

ABSTRACTS

Plenary Speech I (Room F)

January 22 (Wednesday), 10:55-11:45

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

Attractor transition analysis of iPS cell and cancer metastasis in quantified Waddington epigenetic landscape (qWEL)

Hiroshi Tanaka
(Tokyo Medical and Dental University, Japan)

Cells execute their functions by activation of corresponding part of cellular molecular network (CMN). The architecture (network wiring) of CMN is congenitally coded in the germ-line genome for all the cells but actually utilized set of CMN parts is different for every cell type. We consider the activated pattern of CMN of specific cell by its expression profile of whole genes and consider "state space of the CMN (CMN-space)" where each expression pattern of cell can be described as a point (S) within this space. We denote frequentness of each CMN state by introducing the probability distribution $\Phi(S)$ into the CMN-space, and further, define the quasi-potential U of state S through the transformation $U \sim -\ln\Phi(S)$. U is considered to represent the stableness and realizability of CMN-state and could be considered as the quantified version of "Waddington's epigenetic landscape (qWEL)", where each cell type represents a basin in the epigenetic landscape, separated by "epigenetic barrier".

We conduct the study considering cell conversion as attractor transition in the qWEL space. First, we consider iPS cell generation as attractor transition from fibroblast cell to iPS cell and explore the genes which, by up-regulating them, would increase the minimum potential of fibroblast and make attractor transition more probable, and found these genes containing Yamanaka four factors. Second, we consider the cancer metastasis is driven by epithelial-mesenchymal transition (EMT) where epithelial cell converts to mesenchymal cell. We conducted the experiment observing the temporal change of gene expression profile during EMT of retinal pigment epithelium cell line. The ARACNe algorithm was used to infer structural change of CMN. The global structural change of CMN is estimated during EMT where TWIST1/2, ZEB1 and TCF3 act as master regulators.

Though these studies, qWEL theory might bring about the theoretical basis for biological development and can be applied to regeneration medicine and cancer therapy.

Plenary Speech II (Room F)

January 23 (Thursday), 11:00-11:50

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

Unified transition to cooperative unmanned systems under Spatial Grasp paradigm

Peter Simon Sapaty
(Institute of Mathematical Machines and Systems, National Academy of Sciences, Ukraine)

A novel philosophy, ideology, methodology, and supporting high-level networking technology will be revealed capable of guiding gradual transition to intelligent unmanned systems with a variety of important practical applications. The approach is based on a completely different type of high-level language capable of grasping top semantics of complex spatial operations in dynamic and unpredictable environments while shifting numerous technical details to effective automatic implementation. The language is based on holistic and gestalt principles rather than traditional multi-agent organizations, providing high integrity and super-summative features of the solutions described. Cooperative networked interpretation of the language in distributed systems and different parallel and distributed scenarios in it will be demonstrated that can be performed by any combination of manned and unmanned components under unified command and control provided by the technology described.

Special Session on Urban Resilience and Technology (Room G)

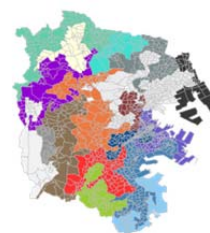
January 23 (Thursday), 15:00–17:00

Chair: Leena Ilmola (International Institute for Applied Systems Analysis (IIASA), Austria)

SS1 Graph Partitioning algorithm for Designing Resilient Local Communities Electricity Sharing System

Yoshiki Yamagata, Hajime Seya, Sho Kuroda
(National Institute for Environmental Studies, Japan)

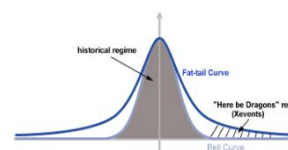
This paper extends the concept of our proposed [Yamagata and Seya, [1],[2]; Yamagata et al. [3]] electricity storage sharing system as a complement or alternative to a feed-in tariff (FiT) to achieve CO2-neutral transportation in cities. In our proposed system, electricity generated from widely introduced solar photovoltaic panels (PVs) is stored in the “cars not in use” in a city. For example, almost half of the cars in the central Tokyo metropolitan area are used only on weekends and thus are kept parked during weekdays. These cars represent a huge new potential storage depot if they were replaced by electric vehicles (EVs), that is, they could be used as storage batteries in a V2G system. The results of our previous study [3] showed that although the entire electricity surplus (PV supply minus demand) could be stored without waste if 12% of the EVs not in use were utilized as storage batteries at an aggregate (city) level in August (with maximum solar irradiance), there exist significant regional mismatches at the local district level. Hence, based on the geographical electricity surplus estimates, this paper develops a metaheuristic-based graph partitioning spatial clustering algorithm to find optimal spatial clusters where local mismatches between electricity surplus and storage potential is minimized, and self-sufficient green electricity is achieved.



SS2 Resilience by shock testing

Leena Ilmola¹, Byeongwon Park²
(¹International Institute for Applied Systems Analysis (IIASA), Austria)
(²Science and Technology Policy Institute (STEPI,) Korea)

Environment dominated by emerging uncertainties set a challenge to decision making. Our paper describes a method developed to plan for uncertainty. As the basis for theoretical elaboration we examine ontological uncertainty, the situation where we do not know what we do not know. The method developed for this situation is called resilience portfolio modeling. The method is applicable in the situation where technology development does not allow us to apply traditional foresight methods. The two fundamentals of the method are instrumental usage of extreme radical technologies and definition of the portfolio of resilience developing actions.



January 22 (Wednesday), 9:00-9:45

Room A

GS6 Evolutionary computations

Chair: Reiji Suzuki (Nagoya University, Japan)

GS6-1 A new swarm intelligence algorithm for continuous function optimization

Arit Thammano, Supparuek Saengrattanachaiyakul
(King Mongkut's Institute of Technology Ladkrabang, Thailand)

This paper proposes a new meta-heuristic algorithm for continuous function optimization. The proposed algorithm is inspired by the way in which insects communicate with each other to inform of an impending danger. In doing this, a chemical substance, called the alarm pheromone, is released into the environment. This results in various kinds of responses. This paper focuses on the two most common responses: (i) it draws nearby insects to attack the target, and (ii) it warns the others to flee the area. These two responses are the main concepts of the proposed algorithm. The proposed algorithm is tested on 6 benchmark functions. The performance of the proposed algorithm is compared with those of Abbass's Marriage in honey-bee optimization (MBO) and Self-organizing model of marriage in honey-bee optimization (SMBO). The experimental results show that the proposed algorithm outperforms the compared algorithms in terms of the processing time and the average effectiveness.

GS6-2 Evolution of introns in linear genetic programming - A study on symbolic regression problems -

Ukrit Watchareeruetai
(King Mongkut's Institute of Technology Ladkrabang, Thailand)

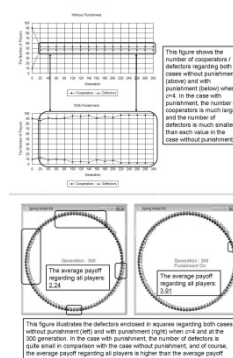
This paper presents an approach to force linear genetic programming (GP) to evolve introns, i.e., non-effective instructions in programs. In this paper, a chromosome in linear GP encodes multiple solutions. In particular, the value stored in the n th register will be used as the output of the n th solution. Each solution in a chromosome will be evaluated and assigned a fitness value. The solution that yields the best fitness is called active solution, whereas the others are inactive solutions which usually consist of introns. When two programs are compared, their active solution fitness will be considered with the first priority. If the two programs have the same active solution fitness, the fitness values of inactive solutions will be sorted and compared one-by-one. In this way, introns would be evolved with a guide and could be switched to be active later on. Experimental results show that the proposed approach outperforms a conventional linear GP in terms of the number of successful runs and computation time.

GS6-3 Teaching a lesson: A new notion of punishment for the evolution of cooperation

Tetsushi Ohdaira
(Aoyama Gakuin University, Japan)

Currently, the study of cooperation under non-kin relationships in prominent journals mainly discusses the effectiveness of punishment that a player pays certain costs and punishes an uncooperative player. Regarding this punishment, there are some negative propositions and also some positive propositions.

Opposing to these previous propositions, this study proposes the novel model introducing the new notion of punishment "teaching a lesson". Because the degree of teaching a lesson (punishment) is proportional to the payoff of the teaching player, the higher his/her payoff becomes, the harder he/she takes punishment on his/her opponent. Utilizing this model, the author investigates whether the changes in both the rate of cooperation among players and the average payoff of all players are dependent on punishment or not. In addition, on the basis of these previous propositions regarding the effectiveness of punishment, the author organizes the new findings from this model.



Room B

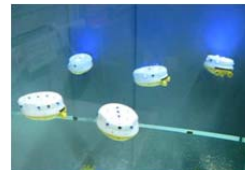
GS12 Multi-agent systems

Chair: Kentarou Kurashige (Muroran Institute of Technology, Japan)

GS12-1 Decentralized Underwater Swarm Communication Using Bio-inspired Approaches

Donny Sutantyo, Paul Levi
(University of Stuttgart, Germany)

Interference and jamming become very crucial issues in swarm robot communication and sensing, especially in underwater applications. In this paper, bio-inspired approaches are proposed to construct a robust communication scheduling to solve the problem. The scheduling mechanism is combined from two well-known bio-inspired algorithms, the firefly-inspired phase synchronization algorithm and the frog-call-inspired anti-phase synchronization algorithm. Novel distributed models for both algorithms are also investigated to improve scalability and provide decentralization of the algorithms. It is proven from a series of simulated experiments that the model is robust and viable for scheduling underwater swarm communication and sensing. In the end, a real robot experiment using underwater swarm robot platforms is also performed.



GS12-2 A Kangaroo Inspired Robotic System: A System of System to Assist Fire Fighters

Trung Dung Ngo
(University of Brunei Darussalam, Brunei Darussalam)

It is very risky for fire fighters to search for and rescue victims in collapsed buildings. The risk can be minimized if they know what is happening inside the building prior to carrying out their mission with the old-fashioned technology that they have used for last 50 years. In this paper we present a kangaroo-inspired robotic system - a system of systems in robotics - that functions as a team of first responders for fire fighters. The semi-autonomous system consists of a kangaroo marsupial robot and three juvenile robots that can be quickly deployed and dispersed for exploration and victim identification. The robots can self-organize an ad-hoc communication network to transmit collected information of victims from the juvenile robots to fire fighters. We highlight the key characteristics of this system in terms of the features of complex systems. Finally, we introduce new concepts of a system of systems demonstrated through experiments of the kangaroo inspired robotic system.



GS12-3 Effective Initial Route Construction for Mobile Relay on Wireless Sensor Network

Yogi Anggun Saloko Yudo, Noritaka Shigei, Hiromi Miyajima
(Kagoshima University, Japan)

In recent years, mobile relay has been studied in order to reduce the energy consumption in WSN [2]. The concept of mobile relay is that some movable nodes can change their location so as to minimize the total energy consumed by both wireless transmission and locomotion. Mobile relay needs to determine an initial route that represents the sequence of relaying nodes. We have already proposed several initial route construction algorithms based on greedy approaches [3,4]. However, the conventional methods cannot always provide optimal routes, because they do not examine all the possible routes. In this study, we propose battery-aware initial route construction based on Dijkstra's algorithm (BAIR-D), which utilizes the node information outside of the direct communication range. The algorithm has a capability to examine all the possible routes. We show the effectiveness by using numerical simulation.

January 22 (Wednesday), 9:00-10:15

GS12-4 Proposal and evaluation of MANET's routing protocol on the assumption of a disaster

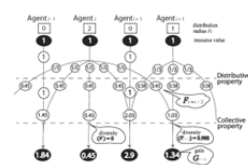
Keisuke Gohara, Hiroyuki Nishiyama
(Tokyo University of Science, Japan)

When a disaster occurs, victims must be rescued quickly and their safety confirmed. However, current information-gathering systems may become unusable if their infrastructures are destroyed. The Mobile Ad Hoc Network (MANET) has attracted attention as a rescue-support system. However, MANET currently has two problems in disasters. The first is the increased number of devices composing MANET. The increased number of devices increases the total number of control packets and degrades the availability of MANET. Second is the difficulty of ensuring electric power. If it is difficult to ensure electric power, the energy status of devices must be considered. In this paper, we propose a MANET system that uses location information and the energy status of the node. By simulating a disaster using ns-2, we demonstrate that our proposed system outperforms the existing systems in the total number of control packets, the delay time, and the average power consumption.

GS12-5 The Role of the Emergent Property of Resource in the Evolution of Distributive Altruism based on Reciprocity

Fuki Ueno^{1,2}, Takaya Arita¹
(¹Nagoya University, Japan)
(²Chukyo University, Japan)

One of the most significant problems in interdisciplinary research fields including evolutionary biology, ecology, economics and sociology is to explain social behaviors such as cooperation. Cooperation seems to be difficult to reconcile with natural selection. Why should an individual help another under Darwinian selection? This paper focuses on the distributive altruism. It seems obvious that giving out nothing is more adaptive than giving resources to others. However, at least we humans as innately social animals sometimes share resource with others in our daily social life. We develop an evolutionary model with the Distribution Dilemma game and investigate the evolution of distributive altruism based on spatial reciprocity, especially by paying attention to the effect of the emergent properties of resource during distribution.



January 22 (Wednesday), 9:00-10:15

Room C

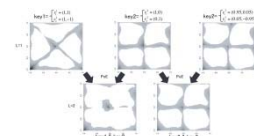
GS9 Intelligent control & modeling I

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

GS9-1 Adaptive LSH based on the particle swarm method with the attractor selection model for fast approximation of Gaussian process regression

Yuya Okadome, Kenji Urai, Yutaka Nakamura, Tetsuya Yomo, Hiroshi Ishiguro
(Osaka University, Japan)

Gaussian process regression is one of the non-parametric methods and has been studied in many fields to construct a prediction model for highly non-linear system. It has been difficult to apply it to a real time task due to its high computational cost but recent high performance computers and computationally efficient algorithms make it possible. In our previous work, we derived a fast approximation method for Gaussian process regression (GPR) using a locality-sensitive hashing (LSH) and product of experts (PoEs) model, but its performance depends on the parameter of hash functions used in LSH which is usually determined by randomly. In this research, we propose an optimization method for the parameters of hash functions referring based on a swarm optimization method. The experimental results show that accurate force estimation of an actual robotic arm is achieved with high computational efficiency.



GS9-2 Development of web based software to share multi-channel surface EMG data for automatic bicycle saddle height control system

Shimpei Matsumoto¹, Tatsushi Tokuyasu², Shoma Kushizaki², Tomoki Kitawaki³
(¹Hiroshima Institute of Technology, Japan)
(²Fukuoka Institute of Technology, Japan)
(³Okayama University, Japan)

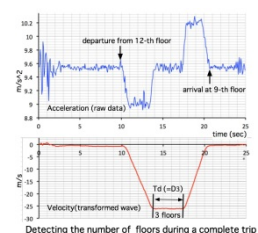
In cycling competitions, a type of competitive bicycle called "cycle road racer" has been utilized. The position setting of this type of bicycle basically depends on frame, handle, saddle, wheels, pedals, and so on. At present cyclists have determined the settings by relying on vague standards such as riding feelings and/or the empirical advices from skilled riders or experts. Against the background of cycling exercise, we have studied how to search an efficient setting of saddle positions for the physical properties of a cyclist, and have developed automatic bicycle saddle height control system. In order to establish a criterion of evaluating the setting of handle and saddle positions, we had employed surface electromyography (SEMG) of lower limb muscles in pedaling motions. In order to collect a lot of dataset of cyclists and to feedback the analysis result to the cyclist, this paper develops a web based software to share and manage multi-channel surface EMG data with Apache, PHP and Microsoft SQL Server, which can store a huge volume of SEMG signal data according to the conditions of pedaling exercise.



GS9-3 Detecting velocity profile generated by an elevator control system and estimating the elevator car position using accelerometer of an Android smartphone

Fujio Yamamoto, Hiroshi Tanaka, Haruhisa Yamaguchi
(Kanagawa Institute of Technology, Japan)

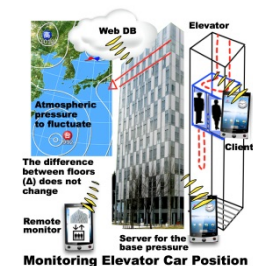
We devised a method for estimating elevator car position in real time, by merely putting in it an Android smartphone that has accelerometer. It is known that there is a pair of a mountain and a valley as an acceleration pattern in elevator movement during a trip from a starting floor to the destination floor. The interval (T_d) between the time a mountain has finished going down and the time a valley begins going down denotes traveling under constant speed, in the case of elevator rising. When an elevator goes down, a valley is replaced with a mountain. Therefore, by the length of the T_d , we can know theoretically the number of floors that an elevator passed through. Whenever an elevator stops, the current floor is set as the base floor, so that there exist no accumulated errors in contrast to general methods to obtain movement distance by integral calculus.



GS9-4 Estimating elevator car position by referring to Android server providing fluctuating atmospheric pressure of a base floor

Fujio Yamamoto, Haruhisa Yamaguchi, Hiroshi Tanaka, Takayuki Suzuki
(Kanagawa Institute of Technology, Japan)

Proposed here a method to get vertical positional information in the building at low cost. Atmospheric pressure sensor is incorporated in recent Android smartphone. Using it, we developed a method to estimate which floor the smartphone was put on at that moment. Although the atmospheric pressure considerably fluctuates with time, the difference of pressures between floors is known to be approximately constant. Therefore a certain floor is chosen as a standard floor, and a server (Android device) measuring standard pressure is put in that floor. The atmospheric pressure level measured by that server is sent out to a cloud database regularly at a short interval. Another client Android device that is moving with a person (or which is put in the elevator car) receives the latest pressure. The client can estimate its current floor according to the difference between its own pressure level and the standard pressure level.



January 22 (Wednesday), 9:00-10:15

GS9-5 Robust Trajectory Estimation of Moving Objects Using Multiple RFID Sensors

Hyunjin Chang, Taeseok Jin
(Dongseo University, Korea)

In this paper, research group supported by Innovation center for Engineering Education of Dongseo univ., undergraduate students in electrical and computer engineering must work on a capstone design project in their senior year in order to graduate. The group suggested absolute position estimation method for a mobile robot in indoor environment is proposed in this paper. Design and implementation of the localization system comes from the usage of active beacon systems (based upon RFID technology). The active beacon system is composed of an RFID receiver and an ultra-sonic transmitter. The RFID receiver gets the synchronization signal from the mobile robot and the ultra-sonic transmitter sends out the traveling signal to be used for measuring the distance. Position of a mobile robot in a three dimensional space can be calculated basically from the distance information from three beacons and the absolute position information of the beacons themselves. In some case, the mobile robot can get the ultrasonic signals from only one or two beacons, because of the obstacles located along the moving path. Therefore, in this paper, as one of our dedicated contribution, the position estimation scheme with less than three sensors has been developed. Also, the Extended Kalman Filter algorithm is applied for the improvement of position estimation accuracy of the mobile robot.

January 22 (Wednesday), 9:00-10:15

Room D

OS4 Bio-thermofluid phenomena

Chair: Ken Naitoh (Waseda University, Japan)

Co-Chair: Takashi Matsuo (Kanagawa Institute of Technology, Japan)

OS4-1 Millenary genius: producing seminal works on computers

Ken Naitoh
(Waseda University, Japan)

Statistical physics reveals the standard network pattern of neurons inside the brain and of biomolecular systems, including those for the circadian clock. The standard network is basically constructed with six macroscopic groups of neurons and molecules. A dynamical equation describing the network demonstrates mysterious temporal oscillations, with frequencies related to the super-magic numbers, including the golden, silver and yamato ratios. Outside the brain, the numbers can also be observed in the nature of atoms, molecules, and stars. Thus, sympathetic resonance with the discrete super-magic numbers appearing both in the brain and in nature easily occurs, which accelerates memorization and judgment. As the magic numbers also are present in music, fine arts, and poetry having a comfortable rhythm or melody, brain fitness can be evaluated by the comfortable numbers, which leads to an ageless brain producing creative works on computer.

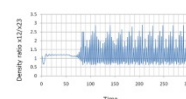


Fig. 4: Temporal evolution of computational results of brain activities.

OS4-2 Fundamental combustion experiment of biomass fuel made from thermophile bacteria

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

Industrial use of bacteria as a method for generating environmentally-friendly energy attracts attention. We focus on a thermophile bacteria (*Aeropyrum pernix* K1) and study the use of it. The bacteria thrives at high temperature, 80°C or more, and contains more than 10% oxygen in its microorganism. So, there is a possibility to use it as oxygenated fuel in the area that the oxygen concentration is low. We directly burn the thermophile bacteria by using a semiconductor laser (output 1.36 [W]) at very lean conditions of oxygen in the air. The results show that the thermophile bacteria can be used as oxygenated fuel for air- and space- crafts.



OS4-3 Blood flow velocity waveforms in the middle cerebral artery during cycle exercise and recovery

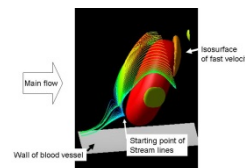
Takashi Matsuo¹, Shin-ichi Watanabe¹, Mutsumi Sorimachi¹, Hidenobu Takao¹, Tatsuhisa Takahashi²
(¹Kanagawa Institute of Technology, Japan)
(²Asahikawa Medical College, Japan)

The blood flow velocity waveforms in the middle cerebral artery (MCA) were measured under incremental cycle exercises and following recovery using the transcranial Doppler ultrasound velocimeter. At rest, the flow waveform in the MCA is characterized by a high forward flow at end-diastole, which is as much as half peak-systolic velocity. The peak-systolic velocity V_s was found to markedly rise in proportion with exercise intensity under mild and moderate intensities (up to 110 Watt) of exercise, while they tended to keep constant values under higher exercise intensities (above 110 W). The end-diastolic velocities V_d showed no significant change under mild exercise intensity and gradually increased under moderate exercise intensities. It was also found that the V_d values decrease more rapidly than V_s in recovery phase. Such nonlinear changes of V_s and V_d indicate that the influence of exercise on cerebral blood flow is more complicated than thought before.

OS4-4 Fusion Visualization for Fluid Dynamics in Blood Vessel

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

The speed-up of supercomputer has increased the complexity of the simulation. To analyze such data, new types of visualization software will be needed. As one of the ways, we are developing "Fusion Visualization" in a project sponsored by Japan Science and Technology Agency (JST). It can visualize data with both volume and surface rendering. The concept was reported at AROB 18th in Korea. To report the ongoing, we report the application example which applies it to blood flow simulation.



OS4-5 Control of Cell Growth Utilizing Magnetic Force

Shinjiro Umezu^{1,2}, Taishi Shinkawa¹, Ryosuke Araki¹
(¹Tokai University, Japan)
(²Riken, Japan)

Three-dimensional (3D) cell structures are required to fabricate artificial organ. Inkjet technology is applied for fabrication of 3D cell structures in order to fabricate artificial organ and investigate biochemical characteristics of cells in 3D cell structures. Usually cells those are located inside 3D cell structures get nutrition via blood vessels. Blood vessels are critical component to fabricate 3D cell structures. Electrostatic inkjet is applied to fabricate 3D cell structures those have blood vessels because electrostatic inkjet has following good merits those are high resolution to print and ability to print highly viscous liquid. Nutrition is transported via blood vessels. When amount and flow of nutrition is controlled, growth speed of cells is changed. In case that magnetic particles are installed in the dish that is filled with medium, nutrition and living cells, when the magnetic particles are trapped and transported by magnetic force, control of cell growth will be controlled. In this paper, we challenge to control the flow utilizing magnetic particles and magnetic force. Flow in medium is generated and growth area of cells is controlled with the experimental set-up.

January 22 (Wednesday), 9:00-10:00

Room E

OS9-I Intelligent building and life

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

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

OS9-1 Multi-module Based Multi-level Monitoring System Applied in Intelligent Life

Yi-Lin Liao, Kuo-Lan Su, Lee-Wei Chang
(National Yunlin University of Science and Technology, Taiwan)

The paper develops a multi-module based multi-level monitoring system using multiple multi-sensor fusion algorithms for intelligent building. The security structure is called M3 system. The system contains various active detection modules, various passive detection modules, some appliance control modules, a monitoring computer, an image system and an experimental platform. The monitoring structure of the system includes three levels. The level one contains some passive detection modules and some active detection modules. Each module uses various fusion algorithms to get a decision output for the dangerous event. The passive detection modules contain wire detection modules and wireless detection modules, and transmit detection signals to the monitoring computer. Mobile robots are active detection modules and carry various sensors to search dangerous events. Each mobile robot transmits the real-time event signal to the monitoring computer and the other mobile robots via wireless RF interface. The level two fusion some decision output of passive detection modules and some active detection modules from the level one to get a decision output using Bayesian estimated method, and transmits the decision output to the level three. The level three integrates the image system, some function based mobile robots and the detection output of the level two, and decides the output of the level using weighted average algorithm. The monitoring computer controls the assigned mobile robots move to the event location for double check according to the decision output of the level two. Finally, we present some experimental scenarios using two mobile robots (active detection modules), wire and wireless fire detection modules (passive detection modules) and an image system using the proposed methods for the fire detection in the experimental platform.

