## Session: OS1
System sensing and control
OS1-1 Broadband robust PWM power amplifier using approximate 2DOF digital control

Takahiro Nomura, Hiroshi Iwata, Kohji Higuchi, and Kazushi Nakano
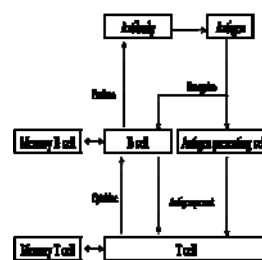(The University of Electro-Communications, Japan)

Lately, it is required that the bandwidth of PWM power amplifier is extended. For example, it is in application of the testing power supply of a low frequency immunity examination, or a class-D amplifier. In this paper, we show that the bandwidth of PWM power amplifier can be extended by using an Approximate 2DOF Digital Controller. This controller is implemented on a DSP. It is demonstrated from experiments that the bandwidth can be made wider with this controller.
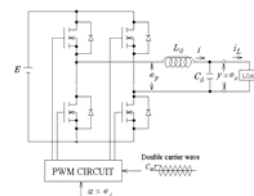
OS1-2 A consideration on immunity-based reinforcement learning with continuous states

Shu Hosokawa and Kazushi Nakano
(The University of Electro-Communications, Japan)

Many reinforcement learning methods have been studied on the assumption that state is discretized and environment size is pre-determined. However, an operating environment may have a continuous state and its size may not be known in advance such as in robot navigation and control. When applying these methods to the environment described above, we may need a large amount of time for learning or fail to learn. In this study, we improve our previous immunity-based reinforcement learning method to work in continuous state space environment. Since our method selects an action based on the distance between the present state and the memorized action, environment information (e.g. environment size) is not required in advance. The validity of our method is demonstrated through simulations for a swing-up control of an inverted pendulum.

Adaptive immunity

OS1-3 Investigation of voluntary movements in auditory stimulated conditions by integrative measurement

Kazuya Saito, Young-il Park, and Masafumi Uchida
(The University of Electro-Communications, Japan)

In general, voluntary movements can easily change from trial to trial. The reasons why are not clearly understood. The purpose of this study is to investigate deformation of voluntary movements related to body sites and caused by stimulation. For the purpose, we used an integrative biological information measurement and analysis system that we previously proposed to measure biological information during voluntary movements, especially handwriting, under auditory stimulation, and we considered the relationship between changes in voluntary movement, body sites and stimulation. Our findings will be applicable to rehabilitation, functional electrical stimulation, bio-feedback, and voluntary movement correction.
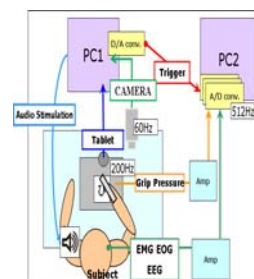
OS1-4 Swing analysis of body-parts motion accompanied by apparent movement

Young-il Park, Kazuya Saito, and Masafumi Uchida
(The University of Electro-Communications, Japan)

In this research, we examined the tactile sense for sensory substitution in people who have lost a certain sense. We considered use of apparent movement to communicate something via the tactile sense. It is necessary to measure the apparent movement objectively and quantitatively because apparent movement is normally a subjective thing. We extracted swing motion, a vital reaction characteristic accompanied by the apparent movement, using an EMG. We presented individual stimuli and performed a t-test with a combination of the presented stimuli. From the t-test results, the difference in vital reaction characteristic for each combination of presented stimuli was not small. The result presented here was obtained using only one subject; it will be necessary to increase the number of subjects in future.
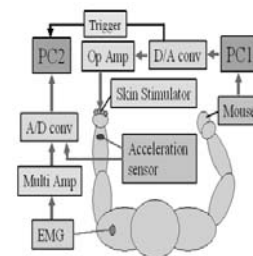
OS1-5 EMG activity of force sensation evoked by vibration stimulation

Tota Mizuno, Mitsuaki Sato, Mizuo Kimura, and Yuichiro Kume
(Tokyo Polytechnic University, Japan)

