Fundamental study of a trajectory tracking control problem of the LEGO tribot robot

Tetsuya Yamanaka, Nobuya Takahashi, and Osamu Sato
(University of Miyazaki, Japan)

This paper consider a tracking control problem of the mobile robot for a virtual target line path. The mobile robot is structured with a three wheels, which is called as a tribot, is constructed by using the Mindstorms NXT of the LEGO company. This robot's structure is very simple. It has two drive wheels on both body side, and it can moves straight and turned by driving these wheels as independently. But the trajectory deviate from the reference target line path because of the accumulated uncertainty in the estimated localization. This is causes from several reason, modeling error, slip of the tire, the noise in the measured value, and so on. We research more accurate control method to run on the virtual target line path given in beforehand to the mobile robot by using a estimated itself position by localization. In this research, the robot done the localization by using only an information of the internal sensor and not uses an external marker information. The tracking controller is designed by PID based method. Through the experiments results, we show the effectiveness of our method. And give the characteristics of the gyro sensor. We give the several knowledge about the control problem with the measurement signal including noise.



OS13-4 Virtual touch panel system with 3D hand motion sensor

Takahiro Inoue, Masahiro Yokomichi, and Takahiro Kai
(Miyazaki University, Japan)

Recently, many computer devices have been equipped with touch panels. They make user interfaces simpler by integrating the input and output for users. However, their size may restrict the fusibilities and it is not easy to control the accessibilities. To overcome these shortcomings, virtual touch panel systems have been studied by many researchers. This report proposes a virtual touch panel system which consists of HMD, monocular camera, and Leap Motion Controller, which is one of the 3D hand motion sensor and can measure the position of the hand and the fingers accurately. The virtual touch panel is generated by user's finger motion and is displayed to HMD screen with being superimposed to the image taken by the camera. In order to implement these functions, i) a finger gesture to determine the position and the size of the touch panel is defined, ii) a calibration method for the camera and the Leap Motion Controller is proposed. The effectiveness of the proposed system is examined by real world experiments. In addition, experiments were performed in a variety of situations for the calibration method, to investigate the situation whereby effective.



January 23 (Friday), 11:00–12:00

Room F

GS5 Biomedical Imaging

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

GS5-1 Pilot Study of Local Free Mesh Dynamic Model for VR System

Tatsushi Tokuyasu¹, Takaaki Nakayama¹, Kazuhiko Toshimitsu²,
Kazutoshi Okamura³, and Kazunori Yoshiura³
(¹Fukuoka Institute of Technology, Japan)
(²Oita National College of Technology, Japan)
(³Kyushu University, Japan)

Palpation is one of the diagnostic skills for dentists, which identifies the size, consistency and location of the tumor occurred beneath the patient skin. Accurate palpation skill of doctors can detect the disease earlier and enhance QOL of a patient after treatment. In the field of dental care, palpation also has been considered one of the important diagnostic skills for dentists. Regardless of the importance of palpation, any practical training of palpation against a patient did not carried out in the Japanese educational curriculum at present because of the consideration for patient safety. Then, the coauthor dentists strongly desire a training system where dental students can accumulate their experience of palpation with a patient without any risks and/or costs. Therefore, this study aims to develop a virtual training system for maxillofacial palpation. In this paper, the system structure and a virtual patient model experimentally constructed by using medical images of human head model and finite element method will be presented.

GS5-2 Development of an intraoperative position indication system in endoscopic Surgery (Withdrawal)

Tatsuya Ueno, Toshiya Nakaguchi, Hideki Hayashi, and Hiroshi Kawahira
(Chiba University, Japan)

GS5-3 Efforts for Assessing Psychological Resilience using EEG

Takako Otabe, Tomochika Kaneda, Makoto Yoshikai, and Tatushi Tokuyasu
(Fukuoka Institute of Technology, Japan)

Psychological resilience can be thought the strength of mind and is necessary for us to be well-being. This study aims to assess the psychological resilience by focusing on psychological response to stress stimulation. We first establish an experimental protocol using images and unpleasant memory as the stressors. The physiological response of participant to these stressors are measured by using electroencephalogram (EEG) and we assesses the physiological resilience based on the spectrum data of EEG. This paper presents first the proposed experimental protocol and discusses the probability of assessing the psychological resilience.

GS5-4 Deep multi-layered GMDH-type neural network using principal component - regression analysis and its application to medical image recognition of brain and blood vessels

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 using principal component-regression analysis is applied to the medical image recognition of the brain and blood vessel regions. The deep GMDH-type neural network algorithm automatically organize the deep neural network architecture which has many hidden layers. Furthermore, this algorithm can select optimum neural network architecture from three types of neural network architectures such as sigmoid function neural network, radial basis function (RBF) neural network and polynomial neural network. This algorithm is applied to the medical image recognition of the brain and blood vessel regions, and it is shown that this algorithm is useful for the medical image recognition of the brain and blood vessel regions.