OS9-2 Investigation and analysis of barrier-free environment- on Nantou County Libraries, T

Ching-Jung Chang, Lei-Lei Chu
(Chung Hua University, Taiwan)

Libraries play the role of spreading knowledge and disseminating wisdom in human society. They are the primary institutes for collecting, organizing and conveying information in an advanced society, as well as the stronghold for publicizing political situation and offering life-long learning for the public. Moreover, it is also the best place for the public to pursue progress and complete self-learning. To people with physical and psychological disabilities, libraries are also important knowledge treasury. The main purpose of this study is to investigate the current status of barrier-free environment in Nantou County Libraries and the satisfaction of users. The research scope is the barrier-free facilities in 13 existing public libraries in Nantou County. The research subjects are the general public and people with physical and psychological disabilities who are users of these libraries. This study used field survey, questionnaire survey and expert interview as the research methods.

Firstly, this study performed descriptive statistical analysis on the content of the inspection forms obtained from the field survey to analyze the compliance rate (rate of compliance with the standard of installation) of barrier-free facilities in various libraries. Secondly, this study conducted a questionnaire survey. The questionnaire contained 20 questions. A total of 163 valid questionnaires were returned, including 114 from the general public and 49 from people with physical and psychological disabilities. This study then performed Principal Component Analysis (PCA) on the results of the questionnaire survey to understand the opinions on and satisfaction with barrier-free facilities of the general public and people with physical and psychological disabilities. Lastly, this study conducted expert interviews to investigate the dimensions of architecture-related laws and systems, site management and maintenance and needs of users with physical and psychological disabilities. After the analyses, this study proposed specific suggestions as the basis for the future improvement.

OS9-3 A Study on the Correlation between Construction Cost Index, International Commodities and Taiwan's Financial Indices

Shih-Sung Lin, Ching-Jung Chang, Yi-Jen Wang
(Chung Hua University, Taiwan)

Construction costs often fluctuate with the costs of international commodities or financial environment, and such cost changes may affect the construct progress, or in worse cases, result in suspension of the construction or bankruptcy of the developer. This study intends to use MANOVA to identify the correlation between construction cost index (CCI) and global financial centers index (GFCI), and further use the stepwise multiple regression method to predict the CCI, thus determining the correlation between construction costs and relevant factors of economic development. The results can serve as the basic information for the prediction of construction cost.

This study collected the monthly historical data of relevant international commodities, energy and financial indices after 2000. After screening, eight basic variables were selected, which are international gold price, global crude oil price, US dollars exchange rate, TAIEX weighted index, leading indicator, wholesale steel index, index of agricultural products, and import price index for analysis of the correlation with Taiwan's CCI. Based on the indices, MANOVA and correlations are used for statistical analysis. Next, the stepwise multiple regression method is used to determine the independent variables of the greatest predictive power from the independent variables, and find the regression equation. As a result, timely correction can be made in regression analysis as the reference for the construction industry in future construction, procurement or investment.

**OS9-4 The Correlation Research between Construction Cost and Connected Industries-
Based on the Related Industries and Consumption Index**

Ching-Jung Chang, Yi-Hsien Pai, Po-Jen Cheng
(Chung Hua University, Taiwan)

Construction industry is infrastructure industry of national economic construction, which can lead or affect the development of other related industries. This article plans to explore correlation between construction index and the related industries with statistical analysis method through various relevant industry indexes, and establish a regression prediction model with regression analysis for further trend study.

Four relevant consumer behavior indexes are selected from the main ten domestic industry indexes and consumer price index relating to construction cost index to with MANOVA analyze differentiation among the relevant indexes. Adopt principal component analysis to integrate the properties of variables for construction cost indexes that are set as dependent variable, and make industry analysis and regression prediction through the properties of variables again for the references of future expansion or investment.

January 22 (Wednesday), 13:00-14:15

Room A

GS1 Artificial intelligence

Chair: Chatklaw Jareanpon (Mahasarakham University, Thailand)

GS1-1 A self-adaptive differential evolution algorithm for continuous optimization problems

Duangjai Jitkongchuen, Arit Thammano
(King Mongkut's Institute of Technology Ladkrabang, Thailand)

This paper proposes a new self-adaptive differential evolution algorithm for continuous optimization problems. The proposed self-adaptive differential evolution algorithm extends the concept of the DE/current-to-best/1 mutation strategy to allow the adaptation of the mutation parameters. The control parameters in the mutation operation are gradually self-adapted according to the feedback from the evolutionary search. Moreover, a new local search based on the krill herd algorithm is combined into the proposed differential evolution algorithm. In this study, the proposed algorithm has been evaluated and compared with the traditional DE algorithm and two other adaptive DE algorithms. The experimental results on nine benchmark problems show that the proposed algorithm is very effective in solving complex optimization problems.

GS1-2 Application of autonomous bias adjustment mechanism to learning of multi-modal joint attention

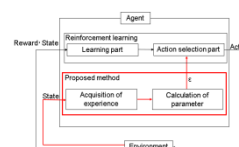
Takahiro Shimizu, Tatsuji Takahashi
(Tokyo Denki University, Japan)

We construct a multi-modal learning agent in vocabulary acquisition. Vocabulary acquisition is what real-world robots need to achieve. It forms the basis of robotics for robots that can develop through its life together with humans. Nakano et al. confirmed that gaze tracking and vocabulary building mutually facilitate through an interaction experiment between a robot and humans and computer simulation of learning agent that simultaneously learn mappings in vocabulary and gaze tracking. The difference from the previous studies is that our agent autonomously adjusts the intensity of a bias in infants (mutual exclusivity) according to LS (loosely symmetric) model, which describes the causal intuition of human beings. As the result, the agent needs no external parameter tuning, hence becomes more autonomous.

GS1-3 Control of exploration and exploitation using information content

Nodoka Shibuya, Kentarou Kurashige
(Muroran Institute of Technology, Japan)

In reinforcement learning, there is a problem about trade-off between exploration and exploitation. It is importance to balance exploration with exploitation. Balance of exploration and exploitation is decides a parameter of action selection methods such as epsilon of epsilon-greedy method. The optimal epsilon varies depending on a size or complexity of an environment. Therefore, it is difficult for human to set to the optimal epsilon. Then, we proposed that an agent controls epsilon based on information content of the environmental transitions. In this paper, we apply the proposed method to the maze problem with simulation. We compare epsilon-greedy method and the proposed method. We show that the number of time of actions in proposed method less than epsilon-greedy method.



January 22 (Wednesday), 13:00-14:15

GS1-4 Mind model for an autonomous decentralized FMS -A mind that lies and its influence on production-

Hidehiko Yamamoto¹, Takahiro Matsuda¹, Takayoshi Yamada¹, Raafat H. Elshaer²
(¹Gifu University, Japan)
(²ZAGAZIG University, Egypt)

In autonomous decentralized FMS factory (with a modest mind and an arrogant mind), it is assumed that the information provided by the agents is always correct. However, this is not the case in a real factory, where that incorrect information can sometimes be sent as a result of machine failures. This incorrect information can lead to AGV path interference, which will decrease the production outputs. In this study, we express the incorrect information being delivered in an autonomous decentralized FMS factory as a mind that lies and examines the influence of this incorrect information or false mind on production.

GS1-5 Parts arrangement of picking operation using virtual factory system and Profit Sharin -Application to an automobile assembly line-

Hidehiko Yamamoto¹, Junichi Murakami¹, Takayoshi Yamada¹, Ikurou Fukuta², Yuuki Yamauchi²,
Masahiro Nakamura³
(¹Gifu University, Japan)
(²Gifu Auto Body Industry Co., Ltd, Japan)
(³Lexar Research Inc., Japan)

In picking operation which an operator takes parts to supply to the assembly line out of the rack, there is the problem that production efficiency changes according to the parts arrangement of the rack. To solve this problem, we propose Virtual Assembly Picking Evaluation for Racks (VAPER) system which decides efficient parts arrangement and visualize the results. VAPER is to quantify the work in addition to the evaluation an operator's walk distance and difficulty of operation, such as an operator's up-and-down bending and stretching exercises, and the quantitative value is improved by the reinforcement learning Profit Sharing. In addition, VAPER system to visualize the results in a virtual work spot.

January 22 (Wednesday), 13:00-14:30

Room B

GS2 Artificial life and chaos

Chair: Ken Saito (Nihon University, Japan)

GS2-1 3D Printing and Simulation of Naturally-Randomized Cellular-Automata

Yasusi Kanada
(Dasyn.com, Japan)

3D printing technology usually aims reproducing objects deterministically designed by 3D CAD tools. However, 3D printing can generate patterns similar to stochastic (randomized) 1D or 2D cellular automata (CA). Cheap fused deposition modeling (FDM) 3D printers can be used for this purpose. By using an FDM 3D printer, melted plastic filament is extruded by a hot nozzle to shape a 3D object. They can generate CA-like patterns with constant head motion and constant filament extrusion and with unintended fluctuation but no explicit randomness. Because of fluctuation, every time the printer generates a different emergent pattern. This paper proposes a method for printing seaweed-like patterns of 1D and 2D CA using FDM, and computational CA models. This method will open a new horizon of 3D printing applications.

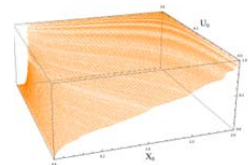


January 22 (Wednesday), 13:00-14:30

GS2-2 A New Shooting Algorithm for the Search of Periodic Orbits

Keita Sumiya¹, Kazuhiro Kubo^{1,2}, Tokuzo Shimada¹
(¹Meiji University, Japan)
(²Max-Planck-Institut für Physik Komplexer Systeme, Germany)

The periodic orbit theory gives the basic frame work to study quantum and classical correspondence. In this paper, we firstly report that we have found the existence of a surface called the devil's staircase surface. Secondly, taking the advantage of some intriguing properties of this surface we propose a new method to search exhaustively periodic orbits in the anisotropic Kepler problem. Our method fully takes into account of an intriguing property of the initial value problem of the anisotropic Kepler problem equation of motion and reduces the two-dimensional search into one-dimensional search. Using our method, all of the periodic orbits up to length $2N=20$ (altogether 19284 distinct periodic orbits) have been successfully obtained which exceed the world record up to $2N=10$.



GS2-3 Evolving multiple designs of soft-bodied agents in a single genome with developmental plasticity

Michał Joachimczak^{1,2}, Reiji Suzuki¹, Takaya Arita¹
(¹Nagoya University, Japan)
(²Institute of Oceanology, Polish Academy of Sciences, Poland)

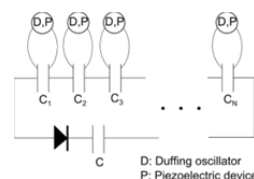
We show how the concept of developmental plasticity, together with a biologically inspired model of multicellular development, can be used to evolve designs of soft-bodied animats, where a single genome encodes different versions of a phenotype (morphs), each adapted to a different type of environment. We employ a model of gene regulatory network driven multicellular development that has been previously demonstrated to produce a range of morphologies of virtual swimming animats. By providing a chemical cue about the type of target environment during development and evaluating each genome in all of its target environments, we obtain genomes that produce different morphologies and motion patterns for each of the scenarios.



GS2-4 Synchronization of Nonlinear Oscillators and Its Application to the Energy Harvesting

Hisakazu Uchiyama, Tokuzo Shimada
(Meiji University, Japan)

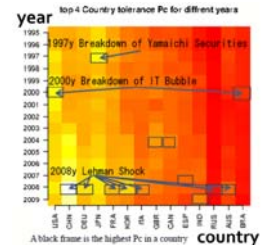
We propose an energy harvester equipped with nonlinear oscillators, which can extract efficiently the energy from the noise with a wide-range frequency. This harvester makes use of a synchronization of oscillators under the common noise. We use single-well Duffing oscillators, as example. By non-dimensionalization, the number of parameters of this model is reduced from five to only two which are the noise strength and the noise time correlation length. We numerically integrate the non-dimensional stochastic differential equation focusing our attention on the synchronization phenomenon. We find useful rules of thumb which are useful for the design of the harvester. We present concrete evidence that our system works and we call it Synchronizing Harvester.



GS2-5 The study of the industry networks about the risk of economic failure using Input-Output table of the world

Kazuko Yamasaki
(Tokyo university of information sciences, Japan)

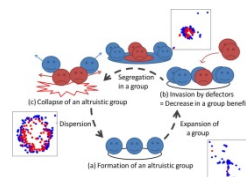
It has been clarified that the globalization of the economy hides the serious risks inside, by spreading a damage of an industry in a country to the world and being amplified through the network. It has become important to study the network of the industries in the world. We develop new methodological framework to quantify interdependencies in the global industries' network and to estimate the internal risks of the damage propagation. We use the input-output table of the industry sections, and make the virtual simulations of the propagation of a damage of an industry section in a country. We found the threshold phenomena of the stability, like critical phenomena, which has correlation with the economic crisis in the past. The results show the economic history and development of the industry networks in the investigated 15 years period, and they give the insight of the development of the industries and the countries in the future.



GS2-6 Where do the dynamics of social relationship come from? - An analysis based on Social Particle Swarm

Keita Nishimoto, Reiji Suzuki, Takaya Arita
(Nagoya University, Japan)

Relationship in a society is thought to be highly dynamic without falling into a fixed point but simultaneously ordered. To reveal the mechanism of the relationship dynamics, we investigate a new social model named Social Particle Swarm based on a physical model, which is a novel type of a self-driven particle system. In the model, each of particles on a two dimensional space represents an individual member of a society, where the proximity between two particles reflects the social distance between two individuals. Each has a game strategy, and its movement is controlled by payoff values, that are derived from the composition of its own strategy and the strategies of its neighbors. We discovered the cyclic dynamics in which a formation and a collapse of altruistic clusters alternately occurred when we adopted Prisoner's Dilemma as a game structure between individuals. We considered this dynamics reflects the dynamic characteristics of relationship in the real world in the sense that it shows not only a constant change in social relationships but also its order as a whole. We conducted experiments to extract factors to generate it by changing some fundamental parameters and the game structure between individuals. As a result, we discovered that the cyclic dynamics emerged when the particle density was high, and interaction radius was an intermediate value. It was also revealed that the cycle occurred only when we assumed Prisoner's Dilemma as the model of social interaction between individuals.



January 22 (Wednesday), 13:00-14:30

Room C

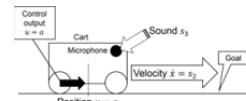
GS11 Learning

Chair: Takayasu Fuchida (Kagoshima University, Japan)

GS11-1 A feature selection method for a sample-based stochastic policy

Jumpei Yamanaka, Yutaka Nakamura, Hiroshi Ishiguro
(Osaka University, Japan)

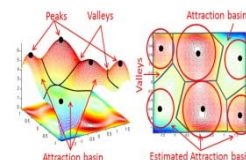
Stochastic policy gradient methods have been applied to a variety of robot control tasks such as robot's acquisition of motor skills because they have an advantage in learning in high dimensional and continuous feature spaces by combining some heuristics like motor primitives. However, when we apply one of them to a real world task, it is difficult to represent the task well by designing the policy function and the feature space due to the lack of the enough prior knowledge about the task. In this research, we propose a method to extract a preferred feature space autonomously to achieve a task using a stochastic policy gradient method for a sample-based policy. We apply our method to a control of linear dynamical system and the computer simulation result shows that a desirable controller is obtained and that the performance of the controller is improved by the feature selection.



GS11-2 ABEGA-2: Improved Attraction Basin Estimating Genetic Algorithm for High Dimensional Space

Zhuoran Xu, Masahito Yamamoto
(Hokkaido University, Japan)

In our previous work, we proposed the Attraction Basin Estimating Genetic Algorithm (ABEGA). It can detect and recognize attraction basins on fitness landscape. The information of attraction basins are used to improve the performance of Niching. However, ABEGA does not work well in high dimensional space. Because there are usually a lot of small local optima in high dimensional space. In this paper, we collect the height of valleys as a new information. The height is used to determine if an optimum is important, so we can track important optima among even hundreds of unimportant local optima. We examine our method in a Neuroevolution problem, in which we evolve an artificial neural network (ANN) to control a robotic arm to catch balls. The ANN have more than 50 dimensions. The results show that our method has a high possibility to escape local optima and find relatively better solutions.



GS11-3 Fundamental study of inverse reinforcement learning from sub-experts in evolutionary process

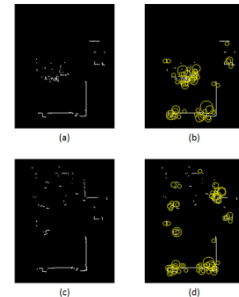
Hiroaki Tsunekawa, Tomoki Hamagami
(Yokohama National University, Japan)

Two approaches can be used to solve the problems of reinforcement learning: sub-goal methods and inverse reinforcement learning. The sub-goal method solves the problem of excessive computational time requirements by dividing the task and learning gradually. Inverse reinforcement learning solves the problem that the reward is not known clearly by extracting a reward function from the behavior of experts. However, learning is more difficult when these two problems are related to each other. Therefore, we propose inverse reinforcement learning using an evolutionary process. A method for learning the reward function is required by the learning process component during an evolutionary process that involves experts.

GS11-4 A proposal of localization method for AGV with considering stability of objects

Yusuke Ikemoto, Hirokazu Matsui, Norihiko Kato, Ken'ichi Yano
(Mie University, Japan)

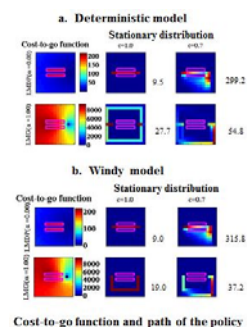
We propose a localization method for an auto guided vehicle (AGV) based on confidence of an environment with using 2-D Laser Range Finder (LRF). In ordinary methods with using LRF, LRF data is applied without considering confidence of each data. In an environment, stable objects and unstable objects exist for LRF localization. The stable objects are immobile and rigid. The unstable objects are mobile or variable. Unstable objects disturb localization. We assume that stable and unstable objects can be classified by their shapes. In our proposed method, an AGV localizes itself by scan matching with using only stable objects in an environment. It converts 2-D horizontal LRF data to 2-D image, and extract SURF features from the image. The method has two steps (learning step and matching step). In the learning step, SURF features are classified into stable and unstable objects by time variation from static viewpoints, and it learns the classification with using SVM. In the matching step, it localizes itself by using classified stable SURF features through SVM.



GS11-5 Robustness of Linearly Solvable Markov Games with inaccurate dynamics model

Ken Kinjo¹, Eiji Uchibe², Kenji Doya²
(¹Nara Institute of Science and Technology, Japan)
(²Okinawa Institute of Science and Technology, Japan)

The Linearly Solvable Markov Decision Process (LMDP) is an efficient model-based optimal control framework. To achieve robustness against disturbances, use of Linearly Solvable Markov Game (LMG) framework has been proposed. Here we investigate the robustness of LMDP- and LMG-based controllers against modeling errors in the task of grid-world with cliffs. When there is a discrepancy between the model used for building the controller and dynamics of the tested environment, LMG-based controllers maintained good performance while that of LMDP-based controllers deteriorated steeply. The result supports the usefulness of LMG framework when acquiring an accurate model of the environment is difficult.



GS11-6 Transfer Learning for Q-learning by Using Similarity of Phase Structure in State Space

Masato Takeishi, Tomoki Hamagami
(Yokohama National University, Japan)

We propose an accelerated reinforcement learning technique using similarity of phase structure in the state space. The technique transfers the values of a state sequence to other sequences that have similar phase structures. Because of the propagation of values from experienced sequences to inexperienced ones, the agent is able to learn and accelerate its learning more effectively. Physical robot simulation experiments are conducted. The simulation results show that the proposed technique contributes greatly to an increase in the success rate, and that the technique clearly improves learning speed.

January 22 (Wednesday), 13:00-14:15

Room D

OS13 Protocomputing

Chair: Moto Kamiura (Tokyo Denki University, Japan)

Co-Chair: Tatsuji Takahashi (Tokyo Denki University, Japan)

OS13-1 Adaptation to environment through causal induction with "biconditional probability"

Tatsuji Takahashi, Junki Yokokawa, Kuratomo Oyo
(Tokyo Denki University, Japan)

As the new paradigm psychology of reasoning (NPPR) (Over, 2009), based on probabilistic logic and suppositional theory of conditionals, marches, energetic arguments over the distinction between conventionally distinct areas of study such as deduction, induction, probability judgment and decision-making arose. Here we apply the NPPR to causal induction. We found that the probability of biconditional event, which is the biconditional in the paradigm, is the most descriptive index for causal induction of strength. We also argue its properties shared with other indices and models in causal induction, especially with the most recent normative model, the SS power model proposed by Lu et al (2008). We further suggest a possibility of a new information theoretic way of analyzing causal induction task with mutual information, which is deeply related to the probability of biconditional event or "biconditional probability."

OS13-2 Weak Identity from Section-Retracton Perspective on Category Theory

Takayuki Niizato
(Tsukuba University, Japan)

What is the identical property for individual. Generally speaking, we take for granted to consider the identity of object, including self-consciousness, never changes with time and keeps its same properties at themselves. However, there are some difficulties in this type of discussions because defining its own structure leads us to the kind of circular argument. We shall apply this self-referential problem to the category theory. In category theory, the identity arrow can decompose into an monomorphism and an epimorphism, which is called a section and a retracton. In this study, we consider this level of difference between the arrow and their elements involved retractons. Because of taking account of interaction between these different levels, we show that dynamical property emerges through identity function. And finally, we also discuss that defining identity has an intimate relation to the choice axiom.

OS13-3 Irrational cognitive properties for efficient adaptation to uncertain environments

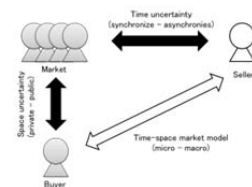
Yu Kohno, Tatsuji Takahashi
(Tokyo Denki University, Japan)

We show that efficient adaptation to uncertain environments can be realized by three irrational cognitive properties: satisficing, risk attitudes, and comparative valuation. These properties are the most major biases in our cognition and have been extensively studied in artificial intelligence, cognitive psychology, and behavioral economics. The three properties, combined together, form a kind of suspension in value judgment. The suspension enables efficient valuation of actions in reinforcement learning where agents need to effectively balance exploration and exploitation under uncertainty. This study proposes a more general and simpler version of LS (Loosely Symmetric model) that is model relevant to the three properties, LSX. It is simpler in that the three properties of LS are analyzed into individual terms, while in LS the properties are fused. This enables further examination of the three properties. Only when all the three properties are combined, superior performance in reinforcement learning is realized through suspension.

OS13-4 A Model of Market Behavior based on Time and Space Uncertainty

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

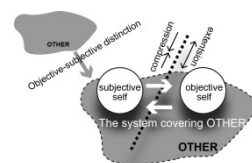
The market behaviors based on human activity are known as particular dynamical property such as power-law distribution. Although many macroscopic theory have been proposed, a problem how to connect between macroscopic trend and microscopic human behaviors is remained. In this paper, we investigate time-space uncertainty of human cognition in the market model and show its relationship with macroscopic statistical property of market behaviors. Our model introduces mixture between macroscopic and microscopic perspectives about a market such as the desire of individual trader and global price regulation for contract enhancement. Further, stock order restriction corresponds to incomplete price comparison between bids. It leads to invalidation of synchronized trading terms (time steps). The results of conducted numerical simulation shows a power-law distribution similar to conventional studies.



OS13-5 Developing a conceptualization of social relationship via rudimentary objective-subjective distinction on social world

Yuta Nishiyama, Kimiko Kato, Keisuke Kawasaki, Masaki Nagasawa, Isao Hasegawa
(Niigata University, Japan)

In this paper, we demonstrate the developmental process and functional role of objective-subjective distinction. At first, we introduce two experiments to verify that preschoolers abstract, categorize and evaluate social relationships. The results showed that children around six years old exhibit both of early social conceptualization and rudimentary objective-subjective distinction. Moreover we claim that the early social conceptualization come from developing a heterarchical system when the experiments are communication between participant and experimenter. The heterarchical system would be regarded as self in life.



January 22 (Wednesday), 13:00-14:00

Room E

OS9-II Intelligent building and life

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

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

OS9-5 Function approximation with outliers using robust wavelet neural network with adaptive annealing learning algorithm

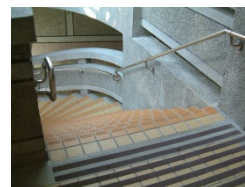
Chia-Nan Ko¹, Cheng-Ming Lee¹, Yu-Yi Fu¹, Li-Chun Lai²
(¹Nan Kai University of Technology, Taiwan)
(²National Pingtung University of Education, Taiwan)

In this study, a robust wavelet neural network (WNN) is proposed to approximate functions with outliers. In the proposed methodology, firstly, support vector machine with wavelet kernel function (WSVM) is adopted to determine the initial translation and dilation of a wavelet kernel and the weights of the wavelet neural network (WNN). Then, an adaptive annealing learning algorithm (AALA) is used to accommodate the translation, the dilation, and the weights of the WNNs. In the learning procedure, the AALA is proposed to overcome the problems of initialization and the cut-off points in the robust learning algorithm. Hence, when an initial structure of the WNN is determined by an SVR approach, the WNN with AALA (AALA-WNN) has fast convergence speed and can robust against outliers. Two examples are simulated in order to verify the feasibility and efficiency of the proposed algorithm.