Force display devices used under virtual environments are desired to be small and simple not to restrict users' movements and comforts. Force sensations of fingers are evoked when vibro-tactile stimulation is applied onto the fingertips. This phenomenon is expected to be used for a simple and small force display, since the users wear only tiny vibrators on their fingertips. The aim of this study is to clarify the relationship between the force sensations by vibro-tactile stimulation and the activities of electromyogram (EMG) of fingers. As a result, it is shown that EMGs of extensor indices and extensor digitorum are more active than those of other finger muscles, and that the force sensations of index fingers in extender direction are perceived. The vibration stimulates extensor muscles more effectively.
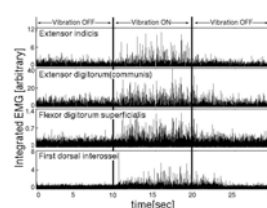
Figure. The EMG of the finger in the flexion state

OS1-6 Emotion spectrum analysis for daily repetitive mental workload

Akio Nozawa and Keita Karita
(Meisei University, Japan)

A group with daily mental arithmetic training was objectively evaluated by physiological indices using the emotion spectrum analysis. Physiological measurement on mental arithmetic task was conducted once a week for each subject. Physiological indices measured were alpha-wave power spectrum, beta-wave power spectrum, Fmθ-wave power spectrum, variation in nasal skin temperature and high frequency component of heart rate variability. And depressive tendency for the mental arithmetic task was measured as psychophysical index by using POMS (Brief Form), and time duration for the mental arithmetic task was also measured as performance index. Correlation between physiological indices, psychological index, performance index, and emotion spectrum analysis was analyzed in relation of mental workload.
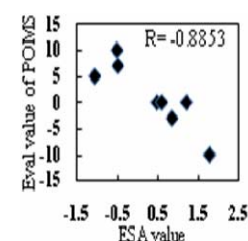
Fig. Correlation of T-A and P1.

OS1-7 Single-trial analysis of voice stimulus evoked potentials

Hisaya Tanaka and Takashi Matsuoka
(Kogakuin University, Japan)

We are developing BCI for event-related potentials (P300) using speech stimulus in the Japanese language based on the need investigation of ALS patients. In this paper, we reviewed the application of independent component analysis (ICA) in order to improve the accuracy of single-trial analysis of P300. As a result, the detection ratio improved from 54.2% for the traditional 4Hz low-pass filter to 90.9% in the choice of one between two. Furthermore in the offline experiment, the detection ratio of P300 response to each sound of "a, i, u, e and o" improved. The maximum detection ratio was 94.7%, and the detection ratio per sound improved from 47.0% to 85.1%.
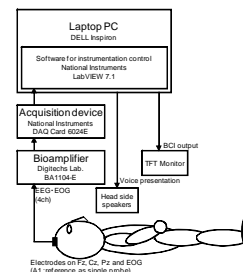
Session: OS2
MOT and interdisciplinary research
OS2-1 Estimating stochastic volatility models of stock returns in Chinese markets

Shu Quan Lu[1], Shiyu Xie[1], and Takao Ito[2]
([1]Fudan University, China)
([2]Ube National College of Technology, Japan)

Volatility plays a key role for microstructure issues in the study of financial market. Stochastic Volatility (SV) models have been applied to the behavior study of financial variables. Two stock markets exist in China: Shanghai Stock exchange and Shenzhen Stock exchange. As emerging stock markets, investors are increasingly concerned about volatilities of these two stock markets. We introduce briefly how to estimate SV models using Markov chain Monte Carlo (MCMC) method. In order to do full and comprehensive analyses of the volatilities of stock returns, we estimate SV models using most of the historical data and different data frequencies of these two Chinese markets. We find that estimated values of volatility parameters are very high for all data frequencies. It suggests that stock markets' returns are extremely volatile even at long term intervals in Chinese stock markets. Furthermore, this result could be considered that there seems to be arbitrage opportunities in Chinese stock markets.
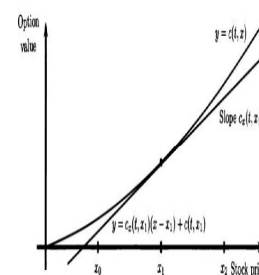
Delta-neutral position.

OS2-2 An analysis of organizational behaviors in the Keiretsu of Mazda

Takao Ito[1], Shinya Tagawa[1], Makoto Sakamoto[2], and Shu Quan Lu[3]
([1]Ube National College of Technology, Japan)
([2]University of Miyazaki, Japan)
([3]Fudan University, China)

The limit cycle is one of the effective tools to analyze organizational behavior. The authors discussed the background of this research, and explained the outline of the limit cycle. The organizational behavior and velocity history of all companies in the keiretsu of Mazda Yokokai have been measured in this paper. Imasen Electric Industrial Co., Ltd, Hi-lex Corporation, and Tokai Corporation are excluded because of lack of data. The organizational behaviors of all suppliers have been divided into four patterns using new approach of the limit cycle, and the velocity history has been measured in this paper. The authors concluded this paper by indicating the weak point of the limit cycle.
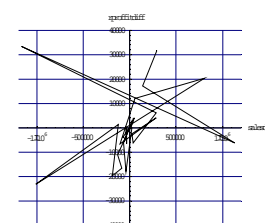
Limit cycle of Denso

Corporation Tokai.