OS9-6 Preventing campus accidents among disabled students

Ya-Hui Wang, Yan-Chyuan Shiau, Shu-Chen Lai
(Chung Hua University, Taiwan)

The United Nations proclaimed that the year 1981 was the International Year of Disabled Persons. Countries worldwide vigorously promote a barrier-free environment to achieve the goal of equal opportunities and full participation. Therefore, providing disabled students with a barrier-free campus environment is an issue that demands substantial attention from governments and schools. In this study, we investigated the physical characteristics of disabled students and their needs regarding a barrier-free environment. We summarized the reasons for campus accidents involving disabled students and proposed recommendations for campus accident prevention to enable competent authorities and schools to improve the provision of barrier-free environments. The results of this study can enable schools to meet the needs of disabled students, allowing them to safely participate in various learning activities and to interact with their peers and increasing their opportunities for social participation and learning, thereby cultivating their potential and fostering further development



OS9-7 A study on re-use of deserted space – A case study on elementary schools in Miaoli County, Taiwan

Ching-Jung Chang, Ying-Yu Su, Wan-Chun Chiu
(Chung Hua University, Taiwan)

A campus, which is a place where everyone grows and receives education, is also a starting point for a person's cognition of his/her own land and culture. Regardless of whatever reasons that result in idle space on campus, the campus still retains the locals' collective memory and good reminiscence of the youth. Over the course of historical development in a region, local residents are often initiators of the reuse of on-campus idle space. Internationally, there have been a number of successful stories of local residents turning idle space into hubs of tourism or arts through integrating local folk customs and arts into the makeover [1].

Due to a low birth rate and prevalence of out-migration from rural areas driven by urban-rural disparities, there has been a considerable amount of idle space at schools in Taiwan in the past 20 years. In this study, reuse of idle space at several elementary schools in Sanyi Township, Miaoli County, Taiwan, was chosen as the research subject due to the township's distinctive Hakka customs and its renowned wood carving industry in the whole Taiwan Island. Firstly, school teachers and students, local residents, and local workers in cultural and creative industries, and art workers were interviewed. Furthermore, data collected from the interviews were structured systematically to redesign a questionnaire with appropriate questions, and variables on the questionnaire were reduced to find out the best match for different users' needs for spatial plans and reuse through the principal component analysis (PCA). Additionally, opinions gathered from experts and scholars were compared with data collected from the questionnaire in a hope to systematically consolidate results of questionnaire analysis with professional opinions, and to offer strategic options pertaining to the design of idle space to the government and schools that have idle space.

OS9-8 KMS-based Engineering Design Assistant for Highway Design Projects

Wen-Der Yu¹, De-Guang Liu¹, Chien-Hung Lai²
(¹Chung Hua University, Taiwan)
(²CECI Engineering Consultants, Inc., Taiwan)

Engineering design is a highly experience-based task in engineering consulting. Previous practice usually relies on experienced senior engineers in conducting the works. Such an approach suffers not only in the leaks of knowledge due to leaves of senior engineers, but also in the increases of cost and time required for design work. This paper presents a knowledge management system (KMS) based approach, namely Engineering Design Assistant for Roads (EDA-Road), to support the engineering design work. A text mining technique based on Vector Space Model (VSM) was adopted for document retrieval. Nine historical design cases with totally 1,683 engineering documents were collected as the knowledge source. A real world express highway design project was selected to test the feasibility of the proposed method. Finally, a questionnaire survey was conducted to evaluate the proposed EDA-Road. The approval rate was 88% for system correctness and 86% for time benefit.



January 22 (Wednesday), 14:45-15:45

Room A

GS8 Image processing

Chair: Takayasu Fuchida (Kagoshima University, Japan)

GS8-1 Deep-sea Optical Visualization System for Mineral Concentration - A Novel Concept for Ocean Development -

Huimin Lu^{1,2}, Yujie Li¹, Lifeng Zhang¹, Seiichi Serikawa¹
(¹Kyushu Institute of Technology, Japan)
(²Japan Society for the Promotion of Science, Japan)

Remote robotic exploration holds vast potential for gaining knowledge about extreme environments accessible to humans only with great difficulty. In the last two decades, various underwater devices were developed for detecting the mines and mine-like objects in the deep-sea environment. However, there are some problems in recent equipment, like poor accuracy of mineral objects detection, without real-time processing, and low resolution of underwater videos. The deep-sea minerals recognition is also a difficult task, because the physical properties of the medium, the captured video frames are distorted seriously by scattering, absorption and noise. First of all, scattering is caused by large suspended particles, such as in turbid water, which contains abundant particles, algae, and dissolved organic compounds. Color distortion corresponds to the varying degrees of attenuation encountered by light traveling in the water with different wavelengths, rendering ambient underwater environments dominated by a bluish tone. Furthermore, in the imaging plane, there always contains noise that caused by algae or organic particulates. To solve all of these problems, in this paper, we are considering utilizing the image processing methods to determine the mineral location and to recognize the mineral actually within a little processing time. We firstly analysis recent underwater imaging models, and propose a novel underwater optical imaging model, which is much closer to the light propagation model in the underwater environment. In our imaging system, we remove the electrical noise by dual-tree complex wavelet transform. Then, we solve the scattering efficient by fast guided trilateral bilateral filter. And finally, we recover the image color through automatic color equalization. These methods are designed for real-time execution on limited-memory platforms, and are suitable for detecting underwater objects in practice. The initial results are presented and experiments demonstrate the effectiveness of the proposed imaging system.

GS8-2 Detecting Objects in Images Using Context-based Approaches

Phatthanaphong Chomphuwiset, Piya Kaewbuadee
(Mahasarakham University, Thailand)

A primary challenge of detecting and identifying objects in images is the variation of various objects and artifacts in image scenes. This work proposes a technique for detecting and identifying objects in images using context-based approaches. The proposed method works in 3 steps, i.e. (i) object detection by using classification-based schemes: pixels in images are classified into object and background using color intensity with expectation and maximization algorithm (EM), (ii) object classification: detected objects are represented by contour-based presentation. Then, object descriptors are generated using normalized chain code techniques. Object classification, finally, carried out using random forest classifiers, and (iii) object classification refinement: detected and identified objects are then proceeded to improve the classification results by rejecting false positives. This is achieved by considering the local interaction of detected objects using Markov random fields (MRFs). The results from experiments show that detecting and classifying objects in image scenes using context-based approaches is superior to the detection and classification using object shape and morphology alone.

January 22 (Wednesday), 14:45-15:45

GS8-3 Generation of Binary Images using Optimal Weight of Neighborhood for Ancient Thai Document Images

Rapeeporn Chamchong
(Mahasarakham University, Thailand)

Although there exists several degradation techniques, there is no specific suggestion on any single degradation technique that can be applied effectively to all kinds of document images. For this reason, the combination method has been proposed to generate the optimal binary image from multiple degraded images. The method of this study is modification of local adaptive weight majority vote. This method is based on Gaussian weight of majority vote from the image. Text/background pixels of the combined image are determined by an average Gaussian weight of majority vote of text/background, otherwise uncertainty pixels will then be defined by using the maximum of Gaussian weight. The evaluation result has been tested over benchmark dataset of the Document Image Binarization Contest (DIBCO) 2011. The result shows that the proposed method provided better performance than other techniques. This proposed method has also been applied to ancient Thai documents.

GS8-4 A proposal of obstacle detector by a front camera on the vehicle with learning system

Hiroki Kurata, Hirokazu Matsui, Norihiko Kato, Ken'ichi Yano
(Mie University, Japan)

We propose a method that detects far obstacles by using a monocular camera on a front of vehicle. Our method uses a monocular camera, since it can detect far objects without stereo vision regardless of the material. The method segments an image into road region and non-road region by textures in the image. Near objects can be 3-D reconstructed by the disparities of textures caused by the camera motion. The textures are recognized as stereo obstacles, if they have heights. Far objects cannot be 3-D reconstructed, since they have too small disparities. But the far objects become near objects by vehicle motion. Therefore, we can let it learn that stereo objects have what kinds of texture in the far region, relating near obstacles with textures of far region.

LOOP	
1. Acquire an image	
2. Transform the image to wavelet image	
3. Divide the images into upper side images and the lower side images	
(a) Upper side images	(b) Lower side images
4a. Segment the upper-side images	4b. Find the disparities
	5b. Distinguish between stereo objects and flat objects
	6b. Associate with the past upper-side image
5a. Store the results of segments	7b. Learn the weights of region
8. Classify the segmented region	
9. Move the vehicle	

January 22 (Wednesday), 14:45-16:00

Room B

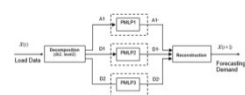
GS13 Neural networks

Chair: Hirotugu Okuno (Osaka University, Japan)

GS13-1 A Short Term Load forecasting by Using wavelets Transforms and Pruned Neural Networks Technique

Kaveepoj Banluewong
(PORAR Lab, Mahasarakham University, Thailand)

This work forecasting a short term electricity usage using wavelets transform with pruned neural networks. Wavelet transform decomposes time series data (electricity usage) to frequency domain in different signal resolution (using multi-resolution decomposition). Multilayer Perceptrons (MLPs) are then generated to predict each wavelet coefficients. In order to obtain optimal networks, the networks (MLPs) are pruned to reduce a number of weight parameters in the networks using Optimal Brain Surgeon: OBS. Then, the output of each MLP is reconstructed using Wavelet Reconstruction:WR. Experiments are conducted using data collected in Queensland, Australia. The results of the experiments show that the proposed method provides better results than single neural network-based techniques (SNN).



January 22 (Wednesday), 14:45-16:00

GS13-2 Can agents with neuromodulation know when they remember?

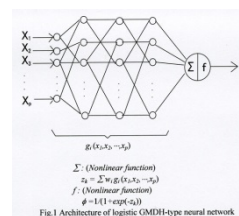
Masaru Sudo, Reiji Suzuki, Takaya Arita
(Nagoya University, Japan)

Humans have the ability to consciously aware of the presence or absence of their memory. This kind of the ability called metamemory plays important roles in human cognition and studies about non-human animals demonstrated that metamemory ability is general for animals, not human-specific. The purpose of our study is, as a constructive approach, to investigate the minimal structure that meets this condition by evolving agents with an artificial neural network in order to shed light on the origin of metamemory of humans. The evolutionary experiments we conducted show that the evolved neural networks behave as if it would monitor its memory states.

GS13-3 Logistic GMDH-type Neural Network Using Principal Component-regression Analysis and Its Application to Medical Image Diagnosis of Lung Cancer

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

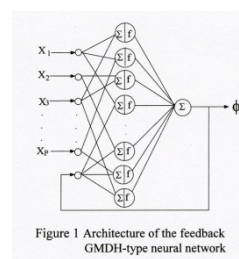
The logistic Group Method of Data Handling (GMDH)-type neural network is proposed and applied to the medical image diagnosis of lung cancer. In this logistic GMDH-type neural network algorithm, the principal component-regression analysis is used to estimate the parameters of the neural network, and the multi-collinearity, which is occurred in the conventional GMDH algorithm, is protected. Therefore, accurate and stable predicted values are obtained in the logistic GMDH-type neural network. Furthermore, the polynomial and logistic neurons are used, and the neural network architectures are automatically organized so as to minimize the prediction error criterion defined as Akaike's Information Criterion (AIC) or Prediction Sum of Squares (PSS). The identification results show that the logistic GMDH-type neural network algorithm is useful for the medical image diagnosis of lung cancer since the optimum neural network architecture is automatically organized so as to fit the complexity of the medical images.



GS13-4 Medical Image Diagnosis of Liver Cancer by Hybrid Feedback GMDH-type Neural Network Using Principal Component-regression Analysis

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

The hybrid feedback Group Method of Data Handling (GMDH)-type neural network is proposed and applied to the medical image diagnosis of liver cancer. 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. Furthermore, this neural network has the feedback loop and the complexity of neural network architecture is increased using the feedback loop calculations, and the neural network architecture is automatically organized so as to fit the complexity of the nonlinear system using the prediction error criterion defined as Akaike's Information Criterion (AIC) or Prediction Sum of Squares (PSS). The recognition results show that the hybrid feedback GMDH-type neural network algorithm is useful for the medical image diagnosis of liver cancer since the optimum neural network architecture is automatically organized.

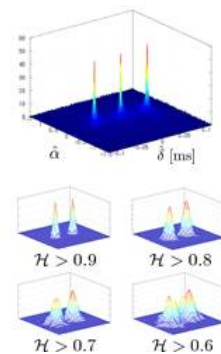


January 22 (Wednesday), 14:45-16:00

GS13-5 Underdetermined Blind Source Separation of Speech Signals Based on Mean Shift Clustering

Yusuke Tajiri, Takaaki Ishibashi
(Kumamoto National College of Technology, Japan)

This paper proposes an extraction method of sparse components for a sparseness-based BSS (Blind Source Separation) algorithm. Recently, DUET (Degenerate Unmixing Estimation Technique) has attracted attention as an underdetermined BSS method. Assuming that the source signals are completely sparse, DUET gives the best performance. In other words, the separation performance depends on the sparseness of source signals and it is important to evaluate the sparseness level before using DUET. Besides, the DUET algorithm has a problem about how to identify the peaks in the two-dimensional histogram. In a previous method, we had to resort to manual peak identification. Therefore, we also propose an automatic peak identification method based on Mean shift clustering.



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Room C

OS7 Educational Technology and Applications

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

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

OS7-1 Light-weight tracking for augmented reality

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

Augmented Reality (AR) is the augmenting of the real or live world using computers. Most AR applications still require comparatively high processing power, and useful AR applications require high-end PCs for acceptable performance. Only fairly simple AR applications can run on current mobile platforms such as smartphones. Video tracking is an important technology used in AR, but required high computational power. In this research a light-weight video tracking method is proposed, to be used to create useful AR applications which can run on less powerful mobile platforms such as smartphones. In this paper, the basic algorithm of the light-weight video tracking method is described, and a simple test case of an application using the proposed method is reported.



January 22 (Wednesday), 14:45-16:00

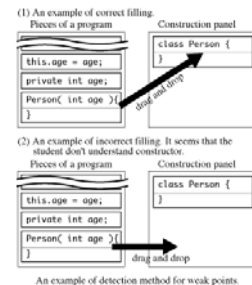
OS7-2 Automatic weak points detection method using syntax-oriented code fragmentation for programming learning systems

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

The authors have developed a programming training system CAPTAIN (Computer Aided Programming Training And INstruction). In this training system, each complete runnable program is fragmented randomly into a few lines by the system. Students must sort the lines as an original source program similarly to solving a puzzle game. In our previous paper, we proposed a new feature for the system. In the new system, a program source is divided in block syntax elements. We call the method syntax-oriented fragmentation.

In this paper, we introduce new advantages of the syntax-oriented fragmentation method. Firstly, we can specify the syntax elements which a student made mistakes using the syntax-oriented fragmentation method. In usual programming lessons, students write a source program freely. In such a case, automatic detection of errors and students' weak points is very difficult.

In our syntax-oriented fragmentation method, we know the correct code and which syntax element mistakes are occurred in. Therefore we can know which syntax the student is not good at. Secondly, we can know where students don't understand in algorithms and flow of process of a program in our system. In our syntax-oriented fragmentation method, some fragments describe control flow statement itself. Therefore, for example, we know loop algorithm is one of weak points of the student who can't fill fragments inside of a for-block fragment. We describe automatic detection method for students' weak points as mentioned above in our systems.



OS7-3 Teaching materials development of the natural environmental and global warming education for the junior and senior high school students using satellite data

Jonggeol Park, Eiji Nunohiro, 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 by SIDAS system. To do natural environmental education in the elementary and secondary education based on the remote sensing engineering education.

OS7-4 A Proposal of Educational Scheme for Self-actualization with Mentoring System and Information Literacy

Yoshihiro Kawano
(Tokyo University of Information Sciences, Japan)

Social media such as Twitter and Facebook have become popular. In the age of social media, many people have become more active online. Personal branding is a very important strategy for capitalizing on individual strong points. This kind of branding is expected to contribute to self-actualization. Therefore, the presence of mentors who advise users to find their strong points for self-actualization is needed. We have proposed a personal branding support service named Mentors. The core concept is: 'Everyone has the face of both a mentor and mentee'. The key function is sharing stages of self-analysis in human life design: Determining value, creating a mission, and forming a strategy. In this paper, we propose an educational scheme for self-actualization by using Mentors. The program aims to improve human life by understanding the student's strengths and using social media effectively. Future works are to evaluate Mentors and the educational scheme.

January 22 (Wednesday), 14:45-16:00

OS7-5 Development and Web public presentation of Entertainment Based Programming Learning Support System

Umesh Maharjan, Masanori Ohshiro, Takashi Yamaguchi, Eiji Nunohiro
(Tokyo University of Information Sciences, Japan)

In this research, we developed a self learning programming support system called CAPTAIN (Computer Aided Programming Training And Instruction) that stimulates students' interest and motivation of their study continuously. And we also designed website for CAPTAIN where we can introduce CAPTAIN for the local users. The website will help us to introduce CAPTAIN throughout the country and even to abroad with the help of foreign students involving in this project. We are developing the pages of the website with both English and Japanese language so that we can publicize CAPTAIN easily even to overseas. Furthermore, we are also adding the message corner and social media for the user to communicate directly with the developers which in result helps developer to get new ideas from the user and develop accordingly.

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Room D

OS6 Construction management and engineering

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

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

OS6-1 Application of coastal vegetation to green roofs of residential buildings in Taiwan

Yu-Chi Chen¹, Lian Pei¹, Tung-Jer Hu²
(¹Chung Hua University, Taiwan)
(²Lanyang Institute of Technology, Taiwan)

Green roofs can alleviate the environmental impacts of reduced green areas resulting from rigorous urban developments. In Taiwan's hot and crowded urban environment, green roofs are indicative of green buildings. Rooftop plants must be able to withstand harsh natural environmental conditions. Coastal vegetation has a high level of tolerance. Therefore, this study selected the seashore coastal region seashore vegetation with landscape scenic features as well as drought, wind, and temperature resistance characteristics as materials for a green roof. Based on the records and analysis of vegetation characteristics provided by The Flora and Vegetation of Taiwan, this study selected coastal hilly plants, as well as coastal beach herbaceous plants, such as plant species for green roofs in Taiwan. A 10 m × 20 m reinforced concrete flat roof structure was selected and designed as the demonstration site to present the coastal vegetation rooftop garden.

Table 1. Comparison between Intensive Green Roofs and Extensive Green Roofs.

	Intensive	Extensive
Medium (covering soil)	Deep (at least 10cm)	Shallow (thin layer of 5 to 15 cm)
Plant selection	Large plants, such as woody plants, shrubs, and trees	Short shrubs, flowers, grasses, ground cover plants
Maintenance and management	High	Low
Design method	Roof garden	Mimics nature
Landscape features	Excellent	Poor
Recreational capacity	High (usually includes social and leisure activities)	Low (unsuitable to leisure activities)
Biodiversity	High	Low
Construction costs	High	Low
Construction sites	Roof gardens, artificial sites, green parks	Pavement and large artificial sites, industrial facilities, public facilities
Irrigation and drainage system construction	Complex	Simple
Floor loading capacity	300 kg to 750 kg per square meter is increased on the structure	22 kg to 58 kg based on soil and the bottom layer features

OS6-2 Evaluation of the Construction Cost and time for Different Excavation Methods on High-Rise Buildings

Ching-Jung Chang, Hsiu-Hsiung Hsu, Chin-Hsiang Lee
(Chung Hua University, Taiwan)

It is necessary to carefully explore and understand the on-site geology before the construction of substructure and choose cautiously the appropriate method, to lead to the optimal planning and construction method in the future. This research is a case study on the deep excavation of a high-rise building in New Taipei City. Two traditional construction methods, bottom-up method and top-down method, were selected at the beginning of this project planning. And their environmental conditions of construction, technical feasibility, construction period, and construction cost have been assessed. In this article, the construction procedures, construction periods, construction costs, and cost effectiveness of the two methods are analyzed. In this way, by comparing the differences between the two methods, calculating their cost effectiveness of construction costs and time costs on the basis of net present value (NPV), hopefully the findings of this study has technical reference value for building constructors in employing construction methods. On the other hand, they will be able to compare the construction costs of the two methods and effectively contrast their capital movements with the costs during the construction.

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OS6-3 Establishing a framework of merchant evaluation in outsourcing the reuse of public deserted space

Hsin-Lung Liu¹, Tian-Yow Chern², Chiu-Yao Chou², Wei-Ling Hsu²
(¹Minghsin University of Science and Technology, Taiwan)
(²Chung Hua University, Taiwan)

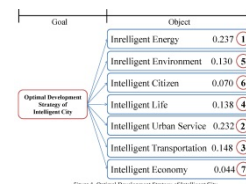
With the progress of times, the rise in quality of life requires larger public open leisure space and better facilities day after by day. The government uses the private funding effectively to lighten the financial burden. As a result, the private section involvement in public works is strongly encouraged. The local government should take proactive actions in developing the "reuse of public deserted space". Many factors need to be considered when the public deserted space is handled by private sectors, including the disturbances at existing original facilities, defaulted risks, legal issues, finance, market demand and rate of return. This study establishes not only multiple evaluation standards, but also the specific evaluation standards for public deserted space when commended to the private entity. Results of the research are obtained through literature review conducting, expert review and cases studying. The framework is further refined in the mode of evaluation the facilities by using Fuzzy Analytic Hierarchy Process, which revenues as a great reference for public sector in selecting managerial teams.

Comparison of the results of the evaluation of the reuse of public deserted space					
Item	Criteria	Sub-criteria	Weight	Ranking	Weight
1. Reuse of public deserted space	1.1	1.1.1 Reuse of public deserted space	0.25	1	0.25
		1.1.2 Reuse of public deserted space	0.25	2	0.25
		1.1.3 Reuse of public deserted space	0.25	3	0.25
2. Reuse of public deserted space	2.1	2.1.1 Reuse of public deserted space	0.25	1	0.25
		2.1.2 Reuse of public deserted space	0.25	2	0.25
		2.1.3 Reuse of public deserted space	0.25	3	0.25
3. Reuse of public deserted space	3.1	3.1.1 Reuse of public deserted space	0.25	1	0.25
		3.1.2 Reuse of public deserted space	0.25	2	0.25
		3.1.3 Reuse of public deserted space	0.25	3	0.25
4. Reuse of public deserted space	4.1	4.1.1 Reuse of public deserted space	0.25	1	0.25
		4.1.2 Reuse of public deserted space	0.25	2	0.25
		4.1.3 Reuse of public deserted space	0.25	3	0.25
5. Reuse of public deserted space	5.1	5.1.1 Reuse of public deserted space	0.25	1	0.25
		5.1.2 Reuse of public deserted space	0.25	2	0.25
		5.1.3 Reuse of public deserted space	0.25	3	0.25
6. Reuse of public deserted space	6.1	6.1.1 Reuse of public deserted space	0.25	1	0.25
		6.1.2 Reuse of public deserted space	0.25	2	0.25
		6.1.3 Reuse of public deserted space	0.25	3	0.25
7. Reuse of public deserted space	7.1	7.1.1 Reuse of public deserted space	0.25	1	0.25
		7.1.2 Reuse of public deserted space	0.25	2	0.25
		7.1.3 Reuse of public deserted space	0.25	3	0.25
8. Reuse of public deserted space	8.1	8.1.1 Reuse of public deserted space	0.25	1	0.25
		8.1.2 Reuse of public deserted space	0.25	2	0.25
		8.1.3 Reuse of public deserted space	0.25	3	0.25
9. Reuse of public deserted space	9.1	9.1.1 Reuse of public deserted space	0.25	1	0.25
		9.1.2 Reuse of public deserted space	0.25	2	0.25
		9.1.3 Reuse of public deserted space	0.25	3	0.25
10. Reuse of public deserted space	10.1	10.1.1 Reuse of public deserted space	0.25	1	0.25
		10.1.2 Reuse of public deserted space	0.25	2	0.25
		10.1.3 Reuse of public deserted space	0.25	3	0.25
11. Reuse of public deserted space	11.1	11.1.1 Reuse of public deserted space	0.25	1	0.25
		11.1.2 Reuse of public deserted space	0.25	2	0.25
		11.1.3 Reuse of public deserted space	0.25	3	0.25
12. Reuse of public deserted space	12.1	12.1.1 Reuse of public deserted space	0.25	1	0.25
		12.1.2 Reuse of public deserted space	0.25	2	0.25
		12.1.3 Reuse of public deserted space	0.25	3	0.25

OS6-4 The Study of the Selection of the Best Smart City Developmental Strategy Applying the Fuzzy Delphi Method and Analytic Hierarchy Process— the Case of Taichung City

Hung-Nien Hsieh, Chang-Yu Hou, Wen-Jui Liao
(Chung Hua University, Taiwan)

Current information and communication system solutions in Taichung City are also compiled as to induce the developmental strategy of "smart city" in Taichung City. It is discovered smart energy (0.237) weights as the most important followed by smart city service (0.232) and smart transportation (0.148); in the second level broadband connection rate (0.067) is the most important, followed by public safety (0.065), energy-saving and carbon-reduction (0.053), digital infrastructure, e-service (0.051). Also, by checking the already established smart system solutions in Taichung City, we had a user satisfactory questionnaire as to fully understand the current situation of local intelligence establishment as well as the citizens' feedback and demands. Last, an outline for the development of smart city in Taichung City is provided divided into short and mid-term planning consisting of 12 developmental strategies within four years.



OS6-5 A study on the current status of the installation of barrier-free facilities at railway stations

Yan-Chyuan Shiau, I-Neng Lee, Ran-Liang Zhuang
(Chung Hua University, Taiwan)

People with physical and psychological disabilities and the elderly over the age of 65 in Taiwan account for 15% of the total population. Taiwan is an aging society, and whether the disabled, the elderly, children and women are able to safely use the facilities in various spaces is an issue worthy of attention. According to a literature review, this study investigated the classification of needs for barrier-free environments and regulations in applicable laws and decrees. This study collected information on the current status of the installation of barrier-free facilities at Taiwan Railway stations, and proposed relevant suggestions for improvement in order to establish a barrier-free environment that facilitates the use by citizens in Taiwan.



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OS6-6 The Research of the Reutilization of the Lost Historical Architecture - Case Study on "Miyahara Eye Hospital" and "The Forth Credit Cooperative Association of Taichung"

Yu-Hui Wang, Wei-Feng Huang, Ching-Jung Chang
(Chung Hua University, Taiwan)

Recently, the concept of reutilizing the historical monuments is gradually burgeoning. Presently, such reutilization is mainly undergoing in the low-density space or the places of non-periodic art activities. However, since the opening of "Miyahara Eye Hospital" in 2002, the combination of the historical monuments and market strategy has made people feel new and stunned. Hence, the present study will be focused on "Miyahara Eye Hospital" and "The Forth Credit Cooperative Association of Taichung" and talk about the reasons behind their prosperity and decline as well as the process of their flourish to wane. Besides discussing the possibility of combining them with the business market strategy, the study will also make an evaluation on the strategy for historical monuments and reprogram them in accordance with the lost historical space and the characteristics of the environment around them. It is hoped that with the result, the present study can serve as a reference in reprogramming and improving the declining business of central district of Taichung City.

January 22 (Wednesday), 14:45-16:30

Room E

OS1 Artificial Control and Sensoring

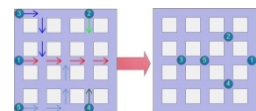
Chair: Kuo-Hsien Hsia (Far East University, Taiwan)

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

OS1-1 Task Assignment on Pattern Reformation for Multiple Mobile Robots

Kuo-Hsien Hsia¹, Bo-Yi Li², Kuo-Lan Su²
(¹Far East University, Taiwan)
(²National Yunlin University of Science and Technology, Taiwan)

In this paper, we focus on the problem that how to move all robots of a group of mobile robots which organized in some pattern in the shortest time to another pattern. In this case, all of the robots may move at the same time, and the task assignment is very important. We use diffusion method at first to determine how long it will take in the shortest way for any one robot to move from its original place to any one destination, and give the highest priority to the robot which takes the longest time to some destination. The robot with highest priority can choose its target destination. At the same time, this robot and the chosen destination are removed from the waiting list. Repeat this process until all robots and destinations are assigned. Then the moving path of each robot is planned by the A* search algorithm.

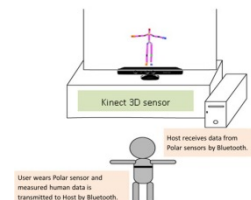


January 22 (Wednesday), 14:45-16:30

OS1-2 Study and implementation of the virtual coach using 3D depth sensors

Chao-Hsiung Tseng¹, Yung-Chiang Wei², Hsien-Hsiang Yang¹
(¹Kun Shan University, Taiwan)
(²Far East University, Taiwan)

It is well-known that regular exercise is advantageous to our health. However, incorrect actions during exercise will cause injury. In order to overcome these shortcomings, it is useful to develop a virtual coach giving the real-time guidance for gaining the effect of fitness. For achieving the above goals, this research uses the 3D depth sensor to design a virtual coach system. With the virtual coach by the side, the exercise guidance is provided in real time. Several subsystems have been developed for the virtual coach, including coaching record, skeleton calibration, and user utility. For skeleton calibration, the subsystem can automatically rectify the skeleton differences between the coach and users. Hence, there is no body limitation for this system, especially for elderly or children. In the user utility aspect, the subsystem identifies whether the user action is identical to the coach action, giving the message of success following the coach's action, and informing the location of the error points in exercising.



OS1-3 A Gyroscope-Based Intuitive Control of Robotic Arm

Zhi-Xiang Yang, Mei-Yung Chen, Ke-Wei Huang, Shi-Wei Bai
(National Taiwan Normal University, Taiwan)

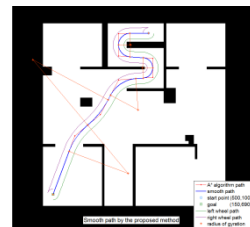
This paper illustrates a newly designed robotic arm which the human arm resemblance after observing the human arm. This study combines the original RoboPlus software program for the CM-700 controller and the LabVIEW software to control a robotic arm. There are two control modes, the computer control mode and the gyroscope control mode. The computer control mode includes automatic control mode and semi-automatic controlled mode. In the gyroscope controlled mode, the low-costing gyroscope is attached to the operator's arm. After allowing the operator to practice the movements which are previously designed, the control system can be trained through the artificial neural network algorithms. The trained control system is able to control the robotic arm accurately through the signals of gyroscopes which is fixed to the operator's arms. To achieve the objective of intuitive control, the controlled system has been trained and this allows the operator to freely control the robotic arm.



OS1-4 Path Planning Using A* Algorithm for Differential Wheel Mobile Robot Based on Vector Models

Bing-Gang Jhong, Mei-Yung Chen
(National Taiwan Normal University, Taiwan)

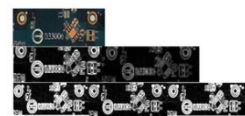
In this paper, we propose a path planning in a known indoor environment based on vector models. Because the nodes of A* algorithm are the corners of obstacle instead of nearby pixels in the vector models, an access checking operator is needed to add in the A* algorithm. This operator will examine the access between two nodes, which may be the corner of obstacle, starting point or goal. Only the adopt nodes will be considered in cost calculation while using the A* algorithm on path planning. Therefore, it ensures the route is feasible. We also propose a path smooth operator to smooth the path after the A* algorithm. This operator uses arcs to replace nodes of path, so that the path is much smoother and the mobile robot can be turned with an arc-shaped path. To avoid smoothing the path incorrectly, it also reduces the radius of gyration which is too large automatically. By using the adjusted A* algorithm and path smoother operator, the proposed method is ultimate to not only possess a good balance between shortest path and obstacle avoidance, but also provide the speed ratio by the differential wheel mobile robot model for robot motors to follow the path without situ rotation. The experiment results illustrate that the limit of motion direction problem from using A* algorithm based on grid map can be overcome, and the time spent of movement can be reduced. Due to the difference of node of composition, the propose method significantly reduces the search steps needed.



OS1-5 Image processing of automatic visual inspection system for PCBs

Jr-Hung Guo¹, Kuo-Hsien Hsia², Kuo-Lan Su¹
(¹National Yunlin University of Science and Technology, Taiwan)
(²Far East University, Taiwan)

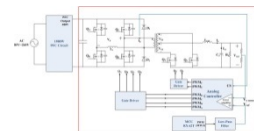
Printed Circuit Board (PCB) plays a key role in electronic products. Conventionally a PCB is checked manually and the checking stability cannot be guaranteed. Because of the increasing sophistication of circuit on a PCB, checking PCBs by visual inspection systems is absolutely essential. In the process of PCB production, multiple types of image detection systems are used. In a multilayer PCB producing process, automatic optical inspection (AOI) system is used for checking all individual layers, and automatic visual inspection (AVI) system is used for checking the finished product. Both AVI and AOI systems are based on image recognition. How to get an image from a raw image for comparing in a minimal computing time is very important. In this paper, actual PCBs are used to compare the efficiency of several image processing algorithms in order to find a suitable algorithm for AVI system used in the finished PCB inspection system.



OS1-6 A programmable output voltage phase-shifted full-bridge DC-DC converter

Chung-Wen Hung, Yi-Ming Tu, Jyun-Jie Ciou
(National Yunlin University of Science and Technology, Taiwan)

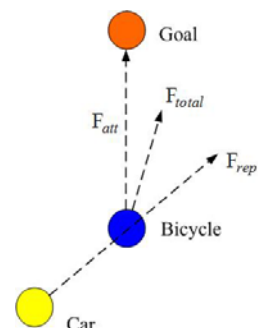
A programmable output voltage phase-shifted full-bridge DC-DC converter is proposed in this paper. This converter provides the adjustable output voltage which could be set via communication, and it is suitable for motor drivers, battery testing systems and variable power supplies etc. The control function is performed with a microcontroller and an analog controller. The proposed converter achieves zero voltage switching, and reduces duty cycle loss, circulating loss and conduction loss, too. The circuit also can lower switching voltage stress by introducing a resonant inductance and clamping diodes. The operation of the proposed scheme is discussed in this paper, and the experimental results show that the proposed 1120 W zero-voltage switching phase-shifted full-bridge DC-DC converters is workable. When the load is the 20% of the specification, the efficiency of this proposed circuit is higher than 80%, and when full load, the efficiency can reach 96%.



OS1-7 A potential field method for a bicycle intelligent safety warning system

Li-Chun Lai¹, Chia-Nan Ko², Yen-Ching Chang³
(¹National Pingtung University of Education, Taiwan)
(²Nan Kai University of Technology, Taiwan)
(³Chung Shan Medical University, Taiwan)

The paper is to explore how to design and develop a bicycle with intelligent features of safety warning system. So that it can be applied in a dynamic environment and remind the rider to keep attention with the warning from the back. Also, it shows the direction to rider how to dodge safely. The program will use artificial intelligence to co-operate that can help them to find out the path and reach the goal. The potential field method, for simplicity, a bicycle is usually treated as a point. The most commonly used attractive potential field between a bicycle and a goal. The attractive factor of potential field affects direction between a bicycle and a goal. On the other hand, one commonly used repulsive potential field between a bicycle and a car. The total force applied to the bicycle is the sum of the attractive force and the repulsive force. The potential field will determine the movement of the bicycle. To show the feasibility of the proposed method, the simulation result is included for illustration.



January 22 (Wednesday), 16:15-17:15

Room A

OS5 Clinical omics analysis and genome cohort studies

Chair: Kaoru Mogushi (Tokyo Medical and Dental University, Japan)

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

OS5-1 Trends in large-scale genome cohorts toward personalized prevention

Soichi Ogishima, Satoshi Nagaie, Jun Nakaya, Hiroshi Tanaka¹

Recent rapid advances of next generation sequencing (NGS) technologies will allow us to sequence personal genomes. Based on personal genomes, realization of personalized prevention will be expected. Here, we review trends in large-scale genome cohorts along with advances of NGS technologies, and then discuss problems to be solved to realize personalized prevention.

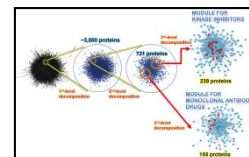
OS5-2 Identification of drug-target modules in the human protein-protein interaction network

Takeshi Hase¹, Kaito Kikuchi², Samik Ghosh², Hiroaki Kitano², Hiroshi Tanaka¹

(¹Tokyo Medical and Dental University, Japan)

(²The Systems Biology Institute, Japan)

A useful characteristic for identification of drug-targets is modular structure in the human protein-interaction network. In networks with modular structure, interactions between proteins are much denser within a module than between modules. If a module contains many target-proteins for a disease (drug-target module), proteins and interactions in the module could play important roles in disease mechanisms and may be potential candidate targets for the disease. In order to investigate potential drug-targets, we developed a novel computational approach that decomposes the network into small modules and identifies drug-target modules among the modules. The approach successfully identified drug-target modules that contain more than 40% of targets of cancer molecular targeted drugs. Further, proteins in the modules are significantly involved in cancer-related signaling pathways. Thus, the listing of proteins and interactions in the drug-target modules may help us to search more efficiently for drug action mechanisms and novel targets, especially for cancerous diseases.



OS5-3 Future design of gene-set analysis on omics study

Masaki S. Morioka, Hiroshi Tanaka
(Tokyo Medical and Dental University, Japan)

Recent advances in high-throughput technologies, gene-set analysis on omics data have become common approach to explore significant changes in biological systems. Although, there are a lot of software for gene-set analyses, new gene-set analysis combined to meta-analysis is required for analyzing omics data sets. Here we summarize the recent proceeding of both gene-set analyses and meta-analyses, suggesting the requirement of new approaches for further integrative study. In the last, we present one of the ideas for new gene-set analysis combined to meta-analysis. This idea is primitive, but gives a clue for future design of gene-set analysis integrating multiple and heterogeneous omics data.

OS5-4 Identification of drug-target modules in the human protein-protein interaction network

Kaoru Mogushi, Miki Fujihashi, Hiroshi Tanaka
(Tokyo Medical and Dental University, Japan)

Liver cirrhosis is caused by chronic inflammation, and most cases of hepatocellular carcinoma (HCC) develop in patients with advanced chronic liver disease. We investigated the dissimilarity of gene expression patterns between the normal liver and tissues with chronic liver diseases using one-class support vector machine (OC-SVM), which is an algorithm for novelty detection problems. We found that gene sets associated with hepatic metabolism (e.g., "fatty acid metabolic process" and "organic acid metabolic process") showed significant correlation with the OC-SVM scores. Moreover, two patient groups that were classified based on those genes showed significant difference in prognosis ($p=0.006$ by log-rank test). This indicated that our OC-SVM predictor was possible to extract genes associated with tumor recurrence in HCC.

January 22 (Wednesday), 16:15-17:15

Room B

OS10 Intuitive Human-System Interaction

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

Co-Chair: Kaoru Sugita (Fukuoka Institute of Technology, Japan)

OS10-1 A synthesis method of the 3-D digital model of object for 3-D printing based on 3-D image measurement technique

Yonghu Zhu, Kazuhiro Tsujino, Cunwei Lu
(Fukuoka Institute of Technology, Japan)

3-D printing is a process of making a three-dimensional solid object of virtually any shape from a digital model. In this paper we use 3-D image measurement technique to measure an object, and then use the 3-D data synthesis technique to generate a 3-D digital model for 3-D printing. First of all we project the optimal pattern to the object from each direction and capture the reflection pattern images. By processing of each reflection pattern images we compute the 3-D information on object each direction. Then we synthesize the computed 3-D measurement results from multiple directions. At the last, we can generate a 3-D digital model of the entire object. Therefore we can reproduce the 3-D form of the object by using 3-D printer.



OS10-2 Learning to Communicate with a Service Robot using Speech and Hand Raising Gest

Tetsushi Oka, Shojiro Shimazu
(Nihon University, Japan)

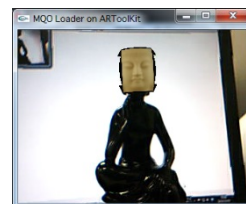
We carefully designed a multimodal language for communicating with a service robot so that one may easily learn it, which is a set of multimodal messages using speech and hand raising gesture. It includes three imperative sentence patterns in Japanese and two hand raising gestures, and the lexicon of the language was carefully designed taking into account consistency. One raises the right hand above the shoulders when demanding a positive action and the left hand when demanding a negative action. This paper presents a case study to investigate how easy it is to learn the multimodal language and how useful such a language can be. The results show that it is easy to learn the language and it is useful for directing service robots to move and control networked home appliances, and imply that one can design a multimodal language easy to learn for demanding a wider range of services.



OS10-3 Some Consideration on AR Application for Retrieving Facial Images of Buddhism Stat

Tzu-Hsuan Huang, Kaoru Sugita, Masao Yokota
(Fukuoka Institute of Technology, Japan)

In this paper, we propose an augmented reality (AR) application to retrieve Buddhism Statues based on facial expression. The application can superimpose a Buddhism statue on a live video at the positions specified dynamically in use of special markers. The Buddhism statue can be retrieved by employing correlations between facial images of Buddhism Statues and their impressions and associated emotional words. We have implemented the AR application as a Windows application by using an AR tool kit.



January 22 (Wednesday), 16:15-17:15

OS10-4 Implementation of Sightseeing Contents Considering Difference in Computer Skills and Devices

Kaoru Sugita, Masao Yokota
(Fukuoka Institute of Technology, Japan)

Through the previous work, the authors have already proposed a new concept of 'universal multimedia access' to narrow the digital divide by providing appropriate multimedia expressions according to users' (mental and physical) abilities, computer facilities, and network environments. In our approach, multimedia contents are presented to support such functions as user interface switching, media switching and QoS switching. In order to evaluate our approach to user interface switching, we have constructed some contents to introduce one of sightseeing areas called 'Keishochi (Splendid Scenery)' providing 9 user interfaces, where a broadcast operation is supported to emulate sightseeing with video data. In this paper, we discuss new sightseeing contents in multiple resolutions supported by 3 additional types of operations in HTML5 and Java Script.



January 22 (Wednesday), 16:15-17:15

Room C

OS15 Sensor Networks and Image Recognition Applied in Intelligent Machine

Chair: Chun-Chieh Wang (Chienkuo Technology University, Taiwan)

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

OS15-1 Image Detection Applied in a Foot Massage Machine via ANFIS

Chun-Chieh Wang¹, Shao-Fan Lien²
(¹Chienkuo Technology University, Taiwan)
(²Chung-Shan Institute of Science and Technology, Taiwan)

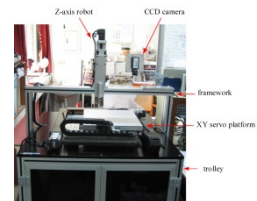
In early years, the foot massage belongs to folk remedies in American. But the technique did not be concerned from the medical profession until the 1970s. Moreover, since ancient times, the concept of acupuncture points corresponding to body organs is used in the traditional Chinese medicine therapy. Therefore, in order to combine the concept of reflexology and acupuncture points, the last decade there were many firms have developed different styles of foot massage machines. The current products on the market contain two kinds of forms of massage, roller-type and push-type. However, it is very difficult to accurately stimulate all acupuncture points for different foot sizes. Besides, the massage roller cannot be controlled independently. Therefore, for the research of foot massage machines, how to find the corresponding acupuncture points will be the biggest challenge. To overcome the above problem, a novel computer vision technology is proposed to detect the foot acupuncture points via Adaptive Neuro-Fuzzy Inference Systems (ANFIS) in this paper. The key features contain three parts. First, we use cameras to take users' soles and execute image pre-processing procedures to segment the region of interest (ROI) of soles. In order to get the reference massage position, the foot acupuncture points are mapped to the foot image. Second, to complete the foot image segmentation, the YCbCr color space is used to separate the luminance in the skin detection. Besides, we use ANFIS to train test-takers' soles-image sets to enhance the success rate of image segmentation. Finally, to implement all acupuncture points massage function, FPGA/DSP embedded system will be used to execute image processing and multi-axes PWM control. The results validate the superiority and practicality of the proposed image detection method for foot massage machines.

January 22 (Wednesday), 16:15-17:15

OS15-2 Realizing the Image Drawing of XY Servo Platform Based on Image Processing Techn

Hong-Ming Chen¹, Chyun-Luen Lin¹, Ting-En Lee²
(¹Chienkuo Technology University, Taiwan)
(²National Yunlin University of Science and Technology, Taiwan)

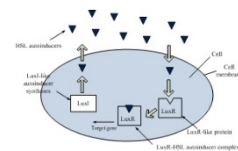
The purpose in this study is to realize the image drawing by using the XY servo platform and image processing technology. One of the main features is applying the LabVIEW to perform the image processing for the image and photo caught by CCD camera. By the contour detection method, the edge curve of object will be extracted from the image background. Then the detected edge pixels will be transferred to coordinate information for XY servo platform. Therefore, the X, Y, and Z axes drove by motion control board will execute the function of image drawing. The experimental results demonstrate that the developed platform can present an outstanding drawing of image.



OS15-3 Bio-inspired Stochastic Density Cognition in Mobile Personnel Portable Sensor Netw

Shao-Fan Lien¹, Shao-Yu Lien², Chein-Hsing Wu¹
(¹Chung-Shan Institute of Science and Technology, Taiwan)
(²National Formosa University, Taiwan)

Full scalability that the number of deployed sensors can be dynamically changed has enabled sensor networks as the most powerful means to collect data distributed over an extensive area. This technical merit hastens the application to human-carried sensors as mobile personnel portable sensor networks (MPPSNet) to track data on individual and among a group of humans (for, such as, logistic applications). However, due to scarce radio spectral, MPPSNet need to share a common frequency band with other wireless systems for data exchanges. The scalability leading to congestions in spectrum induces severe interference between MPPSNet and other wireless systems. For an effective interference control, the data exchanging activity in MPPSNet shall be optimized by each sensors. This distributive optimization depends on the number of sensors (i.e., the density) in MPPSNet. Due to the distributive and mobile nature, each sensors only can reach few neighboring sensors. Estimating the density of sensors autonomously by each sensors thus turns out to be an extremely challenging and critical issue. Inspired by microbiology that gene expressions in individual bacterium are affected by the density of a group of bacteria, we develop a stochastic density cognition framework for each sensor to estimate the overall density in MPPSNet. Confirming to the constraint in microbiology that operations shall be of an extremely low complexity, our framework reaches a remarkably high estimation accuracy, to practically realize MPPSNet.



OS15-4 Wide-Stopband Bandpass Filter Using Stepped Impedance Resonators and Open Stu

Ko-Wen Hsu, Pao-Kuei Horng, Dow-Chih Niu, Tzu-Chien Chao
(Chung-Shan Institute of Science and Technology, Taiwan)

In this letter, a wide-stopband bandpass filter using stepped impedance resonators and open stubs is proposed. By adjusting the suitable impedance ratio and physical ratio of stepped impedance resonators, the spurious response can be push to higher frequency. Moreover, to achieve a wide stopband, the open stubs with appropriate lengths are newly designed to suppress the spurious response. The filter has a good performance at 2.5 GHz with a high selectivity, which is due to the appearance of transmission zeros in the both sides of the passband. Measured results illustrate that stopband up to 8.3 times the center frequency can be achieved to rejection levels about 20 dB.



Room A

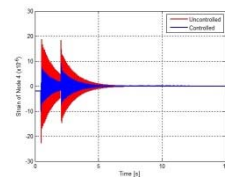
GS16 Robotics

Chair: Jun Kobayashi (Kyushu Institute of Technology, Japan)

GS16-1 Computer simulations on vibration control of a flexible single-link manipulator using finite-element method

Abdul Kadir Muhammad^{1,2}, Shingo Okamoto¹, Jae Hoon Lee¹
(¹Ehime University, Japan)
(²State Polytechnic of Ujung Pandang, Indonesia)

The purposes of this research are to formulate the equation of motion of the system, to develop the computational codes by a finite-element method in order to perform dynamics simulations with vibration control and to propose an effective control scheme of a flexible single-link manipulator. The system used in this paper consists of an aluminum beam as a flexible link, a clamp-part, a servo motor to rotate the link and a couple of piezoelectric actuator to control vibration. Computational codes on time history responses, FFT (Fast Fourier Transform) processing and eigenvalues - eigenvectors analysis were developed to calculate the dynamic behavior of the link. Furthermore, a control scheme using the piezoelectric actuators was designed to suppress the vibration. A proportional-derivative controller was designed and demonstrated its performances. The calculated results of the controlled single-link manipulator revealed that the vibration of the flexible manipulator can be controlled effectively.



GS16-2 Construction of Maxillofacial Patient Model based on Medical Image and Finite Element Method

Tatsushi Tokuyasu¹, Erina Maeda¹, Takuya Okamoto¹, Kazuhiko Toshimitsu², Kazutoshi Okamura³,
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.



January 23 (Thursday), 9:15-10:45

GS16-3 Estimation of Physical Interaction between a Musculoskeletal Robot and Its Surround

Kenji Urai, Yuya Okadome, Yoshihiro Nakata, Yutaka Nakamura, Hiroshi Ishiguro
(Osaka University, Japan)

Recently, robots become to be expected to support our daily lives in real environments. In such environments, however, there are a lot of surroundings and the motion of the robot is affected by those things. In this research, we developed a musculoskeletal robotic arm and a system identification method to cope with external forces and to learn the dynamics of such a complicated situation based on a Gaussian process regression (GPR). A musculoskeletal robot have the ability to cope with external forces including disturbances and GPR can deal with complicated problems and it is an easy-to-implement method. The experimental result show that the behavior of the robot affected by a surrounding can be predicted our method.



GS16-4 Field robot design of agricultural

T. Balaji, M.R. Stalin john
(SRM University, India)

The agriculture sector of India is one of the largest occupations and the largest contribution to India's economy. A lot of issues come along when the Farmers are harvesting their crops. One such is the problem of watering the crops on a timely basis with the exact quantity. In this project we have mainly come up with an idea on how to water the specified portions of the land with the sufficient water whenever needed. We have designed a Robot which has the capacity to Store Water in itself and also move around in the land in the stipulated path without spoiling the crops, to reach the crop area using Artificial Intelligence which checks the whole land for any Water level reduction in the land and by priority basis covers the entire land and waters the crop, all this is done with the help of IP Camera as its Vision Sensors, Wi-Fi and Controller. The Robot has a Water Sprinkler attached to its 6-Axis Robots end effector. The water level in the land and the amount of water needed is attained using soil /moisture sensors and the temperature and humidity of the soil is sensed using Temperature and Humidity Sensors which are connected to the Microcontroller and the power supply unit. The information of robotic system, designing part of robotic vehicle and path control mechanism is explained in section IV. The system algorithm is described in below, which shows the actual working this autonomous farming robot. The approaches of this system are as self operating and controlling assembly, high speed machine, energy saving vehicle, highly accurate and economical robot to be developed. Finally conclusions are drowned. The microcontroller sends the signal to the Robot using Wireless transmission and hence the Robot moves to the location and waters the plant, which is sensed using Flow Sensor. This Robot is an autonomous Robot which has the capability to function on its own without any external human Guidance.