OS2-3 An analysis of interactive influence in the Keiretsu of Mazda

Seigo Matsuno[1], Takao Ito[1], Zengyu Xia[2], and Makoto Sakamoto[3]
([1]Ube National College of Technology, Japan)
([2]Wenzhou University, China)
([3]University of Miyazaki, Japan)

One of the most important issues in corporate management is to find those companies that have higher influence and strength their reciprocal relationship with them. A set of companies with interlocking business relationships is known as a Keiretsu in Japan. In this paper we use the influence analysis tool DEMATEL to measure one kind of reciprocal relationship, the influence, of each company in the keiretsu of Mazda Yokokai from the viewpoints of transactions and cross-shareholdings. Furthermore, we calculate the centrality index of each company, and then analyze the relationship between centrality index and influence in order to identify the determinants of the influence. The results of this research are used to identify some characteristics of the effective relationships between Mazda and its suppliers.
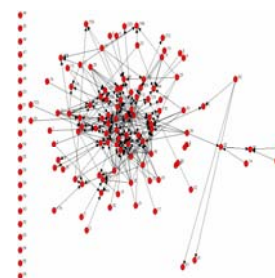
OS2-4 The connection law and networks

Takao Ito[1], Yuchao Ma[2], and Makoto Sakamoto[3]
([1]Ube National College of Technology, Japan)
(Wuhan University of Science and Engineering, China)
([3]University of Miyazaki, Japan)

Cooperation is one of the most important factors in organizations. Unsolved issues of cooperation are still left although many researches have been published. One is the mechanism of cooperation. In Barnard's book, He analyzed the principle of cooperation, but he did not explain the mechanism of cooperation because he considered the ability of each individual to be equal. We believe Barnard's idea to be incorrect; therefore, we will discuss this issue and try to understand network organization using the case study of a competition between Betamax and the VHS to prove our point. Furthermore, we attempt to simulate a percolation model of network organization, and to discover the connection law under the condition that the abilities of all individuals are not equal. Discovering the connection law of cooperation is vital because it will take on more significance in the age of Information Technology than ever before.
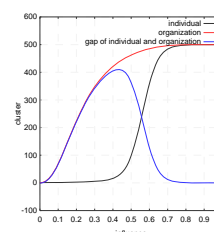
Gaps between the Abilities of

Individual and the New Cluster.

OS2-5 Discovering the efficient organization structure: horizontal versus vertical

Satoshi Ikeda[1], Takao Ito[2], and Makoto Sakamoto[1]
([1]University of Miyazaki, Japan) ([2]Ube National College of Technology, Japan)

Structure analysis is one of the most important issues in corporate management. Pyramid structure, as one of the well-known typical vertical structure, plays an important part in the corporate organization. Most structures of the traditional organizations such as functional structure and divisional structure are vertical. Recently, due to the development of Information Technology, a new horizontal structure, instead of the vertical one, has been drawn considerable attention. In this paper, we reviewed the efficient organization structure, and found that there are two efficient structures: vertical structure and horizontal structure, depending on the different abilities of each member in any organizations with the comprehensive evaluation measurement. The line structure of vertical organization is efficient when the ability of all members is small. While the ability of all members is large, the star structure of horizontal organization will be efficient. Therefore, this paper provides a theoretical perspective to prove the efficient organization structures and their required conditions.
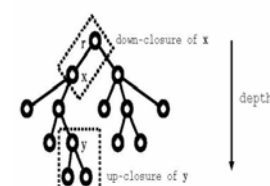
x Down-closure of x, and

up-closure of y in T_r.