GS16-5 Hexapod-Type SMA Driven MEMS Microrobot with Mounted Bare Chip Artificial Neural Networks IC

Kazuaki Maezumi, Shinpei Yamasaki, Hiroki Obara, Yuka Naito, Kei Iwata, Masaki Tatani, Yuki Okane, Yuki Ishihara, Tomohiro Hidaka, Yohei Asano, Hirozumi Oku, Minami Takato, Ken Saito, Fumio Uchikoba
(Nihon University, Japan)

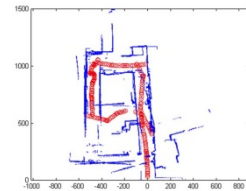
This paper reports a mechanical system and a control system of a millimeter size microrobot. Mechanical system of the microrobot is manufactured by the micro electro mechanical systems technology. The developed microrobot has six legs, and shows a walking motion like an insect. A control circuit is made from artificial neural networks integrated circuit (ANNIC) bare chip and peripheral circuit. The artificial neural networks mimic living organisms, and it is possible to an active and a flexible control. The bare chip IC enables the size reduction of the control system. The sideways, endways, and height dimensions of the microrobot body system are 4.0mm, 2.7mm and 2.5mm, respectively. The sizes of the control system are 8.5mm, 8.5mm and 2.5mm, respectively. Control system was able to mount on the top of the microrobot. The foot step motion of the microrobot was realized by this control system.

January 23 (Thursday), 9:15-10:45

GS16-6 Scan-matching for indoor navigation using downhill simplex method and distance transform

Yau-Zen Chang, Jung-Fu Hou, Ming-Hsi Hsu
(Chang Gung University, Taiwan)

This paper presents a scheme for simultaneous localization and mapping (SLAM) for indoor navigation systems using two-dimensional laser range finders. The scan matching for SLAM is treated as an optimization problem solved by the downhill simplex method in which the two-dimensional distance transform is used for cost value evaluations. Besides, a prediction algorithm is proposed to forecast visible local maps to reduce search range and discard unexpected objects that may cause false match. Experimental results show that the scheme is superior to the ICP-based SLAM technique.



January 23 (Thursday), 9:15-10:30

Room B

GS17 Robotics & Management of technology

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

GS17-1 An application of ant algorithm for searching energy-efficient route of mobile robot by using energy as a weighting factor

Anuntapat Anuntachai, Olarn Wongwirat, Arit Thammano
(King Mongkut's Institute of Technology Ladkrabang, Thailand)

The problem related to energy consumption of mobile robot involves with how to drive the robot with less energy. The ant algorithm can be adapted to find the route of mobile robot consuming less energy. However, it is applicable only for a flat terrain environment. This research proposes the adapted ACO (Ant colony optimization) algorithm for searching the energy-efficient route of mobile robot in rough terrain environment. The energy consumption on each route, including the upward slope, downward slope, and flat surface, is deployed as a weighting factor. The experiment is conducted to verify the outcome of adapted ACO algorithm. The results express that the adapted ACO yields the optimized route consuming less energy, although the energy-efficient route may not be the shortest route. The energy consumption is increased in accordance with the degree of slope in the route. Finally, the energy-efficient route contains more downward slope than upward slope.

GS17-2 Design of Shape Memory Alloy actuated manipulator for minimally invasive surgery and fitting to a random curve

Aman Arora, Fumitoshi Matsuno
(Kyoto University, Japan)

Complications in and post conventional invasive procedures makes minimal invasive surgery very well accepted in society. It causes less pain and scarring, faster recovery and reduces operative trauma for patients. To overcome the difficulties of limited steerability and stiffness control of conventional scope, a continuously curving manipulator actuated by a smart material named Shape Memory Alloy is proposed in this paper. The segmented scope consists of a compression spring backbone and three Shape Memory Alloy actuators to dynamically control the shape of each segment of the manipulator as and when required. The paper also discusses a detailed study carried out to simulate the constraints of the manipulator and fit it to a given random curve in a 3 dimensional space in the best possible way. The manipulator seems to be a promising device to be able to follow given random complex 3 dimensional trajectories, and vary segment stiffness as and when required.

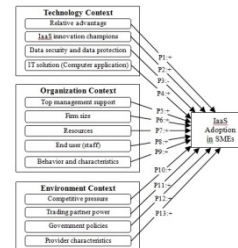


January 23 (Thursday), 9:15-10:30

GS17-3 Determinants Influencing IaaS Adoption in SMEs - a Proposed Model -

Nutjari Totadsa, Singha Chaveesuk
(King Mongkut's Institute of Technology Ladkrabang, Thailand)

Infrastructure as a Service (IaaS) is one of essential service models in cloud computing system with processing service on computer resources through internet technology. Cloud computing has played an important role in new technologies with computing application service. Small and medium-sized enterprises (SMEs) with determinants of cloud computing adoption have encountered ambiguous decision making in information technology infrastructure investment for reinforcing their competitive position against large organizations and standardizing their service and operation with fast data access. The purpose of this paper is to build a proposed model and present potentially related factors that affect IaaS adoption used in SMEs. Technology Organization Environment (TOE) developed from Diffusion of Innovation theory (DOI) is considered for exploring the factors adopted in SMEs.



GS17-4 The Determinants Affecting BI Adoption in Thai Organizations: A Proposed Model

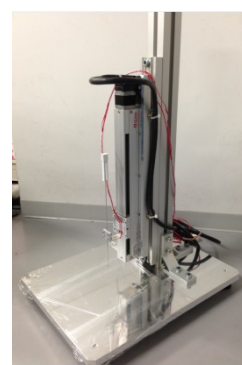
Suparut Horkondee, Singha Chaveesuk
(King Mongkut's Institute of Technology Ladkrabang, Thailand)

Many organizations have believed that BI can help managers make decisions more accurately. However, BI implementation might be inapplicable in some organizations. While BI adoption rate is rising, it has still found failure. Based on surveying BI research it has been found that most research focuses on BI technological perspectives and BI application. Limited research has been presented about BI adoption strategy. This paper aims to propose a conceptual model for determining factors that influence BI adoption in organizations. The model is based on Technology-Organization-Environment (TOE) framework. The proposed model would be an initial model to build a successful adoption model and generate the contribution to knowledge of the determinants affecting BI adoption in Thai organizations.

GS17-5 A Study on Mechanical Properties of Pig's Organ for an Organ's Model in Surgery Sin

Takahiro Tsuji, Kazuo Kiguchi, Nobuhiro Okada, Yasutaka Tsuji, Munenori Uemura, Makoto Hashizume
(Kyushu University, Japan)

In recent years, laparoscopic surgery has been expanded as one of advanced surgery methods. In order to perform the laparoscopic surgery, special skills are required for surgeons. To create the opportunities for practice, a practical surgery simulator is expected to be one of solutions, and practical organ's model is essential in order to make the practical surgery simulator. In this study, two kinds of experiments were performed for the model construction. One is carried out to investigate the influence of the freshness (i.e., the influence of the elapsed time of pig's organ after its slaughter). The other one is carried out to investigate the influence of puncturing speed of a needle to the organ properties. The experimental results show that the elapsed time may affect the organ's properties, on the other hand, the puncturing speed of the needle may not affect the organ's properties.



Room C

OS3 Biomimetic Machines and Robots

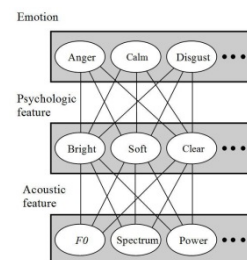
Chair: Keigo Watanabe (Okayama University, Japan)

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

OS3-1 Construction of Dialogue Systems based on an Emotional Recognition System

Shota Yoshimura, Keigo Watanabe, Tsuyoshi Isikawa, Shoichi Maeyama
(Okayama university, Japan)

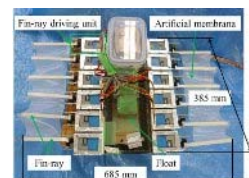
There is a method with speech as a way for recognizing partner's emotions. As a representative study on the speech in the engineering fields, there is research of speech recognition. Speech interfaces are highly expected, because they are considered to be widely used. However, conventional speech dialogue systems respond by obtaining only linguistic information. In this study, we focus on the emotion that is particularly important in nonverbal information, and aim at building a system that can recognize the emotion from speech. A fuzzy inference system is used for the emotional classifier in the system. In this paper, we describe an overview of the emotional recognition system, the collection of speech data, the way of building the system, and the recognition results of the constructed system.



OS3-2 Propulsive Control for a Manta Robot by a Designed CPG Based on the Experimental Knowledge

Masaaki Ikeda, Shigeki Hikasa, Yukito Hamano, Keigo Watanabe, Isaku Nagai
(Okayama University, Japan)

We have already developed an experimental model of the Manta robot which has a propulsive mechanism of a pair of pectoral fins. Furthermore, the relationship between the propulsive speed and the propulsive motion of the robot using two pectoral fins was confirmed by some underwater experiments. As a result, the propulsive speed of the Manta robot changed with the change of the amplitude. In this paper, we design a CPG for the Manta robot to propel it underwater in consideration of the knowledge acquired from the relationship between the propulsive motion and speed of the robot. We mainly control the propulsive speed of the Manta robot by using the fact that a propulsive speed increases depending on the increase in the amplitude. The effectiveness of the proposed method is shown by a numerical simulation.



OS3-3 Development research on human behavior recognition system

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

In this paper, a Hidden Markov Model (HMM) approach is introduced for recognizing human behaviors. Two main points are discussed in this approach: first is the application of HMM to the recognition system of human behaviors, and second is the effectiveness comparison of K-means and fuzzy C-means clustering algorithms. Three sample human behaviors are defined and the corresponded 3D data are collected using the Microsoft Kinect sensor (3D sensor). During these processing, we discuss the difference of k-means and fuzzy c-means clustering algorithms, and also we can see the results impacted by different clustering algorithms, the effectiveness of both clustering methods is shown through demonstrating the performance of our recognition system with HMM. We also will discuss the effect of the same gesture in different speed.

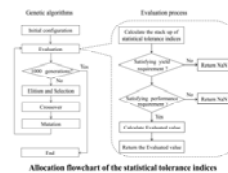


January 23 (Thursday), 9:15-11:00

OS3-4 Optimal Allocation of Statistical Tolerance Indices by Genetic Algorithms

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

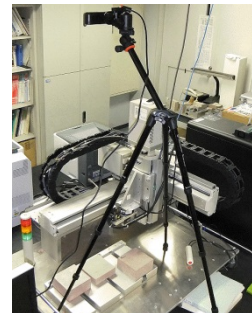
Process abilities of a machining and a measurement in manufacturing industries are getting larger. On the other hand, a customer's demand for a product performance is also getting larger. To satisfy the consumer's demand by making good use of the process abilities, we have studied a tolerancing method by using statistical tolerance indices, which is the specification for the limitation of the process capability indices. In this paper, we propose an allocation method of the statistical tolerance index by genetic algorithms. The proposed method is applied to a product model composed of five parts assembled with linear combination to confirm the effectiveness of the method.



OS3-5 Basic Design of a Computer Vision-Based Controller for Desktop Engraving Machine - The NC-Code Adapter -

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

Modern CNC machine controllers are being more powerful and accurate with the fast evolution of electronic components and control algorithms. But they still lack of autonomy. To perform an engraving operation for instance, the operator needs to guide the tool tip manually toward workpieces for the machine to start its task. Also, for engraving the same CAD model on many workpieces of different sizes, as many NC part programs are needed; and to get each of these, the operator needs to return to the CAD model and scale it according to sizes of workpieces before regenerating tool-paths. Computer vision is a field that provides many advantages to many engineering domains and integrating it to CNC machine controllers can be the solution to the first problem and can add many other advantages at the same time. With a vision component, a CNC machine is not only aware of the number of workpieces on its table and their locations, but it is also aware of their dimensions; which opens a broad array of improvements in its abilities. This paper concentrates on the subsequent parts of the CNC controller's vision components. Indeed, for the second problem stated above, we propose a function called the NC-code adapter.



OS3-6 Nonholonomic control and state estimation for an X4-Flyer with noisy measurements

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

Recently, aerial robots are expected to be used as a rescue robot for collecting any information at the time of a disaster. The aerial robot called X4-Flyer can control at least three attitudes and one position by changing the rotor speed of four rotors. However, the control performance of a controller for the X4-flyer is deteriorated due to measurement noises generated by the rotational vibration of the rotors. Therefore, it is important to reduce the effect of such measurement noises on the controlled system. In this paper, when using a nonholonomic control method based on the Lyapunov stability theory to design a basic controller for the X4-Flyer, it aims at reducing the deterioration of the controller performance, which is caused by the influence of measurement noises, by processing such noises with an extended Kalman filter. The effectiveness of the proposed method is checked through numerical simulations.

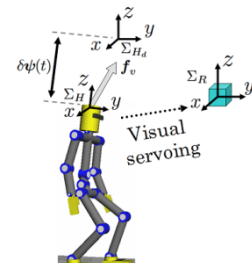


January 23 (Thursday), 9:15-11:00

OS3-7 Analyses of Humanoid Visual Lifting Biped-walking and Spontaneous Arms' Swinging Dynamical Coupling

Jumpei Nishiguchi, Tomohide Maeba, Gyetak Lee, Mamoru Minami, Akira Yanou
(Okayama University, Japan)

Biped locomotion created by a controller based on Zero-Moment Point [ZMP] known as reliable control method looks different from human's walking on the view point that ZMP-based walking does not include falling state. However, the walking control that does not depend on ZMP is vulnerable to turnover. Therefore, keeping the walking of dynamical motion stable is inevitable issue for realization of human-like natural walking---we call the humans' walking that includes toe off states as "natural." In this paper, walking model including slipping, bumping, surface-contacting and point-contacting of foot is discussed. Then, we propose a "Visual-Lifting Control" method to enhance standing robustness and prevent the robot from falling down without utilizing ZMP, i.e., whose walking involve falling down states. Simulation results indicate that this strategy helps stabilize bipedal walking even though ZMP is not kept inside convex hull of supporting area. Moreover, we point out that arms begin to swing spontaneously by dynamical coupling among body links without input torques concerning the arms' joints.



January 23 (Thursday), 9:15-10:45

Room D

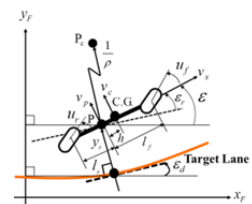
OS8 Estimation and Control of Vehicles

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

OS8-1 Steering Control without Using Measurements of Lateral Velocity of Vehicles

Panfeng Shu, Yasutaka Yoshihara, Jinxin Zhuo, Masahiro Oya
(Kyushu Institute of Technology, Japan)

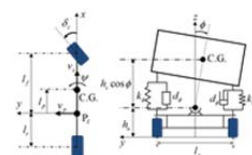
Recently, in order to improve steering stability, many steering control schemes using the front and rear wheel steering have been developed. However, these schemes require the measurements of the yaw rate but also the lateral velocity of vehicle. Even if we use high quality GPS system, it is very difficult to measure the lateral velocity with high accuracy. In this paper, to overcome these problems, we propose a new adaptive steering control scheme using the front and rear wheel steering. The developed controller does not require any accurate knowledge of all vehicle parameters and the measurements of the lateral velocity. Using the steering controllers, the vehicle can realize a good steering control performance. Finally, by using numerical simulation, the validity of the proposal scheme has been checked even if the environment which around driver changes.



OS8-2 Adaptive Estimation Method for Driver parameters

Hiroshi Minato, Jinxin Zhuo, Panfeng Shu, Masahiro Oya
(Kyushu Institute of Technology, Japan)

If the driver parameters can be estimated online, it can be expected that we can design an ideal vehicle model with better rollover performance. Once a good ideal vehicle can be designed, it is very easy to develop a tracking control so that the behavior of an actual vehicle can track that of the designed ideal vehicle model. To meet the objective, in this paper, for the driver-vehicle system with the steering play, we proposed an adaptive online estimate method of the driver parameters. Furthermore, to show the effectiveness of the proposed estimator, numerical simulations are carried out.

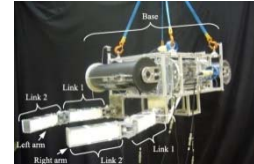


January 23 (Thursday), 9:15-10:45

OS8-3 Experiment on a dual-arm underwater robot using resolved acceleration control meth

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

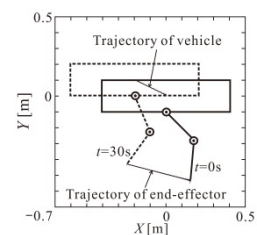
Underwater vehicle-manipulator systems (UVMS) are underwater robots equipped with one or more robotic arms. A major problem for robotics in underwater environment is the ability to work without a fixed base. Moreover, the installation of robotic arms can create additional robot control problem due to coupling effects of the robot body and robotic arms. Furthermore, researchers have been focusing on developing control schemes mainly for single-arm UVMS. In our previous work, we have proposed a resolved acceleration control (RAC) method for a dual-arm UVMS by incorporating the effects of hydrodynamic forces into the control system. We have conducted experiments to verify the effectiveness of the proposed RAC method on an actual dual-arm underwater robot. In this paper, we demonstrated that by using the proposed RAC method, although the dual-arm moved to a desired position, the robot body was able to demonstrate effective station-keeping capability.



OS8-4 Design of an observer-based adaptive controller for underwater vehicle-manipulator systems using radial basis function networks

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

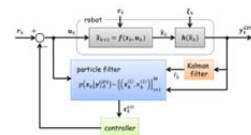
In this paper we develop an adaptive control scheme for underwater vehicle-manipulator systems using a nonlinear observer. This nonlinear observer is designed to estimate the velocity signals of the system states under the condition that the parameters of a robot system are unknown. In order to achieve the design objective, the structure of the observer includes a radial basis function network, a type of neural network, which can approximate the nonlinear dynamics of robot systems, and whose parameters are adaptively generated. The controller developed here combines the nonlinear observer with an adaptive control scheme where a radial basis function network is used instead of the adaptive feedforward term. In the adaptive control system including the observer, the boundedness of all signals is guaranteed. Moreover, it is shown that ultimate bounds of the tracking error and the estimation error can be reduced by setting design parameters.



OS8-5 State estimation and control of a mobile robot using Kalman filter and particle filter

Takeshi Nishida, Sozo Inoue, Shinichi Sagara
(Kyushu Institute of Technology, Japan)

We focus on the filter in a method proposed recently, i.e., a method to improve the state estimation accuracy of mobile robots placed near high-rise buildings using the GPS (global positioning system) signals. In this method, it was assumed that a GPS signal that contains a reflected and diffracted wave is denoted by the sum of the true position information and noise that follows a time-varying Gaussian distribution. On the basis of this assumption, the time-varying bias of a GPS signal is tracked using a Kalman filter. In addition, a particle filter, which executes sampling and likelihood evaluation using the estimated bias, was developed. With the proposed method, a GPS signal that contains the rejected noise introduced by the conventional method can be used efficiently, and the state estimation accuracy of the robot in a shadow area of GPS satellite can be improved. In this research, the control system for an autonomous mobile robot incorporating the proposed state estimation mechanism is evaluated via different simulation condition from the previous work.

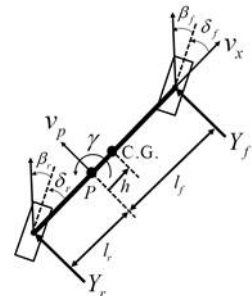


January 23 (Thursday), 9:15-10:45

OS8-6 Adaptive Controller for Vehicles with the Saturated Lateral Tire Force

Jinxin Zhuo, Yasutaka Yoshihara, Panfeng Shu, Masahiro Oya
(Kyushu Institute of Technology, Japan)

We propose an adaptive steering controller. As the first step to design an adaptive steering controller, a linear ideal vehicle model is designed. Then, we develop an adaptive steering controller for the nonlinear vehicle model with saturated lateral tire force so that the behavior of the nonlinear vehicle model can track that of the linear ideal model. At last, to show the effectiveness of the proposed adaptive steering controller, numerical simulations are carried out.



January 23 (Thursday), 12:00-13:00

Room G

Poster Session

PS1 A mixture statistical testing based fire alarm system

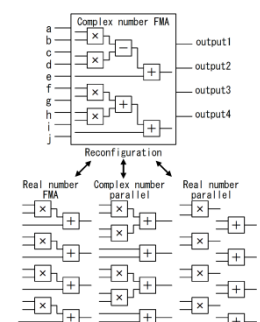
ChinLun Lai
(Oriental Institute of Technology, Taiwan)

In this paper, a color probability model(CPM) combined with Gaussian mixture model(GMM) is proposed to detect the flame/smoke regions, thus to activated the fire event alarm. The former adopt the RGB color of the flame/smoke which is built as a statistic model to select the candidate regions, while the latter use the HSV feature GMM for double checking. To reduce the interference of similar objects or lighting conditions, the temporal probability model (TPM) is also included to inspect the swing and continuation of the candidate regions thus to remove fake regions. After that, the mixed model which combined with flame/smoke color, shape, and texture features are undergone a trained SVM to verify the fire regions. The simulation results show that the proposed fire alarm system not only decreases the false alarm rate but also provide more precise time and location of the detected event.

PS2 A novel architecture of dynamically reconfigurable fused multiply-adder for digital signal processing

Akihiko Tsukahara, Akinori Kanasugi
(Tokyo Denki University, Japan)

Multiply-accumulate operation is the most fundamental operation in digital signal processing for image processing, robotics and automatic control. In this paper, a novel architecture of dynamically reconfigurable fused multiply-adder (FMA) is proposed. Dynamic reconfiguration is a method that can change the circuit configuration without stop of operation. The proposed circuit can calculate complex number FMA. This calculation can be applied in digital signal processing. In addition, by dynamic reconfiguration, the proposed circuit can calculate real number FMA, complex number parallel calculation, and real number parallel calculation. The data format is single precision floating point format based on IEEE754. The proposed circuit was designed using Verilog-HDL. It was simulated by logic circuit simulator, and implemented on FPGA. Then, correct results for each calculation mode were confirmed.

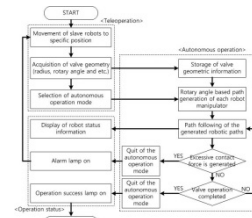


January 23 (Thursday), 12:00-13:00

PS3 A study of a multi-robot teleoperated system using a haptic device based on embedded controllers

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

In this paper, we propose a new approach to operate a multi-robot system. It operates on a valve mechanism, which is based on cooperation between two slave robots that are remotely controlled by an operator using a human-robot interface. A teleoperator (haptic device) is interfaced to an embedded controller using new libraries based on LabVIEW. The new libraries for compatibility between haptic devices and embedded controllers that is created using C++ is called in LabVIEW, which is a GUI (graphical user interface) based software development tool, to operate the haptic device with the embedded controller. The integrated management algorithm between the two slave robots and the single human operator is described according to each unit task. Moreover, it contains GUI designs to regulate and display interactions between the two slave robots and the single human operator.



PS4 Accuracy Improvement of Genetic Algorithm for Obtaining Floating-Point Solution

Kengo Nishijima, Akinori Kanasugi, Ki Ando
(Tokyo Denki University, Japan)

The aim of our study is implementation of Genetic Algorithm (GA) in FPGA hardware. We use GA for obtaining floating-point solutions accurately. For this purpose, we propose applying a gray-coded floating-point format to GA in order to improve accuracy of the solutions. In this paper, we show the result of simulations by using a gray-coded floating-point format. We evaluate performance of the proposed GA by obtaining solutions of five dimensional Sphere function and two dimensional Rosenbrock function. In these experiments, we focused on mutation probability which is one of the parameters of GA for improving its accuracy. In the results, there was a trade-off between convergence speed and speed of finding the optimal solution depending on the mutation probability. However, we showed that our theory can obtain the optimal solutions effectively compared with the normal floating-point format.

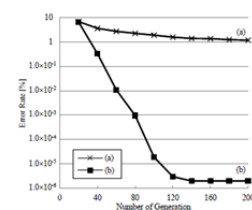


Fig. 6. Simulation of obtaining square root 2.
(a) is the result by normal floating-point format.
(b) is the result by gray-coded floating-point format.

PS5 Adaptive mutation strategies and population for Differential Evolution

Sheng-Ta Hsieh¹, Chun-Ling Lin², Shih-Yuan Chiu³
(¹Oriental Institute of Technology, Taiwan)
(²Ming Chi University of Technology, Taiwan)
(³National Dong Hwa University, Taiwan)

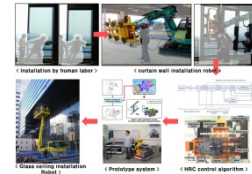
In differential evolution (DE), choosing a suitable mutation strategy can efficiently generate moving vector and guide other vectors toward to potential solution space. In this paper, the mutation coordinator, which is used to switch mutation strategies, is proposed for improving differential evolution (DE) algorithm's solution exploration performance. Also, in order to utilize population more efficiency, the adaptive population concept is also involved to adjust population size according to previous solution searching status. In the experiments, ten multi-modal functions of CEC 2005 are selected for testing proposed method and compare it with two DE methods. From the results, it can be observed that the proposed method performs better on most test functions.

Functions	Results	Proposed Method	DE/Best1	DE/Best1
F_1	Mean	2.0829E+02	5.3124E+02	3.2686E+03
	Std.	6.5715E+02	8.9587E+02	7.9322E+02
F_2	Mean	4.0472E+01	8.0541E+03	2.6164E+01
	Std.	3.3200E+01	4.0112E+04	7.4503E+01
F_3	Mean	5.1341E+03	6.6021E+03	1.1617E+00
	Std.	6.3878E+03	6.1010E+03	6.2770E+02
F_4	Mean	2.0931E+01	2.0951E+01	2.0943E+01
	Std.	6.2392E+02	5.3213E+02	5.1483E+02
F_5	Mean	2.6976E+01	2.8272E+01	1.1999E+02
	Std.	8.0380E+00	2.0689E+01	6.7420E+00
F_6	Mean	2.0022E+02	1.9144E+02	2.1110E+02
	Std.	8.9199E+00	1.4218E+01	1.0377E+01
F_7	Mean	3.7903E+01	3.8904E+01	3.9696E+01
	Std.	2.9053E+01	1.1537E+00	1.0609E+00
F_8	Mean	1.7627E+04	2.5674E+04	2.9443E+05
	Std.	1.3401E+04	2.7276E+04	3.4823E+04
F_9	Mean	3.5748E+00	1.2316E+01	1.6333E+01
	Std.	1.6518E+00	9.3605E+01	1.3617E+00
F_{10}	Mean	1.3362E+01	1.3388E+01	1.3600E+01
	Std.	1.1879E+01	2.0433E+01	1.5724E+01

PS6 Advances in glazing robots from a teleoperated system to a human-robot cooperative system

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

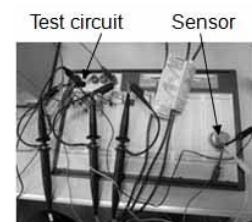
Recent research has found that a lack of skilled manpower in the construction industry is rapidly becoming a serious problem. Construction robots and automation technology have the potential to raise productivity by performing tasks efficiently and improving working conditions through applications where humans are exposed to safety hazards. So far, handling heavy materials has been, for the most part, eliminated for outside work by cranes and other various lifting equipment. Such equipment, however, is not available for precise work. To satisfy curtain-walls (one of the building materials) handling needs for precise work, especially, a Teleoperated Curtain-wall Handling Robot (TCHR) has been developed and applied to real construction sites. After applying TCHR to a real construction site, we deduce that human and robots have advantages and disadvantages in building material handling works. In this paper, we introduce that integration of advantages of both robots and humans, and incorporation of them into the Human-Robot Cooperative (HRC) manipulation, would improve the efficiency or performance of the system from the viewpoints of human error and work efficiency. After field test at a real construction site, productivity and safety of the developed system are compared with the existing handling equipment.



PS7 Analog circuit for detecting position of smell based on information processing of the biological system

Noriaki Munehira, Kimihiro Nishio
(Tsuyama National College of Technology, Japan)

We proposed in this study a novel analog complementary metal oxide semiconductor (CMOS) circuit for detecting position of smell source based on information processing of the biological system. The novel circuit has the function of the feedback mechanism. Since the proposed circuit consists of the smell sensor as the input part and about ten metal oxide semiconductor (MOS) transistors, the proposed circuit is simple structure. The proposed circuit was confirmed by the test circuit. The test circuit was fabricated on the breadboard by discrete MOS transistors. The measured results of the test circuit showed that the output voltage becomes large when the smell sensor detects the smell of the target.



PS8 Artificial Bee Colony Algorithm with Dimension Manager for Global Numerical Optimization

Chun-Ling Lin¹, Sheng-Ta Hsieh², Jhih-Sian Chen²
(¹Ming Chi University of Technology, Taiwan)
(²Oriental Institute of Technology, Taiwan)

In this paper, a new variant of artificial bee colony (ABC) algorithm is proposed for solving numerical optimization problems. In order to increase ABC's exploitation ability, the dimension manager is proposed. It can make Bees perform one or multi-dimensional information exchange. Also, in order to increase onlooker bees' exploration ability, their moving behavior is modified too. In the experiments, 15 test functions of CEC 2005 are adopted for testing proposed method and compare it with 5 related works. From the results, it can be observed that the proposed method performs better on most test functions.

Table 3. Experiment Results

Algorithm	Best	Mean	Std	Min	Max	Success
ABC	1.0E-04	1.0E-04	1.0E-04	1.0E-04	1.0E-04	100
COABC	1.0E-04	1.0E-04	1.0E-04	1.0E-04	1.0E-04	100
SSABC	1.0E-04	1.0E-04	1.0E-04	1.0E-04	1.0E-04	100
ESABC	1.0E-04	1.0E-04	1.0E-04	1.0E-04	1.0E-04	100
Proposed	1.0E-04	1.0E-04	1.0E-04	1.0E-04	1.0E-04	100
ABC	1.0E-04	1.0E-04	1.0E-04	1.0E-04	1.0E-04	100
COABC	1.0E-04	1.0E-04	1.0E-04	1.0E-04	1.0E-04	100
SSABC	1.0E-04	1.0E-04	1.0E-04	1.0E-04	1.0E-04	100
ESABC	1.0E-04	1.0E-04	1.0E-04	1.0E-04	1.0E-04	100
Proposed	1.0E-04	1.0E-04	1.0E-04	1.0E-04	1.0E-04	100
ABC	1.0E-04	1.0E-04	1.0E-04	1.0E-04	1.0E-04	100
COABC	1.0E-04	1.0E-04	1.0E-04	1.0E-04	1.0E-04	100
SSABC	1.0E-04	1.0E-04	1.0E-04	1.0E-04	1.0E-04	100
ESABC	1.0E-04	1.0E-04	1.0E-04	1.0E-04	1.0E-04	100
Proposed	1.0E-04	1.0E-04	1.0E-04	1.0E-04	1.0E-04	100

January 23 (Thursday), 12:00-13:00

PS9 Correlation analysis of 1/f noise of keystroke dynamics and respiration

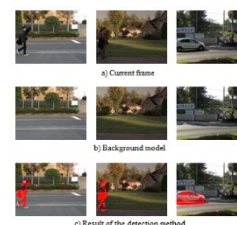
Shizuka Bando, Akio Nozawa
(Aoyama Gakuin University, Japan)

Modern society today is called stressful society with various mental stress that spreads over. Several studies have investigated stress using physiological indices. However, measurement of these indices would itself become a stressor to the subject. The temporal dynamics of key typing are called "keystroke dynamics". It is known the psychosomatic state of user has an effect on. The aim of this research is development a method of measurement is stress free. The relationship between fluctuations in keystroke dynamics and respiration were analysed. Intervals between key strokes were measured while using computer under the state of auditory stimulus or cognitive stress. The power spectrum for the series of inter-stroke time (IST) and the power spectrum density of respiration fluctuation were calculated.

PS10 Detecting moving objects in a video using sequential background inference

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

This paper proposes a method of detecting moving objects in a video taken with a moving camera with sequential inference of the background. On the video taken using a moving camera, the position of the background pixels in the image frame T is not same with the position of the background pixels on the image frame $T+1$. Changes in the pixel position can be searched using 2D projective transform. The background model is created using bilinear interpolation of pixels in the image frame T which correspond to the pixels in the image frame $T+1$. Having obtained the model background, a pixel in the image frame $T+1$ can be determined whether it is a background pixel or a foreground pixel. The effectiveness of the proposed method is evaluated by comparing the foreground detection results of the proposed method with the ground truth.



PS11 Development of Automatic Tracking Robot Using Image Processing

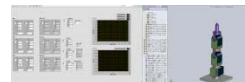
Daichi Takeshita¹, Shota Nakashima², Yuhki Kitazono¹, Seiichi Serikawa³
(¹Kitakyushu National College of Technology, Japan)
(²Yamaguchi University, Japan)
(³Kyushu Institute of Technology, Japan)

In recent years, research on automatic robot has evolved significantly. For example, Automatic follow-up running, such as Subaru "eye site", target-following Robot Based on Distance Information of Image, Research to take advantage of the automatic tracking robot to transport system. In this paper, we develop automatic tracking robot chasing an object of certain. This is a process using the "OpenCV" data from the camera module, and controlled using an "Arduino" and "Raspberry Pi". Conventional automatic tracking robots will not be able to use that function if this lose sight of the object. In this paper, when the Automatic Tracking Robot has lost sight of the object, this is to predict the movement destination of the object from information such as the time and location, and will return to the automatic tracking running.

PS12 Development of Model Robot Based on Multi Agent System

Ryutarou Araki¹, Shinya Haramaki¹, Akihiro Hayashi², Mochimitsu Komori²
(¹Ariake National College of Technology, Japan)
(²Kyushu Institute of Technology, Japan)

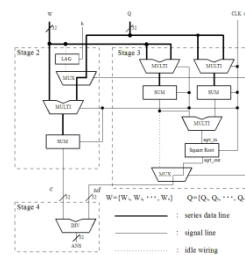
This paper presents the development of model robot based on multi-agent system (MAS) which have been proposed as a kinematics computing framework available for flexible robot control. An agent consists of two elements, a hardware module as a joint mechanism which is limited to one axis, and a software module to control corresponding hardware module above. The purpose of this study is to verify the proposed kinematics computing framework using MAS. First, a summary of MAS is presented. Second, this paper deals with a development of simulator with LabVIEW and small-sized model robot to put a verification using actual machine into execution. Finally, feasibilities of proposed method are shown by a simulation targeting actual robot, and confirmed actual robot motion.



PS13 Dynamically Reconfigurable Circuit for Correlation Calculation

Kentaro Hasegawa, Akinori Kanasugi, Ki Ando
(Tokyo Denki University, Japan)

We proposed an arithmetic circuit for obtaining correlation coefficient. Correlation calculation is frequently used in the fields of image processing. Our proposed circuit can change own structure by switching its internal wiring without stopping execution. This mechanism is called dynamical reconfiguration, and its advantage is reduction of circuit scale. In this paper, we designed a circuit which executed two different calculations by using common logic components. Multiplexers switch the wiring of the circuit and the roles of logic components are changed instantly. Additionally, we verified this circuit by comparing to the circuit which was not applied dynamical reconfiguration. In the result, scale of this circuit was reduced by 17% even though it kept its processing speed. We considered that our design for correlation calculation worked effectively for reducing its circuit scale.



PS14 Fast motion detection in a dynamic background

Panca Mudjirahardjo, Joo Kooi Tan, Hyungseop Kim, Seiji Ishikawa
(Kyushu Institute of Technology, Japan)

We present a fast motion detection technique in a dynamic background as an abnormal motion based on optical flow and a motion history image (MHI). Since a camera view is usually not in perpendicular with motion direction, the velocity of motion is not uniform spatially. Instead of object detection directly from an image, we divide an image into several blocks. Then we calculate the probability that a block(s) contains a fast motion by using parameters of a velocity histogram and a shifting histogram. A velocity histogram is created based on the trajectory of the points tracked by Lucas-Kanade tracker and a shifting histogram is created based on a MHI. The performance of the proposed method is experimentally shown.

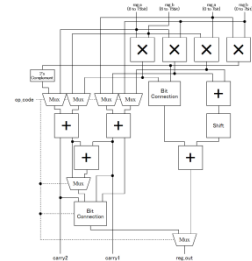


January 23 (Thursday), 12:00-13:00

PS15 Generator of Dynamically Reconfigurable Processor

Takahiko Sega, Akinori Kanasugi, Ki Ando
(Tokyo Denki University, Japan)

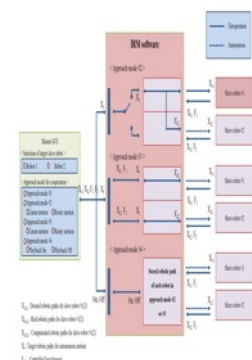
In recent years, demand for FPGA increases significantly. Being able to be designed like software, the FPGA opened the door to the field of hardware for many people. However, it takes much time to develop a circuit by conventional methods yet. In this paper, we suggest the processor generator which can shorten development time and can implement dynamically reconfigurable architecture. This architecture is an advantage in comparison of other processor generators. By applying this architecture, our processor generator makes a significant reduction of circuit scale. The reduction rate of each part of the 16bit processor is shown as follows: slices are 10.7%, flip-flops are 6.2%, LUTs are 11.7%, and multipliers are 14.3%.



PS16 Integrated robot management software for single-operator multi-robot teleoperation systems

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

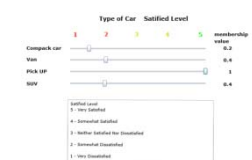
The present paper introduces a single-operator multi-robot teleoperation system that can conduct complex or difficult jobs in a remote location through a single user working with multi-robots. In particular, integrated robot management (IRM) software, which mediates communication efficiently between an operator and multi-robots, is explained in detail. The proposed IRM software is basically responsible for bilateral communication between remote robots and an operator, and it assigns (or change) a role for each robot automatically when an operator instigates cooperative motion between robots based on the operational command created through the master device. In addition, various data relating to the work performed, along with the status of currently operational robots, is observed via the graphical user interface (GUI) of the IRM software. In order to evaluate the efficiency of the proposed single-operator single-robot (SOMR) teleoperation system and IRM software, the time to perform a specific task in a simulated environment is compared with the time it takes to perform the same task in the existing SOSR teleoperation system.



PS17 Online Decision Support System of Used Car Selection Based On Fuzzy Technique

Kaveepoj Banluewong
(Mahasarakham University, Thailand)

This research proposed the Online Decision Support System of Used Car Selection Based on Fuzzy Technique that is an application which is able to suggest the user for selecting the used car. This application consisted of 2 main functions that are 1. Normal search and 2. Decision support system (DSS). From the DSS, the user is able to input the need and level of need for making the characteristic membership function. After that, the used car data will analysis by the Product Classification and show the result ordered by descending. From the user contentment, the DSS system is able to suggest the proper used car more than the normal search.



PS18 Position detection method for microwell chip on microscope stage by photon multiplier tube

Ki Ando¹, Hidekazu Uchida², Ahmed Shamim³, Koichi Nishigaki², Osamu Takei⁴, Akinori Kanasugi¹
(¹Tokyo Denki University, Japan)
(²Saitama University, Japan)
(³Shahjalal University, Bangladesh)
(⁴Lifetech Co.,Ltd, Japan)

In this paper, we propose a position detection method for the Microwell with Manageable Volume (MMV) chip on the stage of the inverted microscope. When the manipulation robot arm puts an MMV chip on the microscope stage, there is alignment error up to 500 micrometers. This error affects measurement sensitivity of fluorescence from solution filled in the MMV chip. Usually, CCD image processing is used for detecting a position. However, adding a CCD camera to our microscope increases complexity of the optical system. Therefore, we used a Photon Multiplier Tube (PMT) which was already equipped for measuring fluorescence. In the result, the position of MMV chip was detected by putting a pilot LED on the opposite side of the objective lens. The detection error was less than 10 micrometers. Although this method is devised for our system, we consider that it is available in other micro optics systems.



PS19 Sensory System for Monitoring Status of Driving Bicycle

Jae Hoon Lee, Takashige Yano, Tomoshi Yamashita, Shingo Okamoto
(Ehime University, Japan)

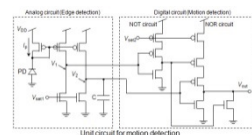
This paper presents a novel monitoring system for measuring the status of driving bicycle. The proposed system can be used to measure and save in real-time not only the motion of bicycle rider but also the surrounding situation near the vehicle. Thus it consists of two main parts; the first one is internal module to measure the human riding motion by using multiple inertial sensors, and the second is external module to measure the surrounding conditions by using laser scanner and camera, respectively. The system configuration was designed for manipulating all data from the sensors with the odometry, i.e., the position information of the vehicle computed by using the rotation angle of wheels. The measurement results taken from the experiments with the developed system are introduced in this paper.



PS20 Simple analog-digital circuit of low power consumption for motion detection based on the biological vision system

Yui Mori, Kimihiro Nishio
(Tsuyama National College of Technology, Japan)

In this research, we proposed the analog-digital circuit of low power consumption for motion detection based on the biological vision system. The proposed unit analog-digital circuit is simple structure since the digital part of the proposed circuit is only constructed with one NOT circuit and one NOR circuit. The low power consumption circuit was realized by limiting the value of the current which flows into the metal oxide semiconductor (MOS) transistors constructed with NOT circuit and NOR circuit. The MOS transistors constructed with novel NOT circuit and NOR circuit are operated in the subthreshold region. The simulation results with the simulation program with integrated circuit emphasis (SPICE) showed that the circuit can output the motion signal.

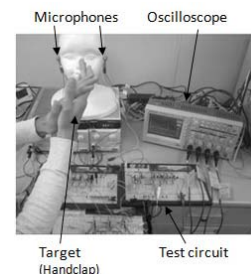


January 23 (Thursday), 12:00-13:00

PS21 Simple sound localization system by analog-digital circuits based on the biological auditory system

Kousuke Nakatsukasa, Kimihiro Nishio
(Tsuyama National College of Technology, Japan)

We proposed in this study the simple system for detecting the sound localization based on the biological auditory system. The proposed system is constructed with the simple complementary metal oxide semiconductor (CMOS) analog-digital circuit based on the biological auditory system and two microphones. The proposed circuit consists of the delay lines and the comparators. The structure of the proposed circuit is simple. The test circuit and system was developed. The test circuit was fabricated with discrete metal oxide semiconductor (MOS) transistors on the breadboard. The experimental results of the test system showed that the proposed circuit can generate the output signal for detecting the position of the sound of the target. We can realize a new target tracking system by applying the proposed system in this research.



PS22 Simulation for innovation diffusion using system dynamics approach

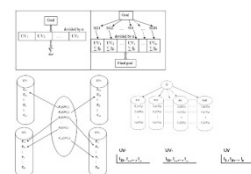
Shiu-Wan Hung, Juin-Ming Tsai
(National Central University, Taiwan)

Previous studies on diffusion have been mostly limited by the propositions acquired from historical data and have lacked a comprehensive exploration of the influential factors affecting diffusion. A more accurate simulation system that considers the multi-factor process is highly desired. This paper presents the innovation diffusion for telehealth using a system dynamics approach, and the sensitivity test was used to explore the key factors. The results show that the technology for telehealth is already at a mature stage; the policy promotion and market demands are the main factors in enhancing diffusion. Medical regulations are the most critical factors in inhibiting diffusion. In addition, this paper also provides guidance for future technology planning and decision making.

PS23 The intelligent modeling of unmanned vehicles for solving the tasks of risk management in the business processes

Young Im Cho¹, Raissa Uskenbayeva², Abu Kuandykov², Dinara Kozhamzharova³, Olimzhon Baimuratov³
(¹The University of Suwon, Korea)
(²International Information Technologies University, Kazakhstan)
(³Kazakh National Technical University, Kazakhstan)

Kazakhstan is one of the leaders of the economic growth in the Commonwealth of Independent States (CIS). Enterprises are growing and developing, but the methods of effective the control of the workflow lag behind their development. For many large companies and economic branches increasing their efficiency of business processes, reduce costs, optimize the supply, obtaining operational management and financial reporting, quality control and repair are becoming major problems. Business process management encompasses the whole range of tasks in the field of risk areas such as agriculture, trade market, cartography, network security, electrical engineering, oil and gas exploration and different areas where human behaviors are impossible. To solve these problems it is more efficient to use unmanned vehicles (UVs), which can organize control and management of the group of vehicles to enlarge the productivity of the enterprise. There exist two kinds of approaches: distributed and agent based approaches. This paper we are using the agent based approach to create the intelligent model of UVs, which will organize and manage the implementation of particular tasks in the risk management field, to escape incorrectness in the performance.

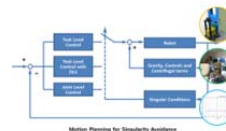


January 23 (Thursday), 12:00-13:00

PS24 Validation of a singularity avoidance algorithm for teleoperated robot systems

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

Recently, offshore plants have been studied actively. In this study, we introduce a tele-operated robotic system that can perform maintenance works at offshore facilities instead of humans. Generally, a spatial coordinate system is used at the end-effector level for transmitting motion commands to teleoperated robot systems. However, when a spatial coordinate system is used at the end-effector level, robots encounter the singularity problem of limited motion as they lose mobility. This study uses the singularity robust (SR)-inverse method for verifying and eliminating the effects such loss of mobility through simulations and experiments.



January 23 (Thursday), 13:00-14:45

Room A

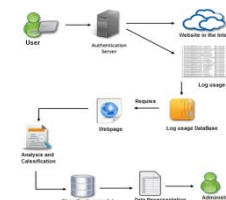
GS5 Data mining

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

GS5-1 A Comparison of Internet Usage Classification for Network Management Using CART algorithm and K-nearest Neighbors

Chatklaw Jareanpon
(Mahasarakham University, Thailand)

Nowadays, the number of internet users has rapidly grown, due to the content of web technology and various digital Medias. The organizations has realized the importance of bandwidth of each application, they've been setup a network for accessing to information in the internet. Because of limited resource, some types of applications use high bandwidth, and the number of users has rapidly been increased. These seasons are affected to the network connection problem. In this research, we'll study the user behavior that used Internet by collecting the log usage of the university student information, then analyzed the web content using various BOWs (Bag of words) and build a classification model to evaluate that website affected to network system. From the K-fold cross validation results, we've found that the CART algorithm has better performance than the K-nearest Neighbors with accuracy rate 62.963 percent. The results can be used to troubleshoot and manage network resources.



GS5-2 A probability-based incremental association rule discovery algorithm for record insertion and deletion

Panita Thusaranon, Worapoj Kreesuradej
(King Mongkut's Institute of Technology Ladkrabang, Thailand)

The maintenance of association rules for dynamic database is an important problem because the updates may not only invalidate some existing rules but also make other rules relevant. This paper is the extension work of Probability-Based Incremental Association Rule Discovery Algorithm which can only handle new data insert into a dynamic database. Unlike the previous work, the proposed algorithm can efficiently handle in case of insertion as well as deletion simultaneously. Promising frequent itemsets, which are obtained by using the principle of Bernoulli trials, can help to reduce a number of times to rescan the original database. The support counts of new candidate itemsets are approximated by using the principle of maximum possible value. The experimental results show that the execution time of the proposed algorithm is faster than that of Apriori, FUP2, and pre-large algorithm.

January 23 (Thursday), 13:00-14:45

GS5-3 A proposal of the sightseeing concierge system using web information

Tomoko Kashima¹, Shimpei Matsumoto²
(¹Kinki University, Japan)
(²Hiroshima Institute of technology, Japan)

In this research, the information on a sightseeing spot is not acquired only from word of mouth information, but the systems configuration also in consideration of the search results which are on Web using Web search API is developed. In our database, we treat not subjective information but the objective information of the person who wrote in from word of mouth information. Search Web information improves reliability by using top ten of text information on a Web page by search. And, a proposal system disseminates different information for every traveler. And development system aims at the support to which a traveler does a comfortably pleasant travel. We do an easy question to a traveler. And we understand a traveler's feature and recommend the sightseeing spot which a traveler likes according to a traveler's travel situation and feature. And, a system tells the word of mouth information which is helpful by getting to know according to a traveler's situation. For example, the information of a change of trains of a sightseeing spot, information of car parking space and parking fee, etc. are mentioned. Furthermore, we develop the system which also added the function which outputs a reply from conversation information as if traveler questions a concierge.

GS5-4 Classifying text by using associative classification based on closed

Panida Songram
(Mahasarakham University, Thailand)

Currently, a very large amount of text documents are dealing with daily life of human, especially online text documents. Information in the text documents is very important and need to be retrieved to find knowledge. Associative classification is a popular method used to classify the text documents to find the information for prediction. The associative classification builds a classifier from classification rules which are easily understood from human. Many algorithms were proposed to build associative classifiers with high accuracy, but they generate the rules based on frequent itemset mining manner. Therefore, a large number of rules are generated and then make the task of analysis very complex. Some algorithms were proposed to prune the rules to find only a set of high quality rules for classification. However, they cannot avoid the generation of the large number of frequent itemsets. Moreover, they need to take time and space consumption to select the high quality rules. In this work, the efficient method is presented to classify text documents based on closed itemset mining. It can build a classifier with high accuracy and non-redundant classification rules. The proposed method directly generates the high quality rules without generating candidate rules in the mining process. Therefore, the time and space consumptions are reduced.

GS5-5 Efficient cluster center initialization method for K-means clustering

Arit Thammano, Pathcharnee Chattanes
(King Mongkut's Institute of Technology Ladkrabang, Thailand)

Clustering is a technique to divide a set of objects into several clusters. Among the clustering methods, K-means algorithm is one of the most well-known methods. However, the clustering results of the K-means algorithm depend heavily on the randomly chosen initial centroids. Therefore, this paper proposes a method for finding the appropriate initial centroids for K-means algorithm. The experimental results show that the proposed initialization method produces more accurate clusters than the original K-means algorithm for most of the datasets.