OS2-6 A centrality analysis of transaction relationship of Panasonic

Yousin Park[1] and Yunju Chen[2]
([1]Ube National College of Technology, Japan)
([2]Kyushu International University, Japan)

A reform called Value Creation 21 of Panasonic group had been undertaken in 2001. This strategy gave strong impact on the transaction relationship of Panasonic. In order to make relationship visible and countable, we measure centrality indexes of graph theory, using the data collected in 2002 and 2005. The findings of this paper are as follows. First, the number of firms included in transaction network of Panasonic in 2005 is less than that in 2002. Second, not only the degree of all firms in Panasonic Group and their suppliers decreased in 2005 compared that of 2002. Third, the relative importance of Panasonic in network is increased while the degree of Panasonic is decreased. Fourth, part of the firms related to Components and Devices and Digital AVC Network in Panasonic group are ranked higher than other firms in transaction network of Panasonic. Based on these findings, we finally concluded how Panasonic arranged its transaction relationship during turnaround.
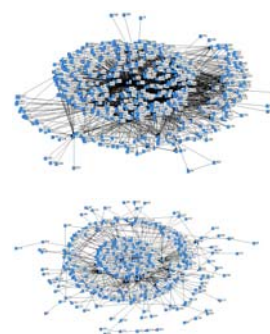
OS2-7 A study of accounting standard-setting using graph theory

Kensuke Ogata
(University of Nagasaki, Japan)

Accounting standards settings are subject to political activities by preparers or companies. Despite of strong objections from preparers of financial statements, the FASB set the conceptual and user-oriented accounting standards on business combinations. The aim of this paper is to clarify who or what kinds of groups played central roles in, using the graph theory. These analyses using voice data and data produced from voting behaviors in the board meetings reveals that the centrality of preparer (group) is low, and ones of academician (group) and user (group) are high in this project. This result may indicate that what blows hole in the powers of preparers in the FASB exists.
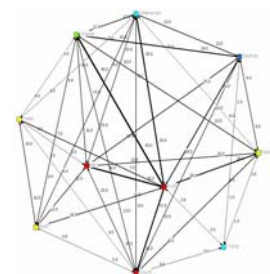
Session: OS3
Learning control and robotics
OS3-1 Real time traffic signal learning control using BPNN based on prediction for probabilistic distribution of standing vehicles

Chengyou Cui, Jisun Shin, and Heehyol Lee
(Waseda University, Japan)

In this paper, a new method to predict the probabilistic distribution of traffic jam at crossroads and to design a traffic signal learning control system are proposed. First, the DBN model used to build a forecasting model to predict the probabilistic distribution of sanding vehicles. And, the adjusted algorithm of traffic signal control is applied to calculate the optimal cycle length and sprit. In order to achieve the real time control, a learning control system based on the BPNN is used. In the new system, the input is the probabilistic distribution of standing vehicles and output is cycle length and sprit. Finally, the effectiveness of the new traffic signal control system using the actual traffic data will be shown.
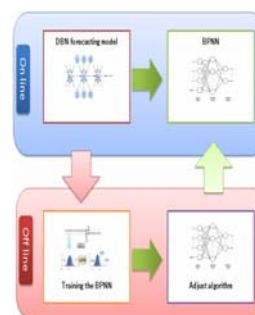
OS3-2 Advanced pipe inspection robot using rotating probe

Kentarou Nishijima[1], Yixiang Sun[2], Harutoshi Ogai[1],
Rupesh Kumar Srivastava[3], and Bishakh Bhattacharya[3]
([1]Waseda University, Japan)
([2]Shanghai Jiao Tong University, China)
([3]Indian Institute of Technology Kanpur, India)

Many plant pipes and drains had become old, for that reason many robots were developed to inspect the degree of deterioration or damage for pipes. Although the wire robots have been put into practical use in recent years, they had the disadvantages of heavy power supply and running with cables. Therefore, we measured the properties of wireless radio signal with steel and ceramic pipes and developed a practical wireless radio communication system. In this paper, we introduce a new inspection robot integrated both the inspection system using wireless radio communication and the image transmission. The inspection system using the rotating probe was developed by Indian Institute of Technology and the image transmission was proposed by Waseda University.
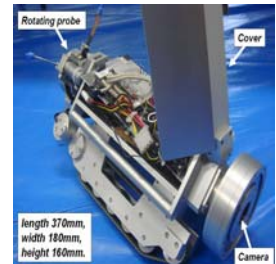
OS3-3 Quasi-ARX neural network and its application to adaptive control of nonlinear systems

Lan Wang, Yu Cheng, and Jinglu Hu
(Waseda University, Japan)