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graph TD
    Start([Start]) --> SearchByCenterWord[Search By Center Word]
    SearchByCenterWord --> IsRoot{Root > 0.7}
    IsRoot -- No --> ClusterByContents[Cluster By contents]
    IsRoot -- Yes --> ClusterByTemporalSequence[Cluster By temporal sequence]
    ClusterByContents --> MakeSearchQuery[Make Search Query]
    ClusterByTemporalSequence --> MakeSearchQuery
    MakeSearchQuery --> ResearchBySearchQuery[Research By Search Query]
    ResearchBySearchQuery --> IsOriginalData{Whether original data in Root or not}
    IsOriginalData -- Yes --> FilterByTemporalSequence[Filter By temporal sequence]
    IsOriginalData -- No --> FilterByContents[Filter By contents]
    FilterByTemporalSequence --> ConstructThesaurus[Construct thesaurus]
    FilterByContents --> ConstructThesaurus
  
```

The flowchart illustrates the proposed algorithm for identifying clusters in a network. It begins with a 'Start' node, leading to 'Search By Center Word'. A decision diamond checks if 'Root > 0.7'. If 'No', it proceeds to 'Cluster By contents'. If 'Yes', it proceeds to 'Cluster By temporal sequence'. Both paths lead to 'Make Search Query', which then leads to 'Research By Search Query'. Another decision diamond asks 'Whether original data in Root or not'. If 'Yes', it leads to 'Filter By temporal sequence'. If 'No', it leads to 'Filter By contents'. Both filtering steps lead to 'Construct thesaurus'.

January 23 (Thursday), 13:00-14:45

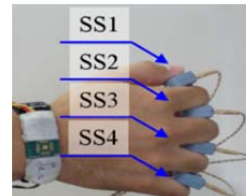
- 65 -

January 23 (Thursday), 13:00-14:45

OS16-2 Control of Body-Sway Using a Tactile Device

Kunio Horiba, Masafumi Uchida
(The University of Electro-Communications, Japan)

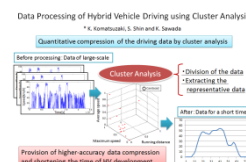
The recognition of tactile apparent movement (AM) is normally a subjective sense. However, quantitative evaluation is necessary when applying tactile AM an engineering system. In a previous study, we examined the body-sway caused by tactile AM under fixed experimental conditions; however, the body-sway characteristics were not fully investigated. In this study, we investigated the body-sway caused by tactile AM under fixed experimental conditions. We focused on biological information and body-sway movement, and compared cases where the apparent motion was recognized and not recognized. We propose the possibility of controlling body sway using tactile AM. Our findings will help improve the performance of systems that use tactile AM.



OS16-3 Data Processing of Hybrid Vehicle Driving using Cluster Analysis

Kohei Komatsuzaki, Seiichi Shin, Kenji Sawada
(The University of Electro-Communications, Japan)

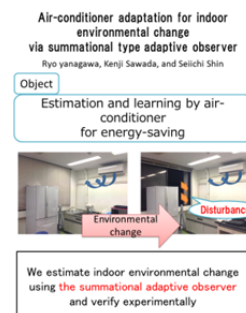
In the development of hybrid vehicles, it is necessary to design a test run pattern called "Fuel Efficiency Evaluation Pattern" such that the gap between the catalog and actual values of HV fuel efficiency is attenuated. One of such test run design methods compresses a huge client driving data and designs a customized pattern for each client. An ideal method is independent of experience and intuition of the engineers and can compress a huge data quantitatively and quickly. Motivated by this, we propose a quantitative compression method via cluster analysis. This paper clarifies that the proposed method enables us to design evaluation patterns quantitatively and to shorten the designing time.



OS16-4 Air-conditioner adaptation for indoor environmental change via summational type adaptive observer

Ryo Yanagawa, Kenji Sawada, Seiichi Shin
(The University of Electro-Communications, Japan)

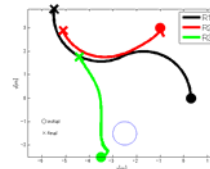
Focusing on reducing the power consumption of the air-conditioner, this paper aims to simultaneously estimate the indoor environment and external factors changing the amount of heat in the room (we call them disturbances). For this purpose, this paper proposes a Kreisselmeier adaptive observer expressed by summational equation. The summational equation is suitable to express a long-term balance of room thermal energy whereas the difference type model is suitable to express an instantaneous change of one. Thus, the summational equation is effective to estimate long-term disturbances. Moreover, this paper verifies the current effectiveness of our method by experiments.



OS16-5 On group motion control of multi-agent systems with obstacle avoidance -the case of column formation under input constraints-

Naoaki Niizuma, Kazushi Nakano, Tetsuro Funato, Kohji Higuchi
(The University of Electro-Communications, Japan)

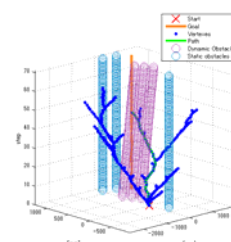
This paper deals with column formation control of multi-agent systems with obstacle avoidance under input constraints. We propose a formation controller which allows to avoid collisions among the robots while satisfying input constraints. More specifically, when there is no danger of collisions among the robots, the robots move by using quantitatively limited inputs. When the robots are in danger of colliding, the collision is prevented by adding obstacle avoidance terms to the limited control inputs. We also design the obstacle avoidance terms. Moreover, we design a potential function to satisfy the input constraints. Simulation results are included to verify the effectiveness of the proposed theoretical results.



OS16-6 StRRT Based Path Planning with PSO-tuned Parameters for RoboCup Soccer

Katsumichi Sameshima¹, Kazushi Nakano¹, Tetsuro Funato¹, Shu Hosokawa²
(¹The University of Electro-Communications, Japan)
(²Control System Security Center, Japan)

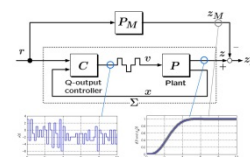
This paper considers the problem of path planning for mobile robots working in a real environment such as RoboCup. The path planning is to derive a route from a current position to a target position. However, it is difficult to make a plan because of the robots' kinematic constraints and presence of obstacles. Therefore, we have tried to make a StRRT-based path planning StRRT with an extension to a dynamic environment. Since parameters of StRRT is should be tuned in real time, Particle Swarm Optimization (PSO) is promising in real-time tuning. Through some simulations, we confirm that parameters of StRRT and RRT can be tuned automatically in real time by the PSO. It is shown that both planning algorithms have sufficient capability to allow real-time path planning such as RoboCup.



OS16-7 Model following control for continuous-time discrete-valued input systems

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

In the networked systems such as wireless control of mobile robots, continuous-valued signals are quantized into discrete-valued signals and transmitted/received over communication channels. In this case, we need to find appropriate quantization methods achieving some control performance requirements over communication channels even if the networked control systems are controlled by coarse discrete-valued signals. Such the system is called discrete-valued input system. This paper considers a dynamic state feedback control for continuous-time discrete-valued input systems. Our controller allows us to achieve model following control for networked control systems and embedded devices with low-resolution AD/DA converters. This paper provides a synthesis condition that is recast as a set of matrix inequalities. Specifically, a synthesis condition considering the controller switching process is presented via multiobjective control.



January 23 (Thursday), 13:00-14:15

Room C

GS10 Intelligent control & modeling II

Chair: Takeshi Nishida (Kyushu Institute of Technology, Japan)

GS10-1 Development of microwave sensor for measuring moisture in granulation process

Shigeru Nakayama¹, Koichi Kawaguchi², Tomoomi Segawa², Yoshikazu Yamada²
(¹Kagoshima University, Japan)
(²Japan Atomic Energy Agency, Japan)

In the nuclear fuel fabrication process, moisture content is very important because of the criticality control. We have developed an open-ended semi-coaxial microwave cavity to measure moisture involved in a substance. In this paper, we carry out a preliminary experiment for measuring moisture of MOX(UO₂+PuO₂) in granulation process, in which water is added as binder. In our preliminary experiment, we measure the moisture of tungsten trioxide WO₃ granule obtained from granulation experiments instead of MOX. The principle of microwave measurement of moisture is as follows. When the tungsten trioxide contained in a plastic container is placed on the open end of the cavity, the resonant peak is shifted by a variation in the end of capacitance which results from the difference in the dielectric constant of tungsten trioxide from that of air. Furthermore, the peak value of the resonance curve is attenuated by the absorption of microwave in the tungsten trioxide. Therefore, the moisture content of tungsten trioxide can be estimated by measuring either the frequency shift or attenuation. They are measured using a tracking generator and a spectrum analyzer. In our microwave experiment, we obtain a good standard deviation in the measured moisture content of 0.277%.

GS10-2 Importance of the real-world properties in chasing task -Simulation and analysis of dragonfly's behavior-

Naoyuki Sakuraba, Kazuyuki Ito
(Hosei University, Japan)

Recently, robots that operate in complex real environments, such as rescue robots and nursing-care robots, have been proposed and developed. However, controlling a robot in a complex environment remains very difficult, and therefore, the study of autonomous control of a robot is one of the most important topics in robotics. In this study, we modeled a dragonfly's behavior and conducted dynamic simulations of chasing behavior. To validate the role of real-world properties, we analyzed the simulation results and showed that by using real-world properties, the computational cost of the autonomous controller can be reduced considerably and interception behavior can be realized by a simple controller without estimating the movement of the prey.

GS10-3 Intelligent Mobile Agents for Disaster Response: survivor search and simple communication support

Assel Akzhalova¹, Atsushi Inoue², Dmitry Mukharsky¹
(¹Kazakh-British Technical University, Kazakhstan)
(²Eastern Washington University, USA)

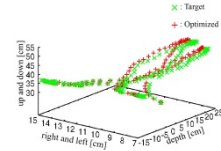
Search and Rescue problem can be defined as the cooperative use of resources by mobile agents to accomplish their mission of finding and rescuing important assets that are either lost or in some way at risk. We consider autonomous intelligent mobile robot-agents that have several sensors and actuators as well as communication capabilities. All mobile agents have an identical architecture so that they autonomously perform their tasks. These robot-agents perform tasks which may be delegated to a single robot-agent or to a group of robot-agents to be implemented in a distributed way. In case of collective task execution the robot-agents should be able to cooperate to minimize resources and improve mission performance. The mobile robot-agents operate in an environment that is only partially accessible. We offer the control framework that uses behavioral model and hybrid approach based on PSO and Q-learning.

January 23 (Thursday), 13:00-14:15

GS10-4 Movement Imitation in a Humanoid Robot with Approximate Inference Control

Toru Kadoya, Hideaki Itoh, Hisao Fukumoto, Hiroshi Wakuya, 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 using a standard Dynamic Programming method, by which we have succeeded in realizing learning by imitation when the movements involved only a single joint. However, this system was computationally too expensive to find the optimal movement when multiple joints are involved. In the present study, we use an approximate optimization method, instead of the standard Dynamic Programming method. In our experiments using the proposed system, we succeeded in realizing learning by imitation when the movements involved four joints.



GS10-5 Occupancy grid map of semi-static objects by mobile observer

Chau V. Dang, Hiroshi Sato, Tomohiro Shirakawa, Akira Namatame
(National Defense Academy, Japan)

In this research we propose a method for spatial representation of semi-static objects in dynamic environment. For this objective, we extend IMAC (Independent Markov Chain Occupancy) model, which is a map constructing method for dynamic environment. In the IMAC model, a mobile observer cannot estimate the grid map correctly if it doesn't stop enough time at the same location. To overcome this limitation, we proposed a technique to estimate the IMAC grid map from an analytical discussion by simulating a grid-world model for a simple straight line path. The simulation result shows that if number of observations for a given grid cell is sufficient, both parameters of the two transition probability parameters of IMAC model can be estimated correctly. We carried out a simple test in real world environment by using a vehicle. The experimental results show that we can create a map from GPS data recorded by a smartphone installed on a vehicle. The contributions of this paper are as follows: 1) proposed a new technique for estimating Poison parameter for IMAC grid map in dynamic environment; 2) we proved the model can be used in real world experiment.

January 23 (Thursday), 13:00-14:00

Room D

OS14 Robot Control and Planning

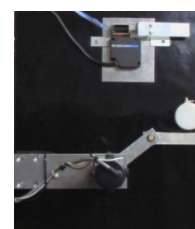
Chair: Masahiro Yokomichi (University of Miyazaki, Japan)

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

OS14-1 Experimental Analysis of the Two-link-manipulator in Consideration of the Relative Motion between Link and Object

Asaji Sato¹, Osamu Sato², Nobuya Takahashi², Masahiro Yokomichi²
(¹Miyakonojo National college of Technology, 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 different height of falling 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 also analyzed theoretically and investigated experimentally.



January 23 (Thursday), 13:00-14:00

OS14-2 Robust observer design with the guaranteed cost control approach

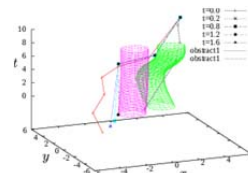
Yutaka Nitanda, Nobuya Takahashi, Osamu Sato, Masahiro Yokomichi
(University of Miyazaki, Japan)

This paper deals with a design method which consists of the different system design approach of minimization of the cost function and improvement of the transient property of the system in the complex plane. And apply the robust control problem of a two-link RR manipulator with uncertainty in the each joint angle. The numerical example shows the effectiveness of our method.

OS14-3 A RRT*-based path planning and replanning algorithm for dynamic environments

Masahiro Yokomichi, Tatsunori Yonemura, Osamu Sato
(University of Miyazaki, Japan)

This paper presents some algorithms for planning and real-time re-planning the effective motions or paths in dynamic environment. The Rapidly-exploring Random Tree (RRT) algorithm has applied to widespread areas in the field of robot motion planning. It has also been extended to RRT* such that the quality of the path is improved by A*-like re-connection method. However, the applicable class of the problem was limited to offline planning on static environments. We extend the original RRT* in two points. The first is, the configuration space is extended to CT-space. In this case, the directions of edges should satisfy the causality condition so that the neighborhood searches in algorithm should take this causality into account. The second is that, real-time re-planning on CT-space is possible. To achieve this, some algorithms for re-using available nodes and edges from previous planning iterations are proposed. The efficiency of the proposed method is evaluated by numerical simulations.



OS14-4 An extension of dynamic window approach in the presence of moving obstacles

Tatsunori Yonemura, Masahiro Yokomichi, Osamu Sato
(University of Miyazaki, Japan)

This paper presents a real-time obstacle avoidance method for mobile robots in dynamic environments. In the previous work of the authors, the dynamic window approach (DWA) is extended such that the randomized tree-based inputs search was implemented in order to obtain feasible inputs with low computational costs. This was because, in the dynamic environment, search with long time horizon is needed in order to avoid dangerous maneuvers. In general, the control performance depends on the number of the generated nodes, however, generating many nodes should cause the computational delay and this may yield the loss of stability and decrease of control performance. This paper applies a method in the MPC (Model based Prediction Control) to compensate the computational delay. The effectiveness of the proposed method is evaluated by numerical simulations.

Room A

OS17 System Sensing and Its Applications

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

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

OS17-1 Analysis of Biological Signal by Using Multilayer Neural Network

Tadayuki Murata, Masafumi Uchida
(The University of Electro-Communications, Japan)

Recently, a lot of researches to apply someone's sensitivity to engineering have been carried out actively. The quantitative evaluation of sensitivity is absolutely imperative in order to apply sensitivity to engineering and have been carried out by various physical and mental responses. In this study, sensitivity is quantitatively valued using peripheral skin temperature which is one of the physiological index. So far in this study, the quantitative evaluation of "Kansei information" about the pleasure-unpleasure affect has been attempted by using nasal skin temperature which is peripheral skin temperature and the electroencephalogram (EEG) as the index. In the previous analytic methods, however, the agenda to be considered such as the structure of the neural network and the adjustment of parameters of the SVM is left. The aim of this study is catching more effectively the dynamics of feature quantity related the pleasure-unpleasure affect using five-layer neural network and peripheral skin temperature to external stimuli as a subject.

OS17-2 Correlation of 1/f noise in vehicle operating data with cognitive stress

Akio Nozawa
(Aoyama Gakuin University, Japan)

Drivers have to safely drive a vehicle with steering, throttling and braking controls properly. Drivers, however, do not always concentrate to manage a vehicle. Primary causes of driver inattention are distracting activities and drowsiness. This driver inattention was thought to be one of the major causes of traffic accidents. The objective of the present study is to develop a brand-new method to detect driver inattention by 1/f fluctuations of vehicle operating data. Steering and throttle operation while driving was measured by acceleration sensors. Respiration rhythm and the Electrocardiogram were also measured for physiological indices. A correlation of 1/f noise in the operation data and physiological indices were analyzed. As a result, 1/f noise in vehicle operating data was significantly distinguished in accordance with cognitive stress. And 1/f fluctuation exponent correlated with parasympathetic activation indexed by cardiovascular and respiratory signals in drowsy state.

OS17-3 Influence which auditory stimulation containing a low frequency wave or high frequency has on brain activity of the frontal lobe

- The objective evaluation of Noise using oxygenated hemoglobin concentration -

Takeru Osawa¹, Hirotohi Asano², Tota Mizuno³, Akio Nozawa¹, Hisaya Tanaka⁴, Syusaku Nomura⁵,
Toshikazu Okazaki², Hideto Ide¹
(¹Aoyama Gakuin University, Japan)
(²Kagawa University, Japan)
(³The University of Electro-Communications, Japan)
(⁴Kogakuin University, Japan)
(⁵Nagaoka University of Technology, Japan)

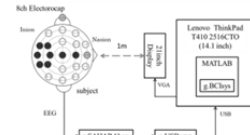
This study intends to make an objective evaluation about the influence on brain after exposure to noise using functional Near Infrared Spectroscopy. In this paper, I report on the psychological research and physiological measurements that were carried out. We used the VAS to research the feeling. The physiological factor measured was oxy-Hb. The experimental results show that the sound pressure level affects a frontal lobe part rather than frequency. We showed that the noise of high frequency than a low frequency wave was more unpleasant by oxygenated hemoglobin concentration.

January 24 (Friday), 09:15–10:30

OS17-4 Improvement of the BCI based on Occupational Therapists' Opinions

Hisaya Tanaka, Yuma Koizumi
(Kogakuin University, Japan)

We are doing research and development in the brain computer interface (BCI) based on ALS patient demand or occupational therapists' opinions. Although the EEG measurement of BCI generally required attaching the electrode by gel, since it was problematic to shampoo the patients' hair, a simple measurement method was sought. Then, we performed the EEG measurement with the dry electrode, which does not use gel. This paper describes the BCI system using a dry electrode, and evaluation by a healthy person.

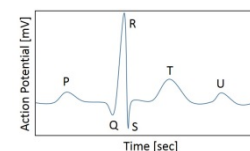


OS17-5 A Wavelet Approach to Identification of Ventricular Fibrillation Including State Transit

Eduardo Rivera Jaramillo¹, Katsuhiko Hirose², Yoshihiro Ogino², Kazushi Nakano², Tetsuro Funato²,
Hidetoshi Oya³

(¹National Polytechnic Institute, Mexico)
(²The University of Electro-Communications, Japan)
(³The University of Tokushima, Japan)

Automated external defibrillators (AEDs) are portable electronic devices that automatically diagnose the potentially life threatening cardiac arrhythmias of ventricular fibrillation in patients. However, the precise state identification of electrocardiogram signals is difficult in the present AEDs because the state identification of state transition in the signals has never been dealt with. This paper proposes a method for improving the identification accuracy of electrocardiogram signals including the state transition by using the Wavelet Transform and the Support Vector Machine.



January 24 (Friday), 09:15–10:30

Room B

GS14 Neuro Computing & brain Science

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

GS14-1 A real-time simulator of a biological visual system composed of a silicon retina and SpiNNaker chips

Hirotsugu Okuno¹, Takumi Kawasetsu¹, Luis A. Plana², Steve B. Furber², Tetsuya Yagi¹
(¹Osaka University, Japan)
(²The University of Manchester, UK)

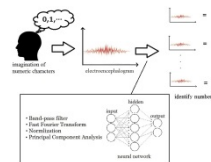
To understand the functional roles of visual neurons in the retina and the visual cortex, responses of a visual neuronal network under natural visual environments should be investigated. In this study, we developed an emulation platform for reproducing neural activities in the retina and the visual cortex with the following features: real-time reproduction of neural activities with physiologically feasible spatio-temporal properties and configurable model structure. To achieve both real-time simulation and configurability, we employed a mixed analog-digital architecture with multiple parallel processing techniques. The system was composed of a silicon retina with analog resistive networks, a field-programmable gate array, and SpiNNaker chips. The emulation system was successful in simulating a part of the retinal and cortical circuits at 200 Hz.



GS14-2 Analysis of brain state in imaging of numeric characters by using EEG

Shumpei Ako, Yuki Seto, Hirokazu Miura, Noriyuki Matsuda, Hirokazu Taki
(Wakayama University, Japan)

We studied the identification method of the electroencephalogram (EEG) frequency in imaging numeric characters. Our identification method uses the EEG frequency distribution, in contrast with the conventional method which analyzes the reaction time and the magnitude of the EEG. We associate the every numeric characters and frequency distribution of the EEG. So, we make it possible to identify the numeric characters directly from the measurement site and the EEG we measured. The analysis is band-pass filter, FFT, normalization, principal component analysis and a neural network.



GS14-3 Biomimetic CPGs for robotic applications

Timothée Levi¹, Matthieu Ambroise², Filippo Grassia², Sylvain Saïghi², Takashi Kohno¹
Haruyuki Kinoshita¹, Teruo Fujii¹
(¹LIMMS/CNRS-IIS, Institute of Industrial Science, The University of Tokyo, Japan)
(²IMS Lab., University of Bordeaux, France)

Locomotion is one of the most basic abilities of animals. Neurobiologists have established that locomotion results from the activity of half-center oscillators that provides alternating bursts. Most rhythmic movements are programmed by central pattern-generating (CPG) networks consisting of neural oscillators. A biomimetic system mimics the nature for simulating the living behavior and/or replaces it (rebuilding the living part). We propose a network of hundreds biomimetic CPGs using biomimetic neuron model and synapses. This network is implemented in an FPGA (Field Programmable Gate Array). This article is decomposed into two parts: the description, the implementation and results of the biomimetic network of CPGs, and the architecture and advantages of robots including our biomimetic CPGs.

GS14-4 Silicon neuron: digital hardware implementation of the quartic model

Filippo Grassia¹, Timothée Levi², Takashi Kohno², Sylvain Saïghi¹
(¹IMS Lab., University of Bordeaux, France)
(²LIMMS/CNRS-IIS, Institute of Industrial Science, The University of Tokyo, Japan)

This paper presents an FPGA implementation of the quartic neuron model. This approach uses digital computation to emulate individual neuron behavior. We implemented the neuron model using fixed point arithmetic operation. The neuron model's computations are performed in arithmetic pipelines. It was designed in VHDL language and simulated prior to mapping in the FPGA. We show that the proposed FPGA implementation of the quartic neuron model can emulate the electrophysiological activities in various types of cortical neurons and is capable of producing a variety of different behaviors, with diversity similar to that of neuronal cells. The neuron family of this digital neuron can be modified by appropriately adjusting the neuron model's parameters.

GS14-5 Sustainable Delivery of Carmustine into the Cerebral Cavity via Biodegradable Poly[(d,l)-lactide-co-glycolide] Nanofibers

Yuan-Yun Tseng¹, Shih-Jung Liu²
(¹Taipei Medical University, Taiwan)
(²Chang Gung University, Taiwan)

In this study, we developed biodegradable poly[(d,l)-lactide-co-glycolide] nanofibrous membranes via electrospinning that provided a sustained release of BCNU. An elution method and a HPLC assay were employed to characterize the in-vitro and in-vivo release behaviors of pharmaceuticals from the electrospun membranes. The experimental results show that the biodegradable, nanofibrous membranes released high concentrations of BCNU for more than 6 weeks in the cerebral cavity of rats. Furthermore, the membranes can better conform to the geometry of the brain tissue and can cover more completely the tissue after the removal of tumors, achieving better drug transport without interfering with the normal function of the brain. Histological examination showed no obvious inflammation reactions of the brain tissues.

January 24 (Friday), 09:15–10:30

Room C

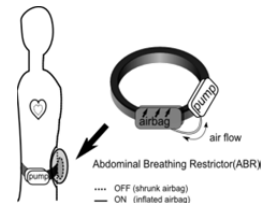
GS7 Human-welfare robotics

Chair: Chun-Hsu Ko (I-Shou University, Taiwan)

GS7-1 Abdominal breathing restrictor for mental tension enhancement

Ippei Nakayama, Kenichiro Koga, Jun Kobayashi
(Kyushu Institute of Technology, Japan)

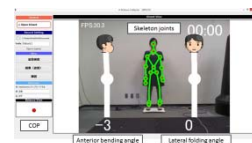
This paper presents an apparatus that intentionally makes you sensitive to mental tension by controlling your breathing pattern. The apparatus is called Abdominal Breathing Restrictor, which is abbreviated to ABR. The ABR realizes the mental control function based on the knowledge about relation between breathing patterns and mental condition. It is well known that abdominal breathing relaxes your mental state. On the other hand, costal breathing results in mental tension. The ABR impedes your abdominal breathing and compels you into costal breathing, and then leads you into mental tension. The experimental results described in this paper implicates that the ABR successfully controlled a subject's mental state. The ABR will be used for controlling mental condition of the audience at movie theaters.



GS7-2 Development of Low-cost and Accurate Posturography Using Kinect for In-home Rehabilitation of Balance Disorders

Yasuyuki Orito¹, Hiroyuki Funaya¹, Tomoya Tamei¹, Tomohiro Shibata¹, Kazushi Ikeda¹, Yohei Okada²
(¹Nara Institute of Science and Technology, Japan)
(²Kio University, Japan)

There is a social need for low-cost, compact, and accurate systems for in-home rehabilitation. We developed a system that measures a user's posture, anterior bending angle, lateral folding angle and center of pressure (COP), by integrating a Kinect and the Wii Balance Board (WBB). We first compared the performance of Kinect and an optical motion capture system (MoCap) to validate the accuracy of the developed system. The result showed that the angular data recorded by the Kinect and the MoCap had a high correlation coefficient. Next, we investigated the relationship between the angular data and the COP to confirm the necessity of measuring the COP using WBB. The result suggests that it is not possible to estimate the angles from the COP accurately. Overall results suggest that our system has the possibility of providing affordable in-home rehabilitation.