This paper introduces a quasi-ARX neural network and discusses its application to adaptive control of nonlinear systems. A switching mechanism is employed to improve the performance of control system. An adaptive switching control of nonlinear system is established and some stability analysis of control system is shown. Simulations are given to show the effectiveness of the proposed method both on stability and accuracy.
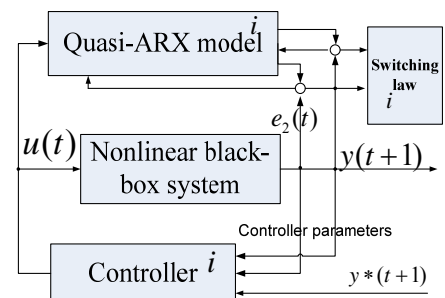
OS3-4 Real-time generation of developed view for drain pipe based on web camera video

Zhicheng Wang, Harutoshi Ogai, and Shigeyuki Takeno
(Waseda University, Japan)

A real-time algorithm for generating the interior developed view of a drain pipe based on video taken by a robot-inspector is presented. The objective is to increase the efficiency of examination and maintenance of a drain pipe, and make it possible to check the situation of the drain pipe with an easy view. The key idea of the paper is to identify the central point of the drain pipe automatically based on the video image and connect the images as a development map of the drain pipe in real time. We described the Hough transform method and the Least-Squares method for searching the centre of the drain pipe in detail.
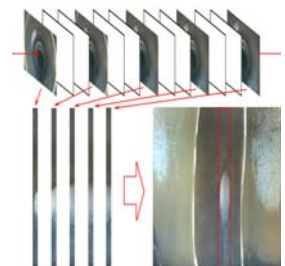
Session: OS4
Analysis and implementation of nonlinear systems
OS4-1 An Izhikevich type silicon neuron circuit

Y. Nagamatsu, K. Aihara, and T. Kohno
(The University of Tokyo, Japan)

The Izhikevich model is 2-variable differential equations of a qualitative neuron model. In spite of its simple mathematical structure, it can produce a variety of firing patterns because of its nonlinearity, including jump of state in the equations. When we construct spiking neural networks, we need simple circuitry that can produce rich dynamics because more dynamical patterns are thought to give the higher probability of complex information processing. In our research, we aim to design an Izhikevich-type simple silicon neuron circuit by reproducing the mathematical structure in the original model using analog electronic circuit. It is operated in the subthreshold region of Metal-Oxide-Semiconductor Field-Effect Transistors (MOSFETs) for low energy consumption in the Complementary Metal-Oxide-Semiconductor Very Large Scale Integration circuit (CMOS VLSI) technology.
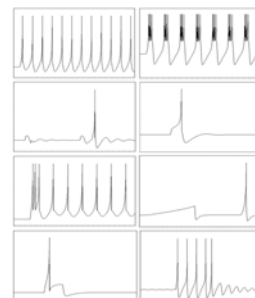
OS4-2 A digital spiking silicon neural network

T. Nakayama, Y. Katori, K. Aihara, and T. Kohno
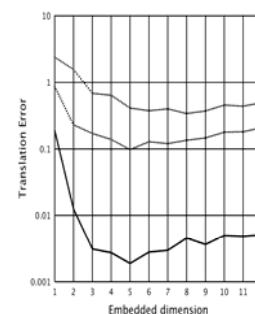(The University of Tokyo, Japan)

A silicon neuron is an electrical circuit that replicates the electrophysiological phenomena of biological neural system. Despite most of conventional spiking silicon neuron models are designed for analog circuit technology, we proposed, in the previous study, a digital spiking silicon neuron (DSSN), which is optimally designed for digital circuit technology. In addition to the DSSN, we propose here a digital silicon synapse that mimics the elemental features of a chemical synapse and underlies the construction of a silicon neural network. We built a fully-connected digital silicon neural network with the digital silicon synapses and demonstrate synchronization and phase-locking in neural activities in a hardware description language (HDL) simulation.
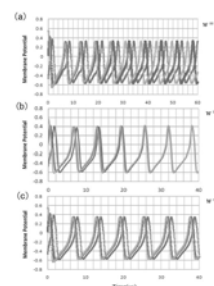
OS4-3 Failure of pseudo-periodic surrogates

Masanori Shiro, Yoshito Hirata, and Kazuyuki Aihara
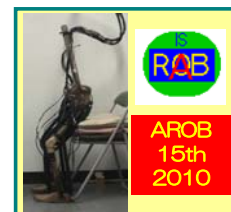(The University of Tokyo, Japan)