GS7-3 Facial muscle control algorithm of an android robot for emotional human-robot interaction

Dong-Wook Lee, Byeong Kyu Ahn, Dongwoon Choi, Duk-Yeon Lee, Ho-Gil Lee, Young-Soo Lee
(Korea Institute of Industrial Technology, Korea)

This paper presents the facial expression of an android robot based on the relation between 2 dimensional internal states and facial muscles. Most common the affective dimensions of internal states consist of pleasantness and arousal. By the analysis of the relations between the 2-parameters and the value of facial muscles, we found the movement of some muscles such as lip and brows are proportional to these parameters. If the 2 internal states are given, we can calculate the values of facial muscles by the relations. This method can be applied for an emotional interactive robot.

January 24 (Friday), 09:15–10:30

GS7-4 Passive control of walk-assist robot for moving obstacle avoidance

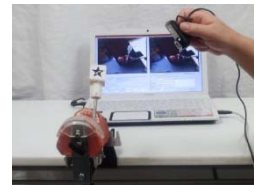
Chun-Hsu Ko¹, Yi-Hung Hsieh², Kuu-Young Young²
(¹I-Shou University, Taiwan)
(²National Chiao Tung University, Taiwan)

With growing elderly population in the society, walk-assist robots continue to be an important research topic for being able to assist them to achieve stable walking. The passive types of walk-assist robots are inherently safe for using the controlled brakes to steer the walker. One basic demand for them is to safely guide the user to reach the target while avoiding the obstacles, both static and moving types. In this paper, we propose a control scheme for moving obstacle avoidance based on receding horizon control. The scheme first plans a feasible path among static obstacles. The terminal-state and obstacle collision penalties are then added to the cost function for moving obstacle avoidance, with system passivity guaranteed by adding the constraints for braking torque. The effectiveness of the proposed approach is demonstrated via simulations based on a passive walk-assist robot.

GS7-5 Visualizing scaler stroke motion by a camera-computer system

Megumu Kuroiwa, Joo Kooi Tan, Hyungseop Kim, Seiji Ishikawa
(Kyushu Institute of Technology, Japan)

An effective treatment of periodontitis is to remove dental plaque and scale periodically by a scaler. For this purpose, dental students must take training of scaling and root planing using a jaw model and a scaler. But it is difficult for a trainer to evaluate their scaler stroke motion as the tip end of the scaler in a mouth is invisible from outside. This paper proposes a method of visualizing the scaler stroke motion in the mouth using a computer vision technique. The system is described and some experimental results are shown.



January 24 (Friday), 10:45–11:45

Room A

GS4 Cognitive science

Chair: Timothée Levi (The University of Tokyo, Japan)

GS4-1 A human causal value function and its optimality under greedy method for two-armed bandit problems

Kuratomo Oyo, Tatsuji Takahashi
(Tokyo Denki University, Japan)

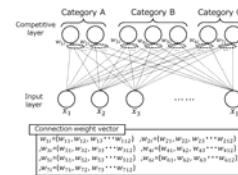
The central challenge of reinforcement learning is the development of a method for solving the exploration-exploitation dilemma and the speed-accuracy tradeoff caused by this dilemma. As one of the way, loose symmetry (LS) model that quantitatively treat human cognitive biases (symmetry and mutual exclusivity) has attracted attention. LS accurately describes human causal intuitions. Specifically, we use LS as a simple value function within the framework of reinforcement learning. We show reliable and robust performance of LS and its optimality in relation to probabilistic policies including epsilon-greedy methods and Softmax action selection. Based on the simulations, we show that LS has the "policy optimality" and has a mechanism that escapes a local optimum and, we clarify the mechanism for good performance in LS.

January 24 (Friday), 10:45–11:45

GS4-2 Classification of Mixed Odor Using Metal Oxide Semiconductor Gas Sensor

Tatsuyoshi Onishi, Daigo Hayashi, Sigeru Omatu
(Osaka Institute of Technology, Japan)

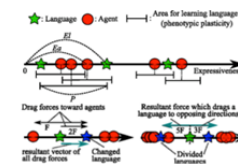
In recent years, odor research using the odor sensors has been actively carried out. Thus, the importance of the research of odor has been growing. There are various smells mingled in our environment. If the poisonous odor material exists in the living environment, it must be known immediately by the human. Therefore, it is necessary to classify mixed odors to identify only the specific odor. This time we measure the odor by using metal oxide semiconductor gas sensor of twelve different types which are not expensive and able to be used repeatedly. In this research we use mixing three odor substances. For classification of the odor we use the learning vector quantization method which is one of neural networks. First, we show that the classification of a single odor can be possible. After that, we perform the identification of the mixed odor by using the training data of single odor.



GS4-3 Does biological evolution keep pace with cultural evolution?: an analysis of gene-cul coevolution of language

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

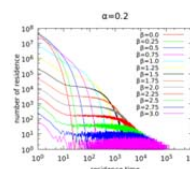
In this paper, we focus on the following problems which are concerned in the context of language evolution: 1) how the communicative ability can evolve directionally under the positively frequency-dependent selection, 2) how do we get a comprehensive understanding of language evolution including biological evolution although the evolutionary relationship between genes and language is complex and shrouded in controversy. We employ a gene-culture coevolutionary framework which includes the concept of learning and propose an agent-based model for investigating possible scenarios of the coevolution in language. From our simulation, we discover that a cyclic coevolutionary process occurs repeatedly and that the rates of evolutionary change of languages are usually faster than the rate of biological evolution, and fluctuate in a short time scale, however in long time scale, the biological evolution is more directional than cultural evolution. It means that the biological evolution could keep pace with language evolution.



GS4-4 Stability of dominant state and dynamics of learning in stochastic model of collective decision making

Akira Masumi, Takashi Hashimoto
(Japan Advanced Institute of Science and Technology, Japan)

Collective decision making is an essential feature for animals living in groups, including human. One of the serious problems confronting to a group is how they find the solutions which can bring both a consensus and maximum benefit for each player under significant conflict of interest among them, and how those solutions are stable. To address these questions, we introduce a stochastic model of collective decision making in which players try to make consensus through majority voting and they adaptively change their strategies through reinforcement learning. Assuming a nontransitive competitive relationship among players, we find a stochastic switching behavior among dominant states in certain parameter regime. Furthermore, we show that the distribution of residence time on each dominant state change from exponential to power-law with decreasing randomness of action. This result means that learning of each player can qualitatively change statistical property on stability of the dominant state.



Room B

OS11 Learning and Control

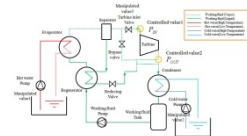
Chair: Hee-hyol Lee (Waseda University, Japan)

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

OS11-1 Modeling and Design of Decouple PID Control for Ultra-Compact Binary Power Generation Plant Using Low Temperature Difference Thermal Energy

Kun-Young Han, Hee-Hyol Lee
(Waseda University, Japan)

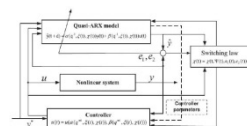
The scope of this paper extends as follows. Linearized transfer function matrix models that represent dynamic characteristics at the operating point of power generation plant are deduced. Then, Decouple PID control system to reduce remarkable interaction between controlled variables and manipulated variables is designed. Furthermore, control performance of control system that has a larger number of manipulated variables than the number of controlled variables is considered to confirm the effectiveness of the designed control system through the simulation.



OS11-2 Quasi-ARX NN Based Adaptive Control Using Improved Fuzzy Switching Mechanism for Nonlinear Systems

Imam Sutrisno^{1,2}, Chi Che¹, Jinglu Hu¹
(¹Waseda University, Japan)
(²Politeknik Perkakapan Negeri Surabaya, Indonesia)

In this paper, an improved fuzzy switching mechanism based on Quasi-ARX neural network (NN) is presented for the adaptive control of nonlinear system. The proposed improved fuzzy switching adaptive control is composed of a quasi-ARX NN based prediction model and an improved fuzzy switching mechanism using two new adaptive control laws. The obtained quasi-ARX NN model is divided into two parts: linear part and nonlinear part. The linear part is used to ensure the nonlinear control stability, and the nonlinear part is utilized to improve the control accuracy. The linear controller is obtained based on the linear part, while the nonlinear controller is given based on the quasi-ARX NN model. As the control result of nonlinear predictor is better than the linear predictor in most of time, the adaptive control with a simple switching mechanism has many useless switching during the processing. So the improved fuzzy switching mechanism is proposed to replace the original switching mechanism, it can improve the performance by reducing the useless switching while guarantee stability of the system control. The simulations show efficiency of the proposed control method satisfies in stability, accuracy, and robustness.



OS11-3 Cellular Automaton Traffic Model and Real-time Stochastic Optimal Coordinated Control of Traffic Signals

Chengyou Cui¹, Hu Jin², Jizhe Cui¹, Hee-Hyol Lee²
(¹YanBian University, China)
(²Waseda University, Japan)

In this paper, a real time stochastic optimal coordinated control method is proposed to adjust splits, cycles, and offsets of traffic signals. A Bayesian Network (BN) model is used to establish a stochastic model for predict the probability of traffic jam. Here, the prior probabilities of traffic flows under different traffic signals and different traffic condition are estimated by using a modified Cellular Automaton (CA) traffic model and an empirical equation. Then Particle Swarm Optimization (PSO) algorithm is used to search optimal splits of each traffic light to minimize probabilistic distributions of traffic jam at every cycle. In addition, the modified CA traffic model is used to calculate optimal offsets at set intervals. Finally, simulations are carried out at multiple intersections using a micro traffic simulator. The effectiveness of the proposed coordinated control method is proved by comparing other traffic signal control methods such as pre-timed signal control, two types of the traditional coordinated control, and distributed control.



January 24 (Friday), 10:45–11:45

OS11-4 Thermal Fusion Bonding Control of Distributed Parameter Panel

Zongyi Huang, Sung-Geun Kim, Hee-Hyol Lee
(Waseda University, Japan)

During manufacturing process of the LCD products such as LCD TV and Pad computer, the most important step is installation of LCD screen. Most of the LCD manufactures are now using "thermal fusion bonding" in the manufacturing process. In the traditional thermal fusion bonding, temperature controls are applied regarding the screen (panel) as a lumped parameter system. Therefore a rather long time is required for its control, and temperature difference appeared on each part of the screen. This research aims to increase the speed of the heating process and reduce the temperature difference among each part of the panel. By using Decouple PID control, each heater is controlled independently regarding the panel as a distributed parameter system. In the experiment, PID parameter is designed using models deduced from step responses of the panel, and then the control parameters are transferred to a target PC, in which communication is built between the control unit and heating system in order to realize the control process.

January 24 (Friday), 10:45–11:45

Room C

GS15 Pattern recognition

Chair: Seiji Ishikawa (Kyushu Institute of Technology, Japan)

GS15-1 A Method of Detecting a Bicycle Using Circles

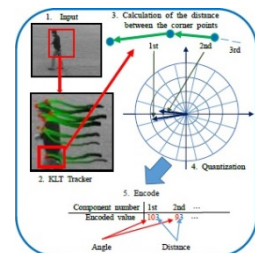
Heewook Jung, Joo Kooi Tan, Hyoungeop Kim, Seiji Ishikawa
(Kyushu Institute of Technology, Japan)

Recently ASV(Advanced Safety Vehicle) systems have been developed in a few automobile industries to reduce traffic accidents. We are focusing on the detection of pedestrians and bicycles among various techniques demanded in ASV, because it prevents traffic accidents that may occur caused by the carelessness of drivers. There have been many studies on the detection of pedestrians, but studies on the detection of bicycles are rare. It is actually difficult to detect pedestrians and bicycles in real traffic environments, because there are various objects and occlusion in real traffic scenes. In this paper, we propose a method of bicycle detection that is robust to occlusion by detecting upper body of a bicycle driver and bicycle wheels using HOG feature and circle detection. Experimental results show satisfactory performance of the proposed method.

GS15-2 A Proposition of Human Action Recognition Method considering Co-Occurrence of Corner Trajectories

Kyosuke Masumitsu, Takayasu Fuchida
(Kagoshima University, Japan)

Corner points have been used to represent the features of shapes in a movie. Recently, a lot of methods are presented to extract the motion features of objects using corner trajectory. In this paper, we propose a novel action recognition method of the human using co-occurrence of extracted features and corner trajectories appeared in a movie. In recent 10 years, the researches of motion analysis have been changing so as to use the statistical distribution of features "bag-of features" adopting the concept of "bag-of-features" in the field of processing of language statistics. Also in this paper, we intend to achieve the higher recognition ratio by using the corner trajectories of each object those are extracted by co-occurrence and mutual information.

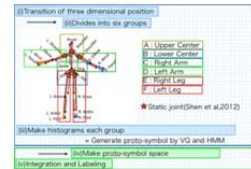


January 24 (Friday), 10:45–11:45

GS15-3 Design of collaborative method with specified body regions for activity recognition

Yusuke Saito, Hiroyuki Nishiyama
(Tokyo University of Science, Japan)

Recognizing detailed human behavior expands the possibilities of anomaly-detection systems and health-management systems. In recent years, activity recognition using skeletal-recognition technology has been studied. In these studies, human activity is divided into data for classifying human behavior. Human activity was learned as one label behavioral data of the whole body. However, the action of the whole body should not be represented by a single label because the action consists of behavior of individual parts, such as the arms and legs. Also, human activity includes parallel actions such as eating breakfast with watching TV. This study divides human joints into six groups. Our method produces histograms of the action data and learns it with histograms of each group. It then integrates these histograms collaboratively as labeling of the overall operation. Finally, we conducted experiments to verify the effectiveness of our proposed method.



GS15-4 Development of a Mobile Sensor for Adaptive Configuration of Intelligent Spaces

Hiroki Sasabuchi, Kazuyuki Morioka
(Meiji University, Japan)

Intelligent spaces based on many networked sensors have been studied in recent years. Generally, it is time-consuming to distribute and calibrate many sensors in the spaces. In this study, a mobile sensor using a human-following robot is considered for adaptive construction of intelligent spaces. The proposed mobile sensor builds 3D maps around a user while following him. Then, positions humans and robots in the spaces are estimated and tracked using the built map. This paper calls the proposed system with mobile sensors based on mobile robots "Mobile Intelligent Space". In this paper, at first, map building using the mobile sensor is introduced. Especially, an image-selection method from multiple cameras installed in the mobile robot is shown for adaptive map building. Also, an augmented reality application is shown as results of adaptive construction of intelligent spaces and user position estimation.



January 24 (Friday), 13:00–14:00

Room A

GS3 Bioinformatics

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

GS3-1 A polynomial optimization approach to optimal control of context-sensitive probabilistic Boolean networks

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

In this paper, a control method for a context-sensitive probabilistic Boolean network (CS-PBN) is discussed. A CS-PBN, which is one of the extended models of Boolean networks, is widely used as a model of complex dynamical systems. For a CS-PBN, the optimal control problem is considered. For this problem, a solution method using polynomial optimization is proposed. Finally, a numerical example is presented. The proposed method provides us a useful tool in control theory of complex dynamical systems.

January 24 (Friday), 13:00–14:00

GS3-2 Modeling a Bacterial Ecosystem Through Chemotaxis Simulation of a Single Cell

Nesrine Ouannes¹, NourEddine Djedi¹, Hervé Luga², Yves Duthen²
(¹Biskra University, LEISA Laboratory, Algeria)
(²Toulouse University, France)

This paper describes a bacteria system that reproduces a population of bacteria that behave by simulating the internal reactions of each bacterium cell. The chemotaxis network of a cell is modulated by a hybrid approach that uses an algebraic model for the receptor clusters activity and an ordinary differential equation for the adaptation dynamics. The experiments are defined in order to simulate bacterial growth in an environment where nutrients are regularly added to it. The results show analysis of the motion obtained by some bacteria and their effects on the population behaviors generated by evolution. This evolution allows bacteria to have the ability to adapt themselves to better growth in the available food existed in its environment and to survive. As future work, we aim to improve the effect of the chemotaxis network to obtain more powerful bacteria that can emerge as new species, which behaves differently from others, via the concept of bacteria colonies.



GS3-3 Nine-step tai chi exercise for improving elderly postural stability via complexity index analysis

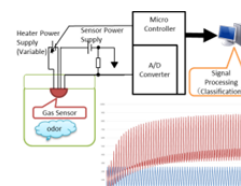
Jiann-Shing Shieh¹, Bernard C. Jiang², Wei-Hsin Chen¹, Cheng-Wei Huang¹, Heng-Hui Chu¹
(¹Yuan Ze University, Taiwan)
(²National Taiwan University of Science and Technology, Taiwan)

The main purpose of this study is trying to investigate simple 9 steps tai chi twice every day to see whether it affects the center of pressure (COP) and physiological signals or not. We collect 6 times of the COP signals, electromyography (EMG), and pulse oximetry for one minute every two weeks until taken 12 weeks. While measuring the COP signals, we use multivariate empirical mode decomposition and multivariate multiscale entropy of these two new methods to analyze data and calculate the complexity index (CI) to do the comparison. Subjects in this experiment are over 65 years old who are 11 men and 7 women, and average age is 74 ± 8.18 years old. In conclusion, tai chi exercise really can improve human body balance even in our experiment just walk some simple steps. However, we cannot find any effect or improvement in the pulse oximetry and EMG signals analysis.

GS3-4 Olfactory sensor system applying variable heater voltage of metal-oxide semiconductor gas sensor

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

Human olfactory is studied in a long time and many ways. Smell sensing and classification are studied for electronic nose system (e-nose). The studies are applying MOS gas sensors and QCM gas sensors. We are researching e-nose system with 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. However, by changing temperature of the sensors, characteristics of sensors are changed. In this paper, we show a sensing system which has one MOS gas sensor with controllable heater voltage power supply. In our experiments, we show results of our system to sense soy-source and black-vinegar, because we are considering applying the system for management of cooked foods. Furthermore, we evaluate the potentials of our system for applying quality control system of cooked foods.



Room B

OS2 Bio-inspired Theory and Applications

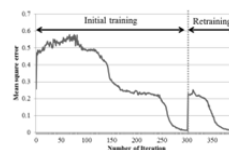
Chair: Kunihiro Yamamori (University of Miyazaki, Japan)

Co-Chair: Ikuo Yoshihara (University of Miyazaki, Japan)

OS2-1 Self-defect-compensation simulation on pulse-coupled neural network

Yuzuru Tomitaka, Kunihiro Yamamori, Masaru Aikawa
(University of Miyazaki, Japan)

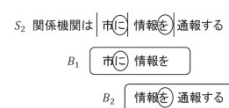
A problem of large scale neural network is huge training time. For fast training, acceleration by hardware has been proposed. However, hardware cost raises another problem when we directly implement training algorithm including floating-point operations. This paper proposes a pulse-coupled neuron model based on Kawashima's model. Since Kawashima's model equips forward-pass only, we extend it with backward pass. In addition, hardware neural network has to have defect compensation mechanism. We try to embed retraining base defect compensation in hardware neural network.



OS2-2 A Method for Newspaper Article Summarization Using the “Clause Box with a Case-Marking Particle”

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

In this paper, we propose automatic text summarization method by grammatical point of view. Since a subject and a predicate is the most important in Japanese, we try to summarize long sentence by finding these subject and verb. Before summarization, we analyze a sentence by morphological analyzer. By this analysis, it can detect predicate easily, but it is difficult find subject part. To find subject, we introduce “Clause Box with a Case-Marking Particle”. Then our method give a score to clauses. To select appropriate clauses for summarization, we deal with this clauses election as a 0-1 knapsack problem. Evaluation results of our method by “ROUGE-2” is as the same as that by hand summarization although our method does not need enormous corpus and templates.



OS2-3 A detection method for snoRNA modification domain by fully indexable dictionary retrieving

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

Recently, non-coding RNA which participates with organic activities has been found in non-coding region. Until now, we don't know detailed function of non-coding RNAs very well. To make clear functions of non-coding RNAs, we need to obtain a lot of data about non-coding RNAs and their targets. However, we don't have efficient techniques to analyze relations between non-coding RNAs and their targets. In this paper, we propose a high-speed method that can detect modification domain candidates on the target RNA based on the snoRNA sequence. A snoRNA modifies a target RNA by composing complementary base pairs between a part of snoRNA and a part of target RNA. Our method employs Fully Indexable Dictionary (FID) which is built by Trie and Level-Order Unary Degree Sequence (LOUDS).

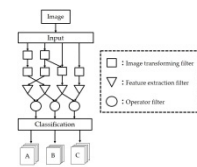


January 24 (Friday), 13:00–14:00

OS2-4 A high-speed generation of image classification algorithm by parallel genetic image n

Takuya Yoshida, Kunihito Yamamori, Masaru Aikawa
(University of Miyazaki, Japan)

Recently, popularization of digital camera takes us a huge number of digital images, and some researchers investigate new technologies for automatic image classification. Since image classification technologies depend on target images, it is difficult to decide what kinds of classification algorithm should be used. To solve this problem, a technique called as Genetic Image Network for Image Classification (GIN-IC) that automatically builds an image classification algorithm has been proposed. However, GIN-IC requires a huge computation time. In this paper, we propose a high-speed GIN-IC with master-worker parallel computation model. We implement our method in a cluster computer, and evaluate computation time to build a suitable algorithm that classifies digital images into two classes.



January 24 (Friday), 13:00–13:45

Room C

OS12 Medical imaging

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

OS12-1 Earth mover's distance based segmentation of abnormal liver region using histogram

Shoji Ezaki¹, Hiroaki Shimizu¹, Shoji Yamamoto², Toshiya Nakaguchi¹, Norimichi Tsumura¹
(¹Chiba University, Japan)
(²Tokyo Metropolitan College of Industrial Technology, Japan)

Recently, computed tomography (CT) has been improved by using advanced technology which can perform high speed scanning. On the other hand, there has been an increase in workloads for diagnosis of radiologists. To decrease the workloads, computer aided diagnosis (CAD) system has been desired for clinical field. Conventionally, the similarity between each histogram is calculated by integrating difference between each bin of the histograms. However, this similarity is unsuitable for the appropriate comparison since the number of bins is varied in the practical use for calculating the local histograms in CT images. In this paper, we used earth mover's distance to resolve this problem about the difference of bin numbers, and the obtained distances are used for mapping the local histograms by multidimensional scaling to low dimensional space. In the low dimensional space, the metastatic liver cancer was well segmented by support vector machine in the test data sets.



OS12-2 Oxygen saturation of skin reflects “Oketsu”

Satoshi Yamamoto¹, Norimichi Tsumura², Tomokazu Yoshizaki³, Keiko Ogawa-Ochiai⁴
(¹Keio University, Japan)
(²Chiba University, Japan)
(³Kanazawa University, Japan)
(⁴Kanazawa University Hospital, Japan)

Kampo medicine (Japanese traditional herbal medicine) contains a number of concepts which are useful for preventive medicine. The Oketsu status is a pathological concept in Kampo medicine, primarily denoting blood stasis / stagnation. In this study, we focused on oxygen saturation of skin as an objective index of skin properties, and studied correlation with the Oketsu score. First, we acquired Oketsu score of the patients, and measured hemoglobin concentration and oxygen saturation of the patients at two locations: fingertip of the right first finger and dorsal surface of the right hand. Then, correlation among these values were calculated. As the result, the oxygen saturation showed large correlation with the blood flow and the Oketsu score at dorsal surface of hand. The oxygen saturation of skin will reflect systemic blood flow and Oketsu status, and it would help objective diagnosis by measuring skin color spectrum.

OS12-3 Color reproduction in medical diagnosis

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

The differences in colors captured and reproduced using various imaging modalities may cause erroneous medical diagnoses. The influence of the color on the medical diagnosis has been still unclear, but our experiment has shown that the poor reproduction of color information possibly interferes the proper diagnoses. Furthermore, considerable differences in the precision of color reproduction required for proper medical diagnoses have been experienced among the various imaging subjects.

Color imaging with the RGB system neither captures a whole color space of real objects nor reproduce their colors observed under different illuminant. Difference of color sensitivity among physicians' eyes and modification of the color sensitivity caused by color adaptation may affect the diagnosis made on color imaging. Although most of these concerns would be fixed by applying multispectral imaging to medicine, it is mere one of possibilities. Nevertheless, this novel color technology will lead to new morphological diagnostic methods more powerful than human visual perception alone, for example, very early detection of latent decubital ulcers or latent diabetic gangrenes.

The Morphological Internet Survey Research Project Team, which was conducted by the author, proposed a solution for standardization, in which a set of typical medical images with their diagnoses authorized in advance is used as a practical calibrator for common color imaging equipment.

Image No.	Image	Display equipment						
		No.1	No.2	No.3	No.4	No.5	No.6	No.7
		CRT1	CRT2	CRT3	CRT4	LCD1	LCD2	LCD3
M-01		6.0	6.0	6.0	6.0	6.0	6.0	6.0
M-02		6.0	6.0	6.0	3.0	6.0	4.0	4.0
M-03		6.0	6.0	6.0	6.0	6.0	6.0	3.0
M-04		6.0	6.0	6.0	6.0	6.0	6.0	6.0
M-05		6.0	6.0	6.0	6.0	6.0	6.0	3.0
M-06		6.0	6.0	3.0	2.0	4.0	2.0	2.0
M-07		6.0	6.0	4.0	4.0	4.0	4.0	4.0
M-08		6.0	6.0	6.0	4.0	6.0	6.0	4.0