A surrogate test is a method for revealing properties of the time series data. To judge whether or not a pseudo-periodic time series has a deterministic property beyond the pseudo-periodicity, some methods to generate surrogate data have been proposed. Luo's test is one of such methods. In this report, Luo's test and its problem will be shown. On that test, surrogate datasets are produced by adding the original data to the time-shifted original data. So, the pseudo-periodicity of the time series will be presumably preserved, but fine structure related to the determinism is destroyed. The test gives correct results for many ordinary data. However, Luo's test also provides wrong results for certain time series, for example, time series of Rossler chaos and phase-shifted sinusoidal waves. To overcome this problem, we propose an alternative method based on the Poincare section.

OS4-4 Estimation of excess entropy from spike trains

H. Motoyoshi, Y. Katori, and H. Suzuki
(The University of Tokyo, Japan)

Entropy rate is widely used for analysis of neural data as a measure for randomness of spike trains. In addition, its convergent process also contains information on spike trains' structures or patterns. Therefore, it can be expected to be a measure for certain aspects of spike trains. In this paper, we investigate applicability of excess entropy to neural spike train data by numerical simulations of gamma process. We show that even when the spike train is not so long, the estimated excess entropy correctly reflects the shape parameter of the gamma process.

OS4-5 Synchronized brain activity changes related to perceptual alternations

Koji Iwayama, Kohske Takahashi, Katsumi Watanabe,
Yoshito Hirata, Kazuyuki Aihara, and Hideyuki Suzuki
(The University of Tokyo, Japan)

When we look at ambiguous figures, perception spontaneously changes from one to the other (perceptual alternation). We measured the brain activity from subjects who observed the Necker cube, one of the most famous ambiguous figures, using magnetoencephalography (MEG). To identify the brain activity inducing perceptual alternation, we propose a novel change-point detection method using spectral clustering to recurrence plots, and apply to measured data. Synchronized activity changes were detected at parietal channels.
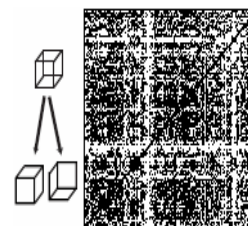
Session: OS5
Control and automata
OS5-1 Sampled-data models for affine nonlinear systems using a fractional-order hold and their zero dynamics

Masatoshi Nishi and Mitsuaki Ishitobi
(Kumamoto University, Japan)

One of the approaches to sampled-data controller design for nonlinear continuous-time systems consists of obtaining an appropriate model and then proceeding to design a controller for the model. Hence, it is important to derive a good approximate sampled-data model because the exact sampled-data model for nonlinear systems is often unavailable to the controller designers. Recently, Yuz and Goodwin have proposed a more accurate model than the simple Euler model in the case of a zero-order hold. This paper derives a sampled-data model for nonlinear systems using a fractional-order hold, and analyzes the zero dynamics of the sampled-data model.
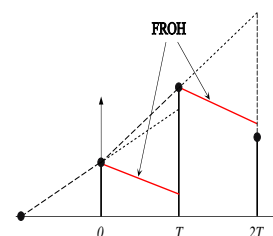
OS5-2 Development of 6-DOF force feedback system with pneumatic parallel mechanism

Yasunobu Hitaka[1], Yoshito Tanaka[2], Yutaka Tanaka[2], and Junko Ishii[1]
([1]Kitakyushu National College of Technology, Japan)
([2]Hosei University, Japan)

In this paper, it is presented the development of a new type force feedback system. It is based on a 6-DOF Stewart parallel mechanism which has six pneumatic actuated cylinders. The thrust force of each cylinder is controlled by PWM control for two solenoid valves. When the pneumatic actuator is controlled, it must be considered the influence on the compressibility of air. For this problem, the control characteristics are guaranteed by the effect of the accumulator. It is confirmed that the thrust force of the cylinder can be applied to the pneumatic parallel mechanism, and it is presented the experimental result of force control for vertical direction.

OS5-3 A study of guaranteed cost control of the manipulator with passive revolute joint

J. Hara, N. Takahashi, J. Kato, O. Sato, and M. Kono
(University of Miyazaki, Japan)

In practice, the effect of uncertainty is a considerable problem. Such an uncertainty is caused by a measurement error, noise in the signal, secular distortion of the device, etc. and makes degradation of the performance index. On of the approach to deal with the influence of uncertainty is to include these uncertainties in form of the LTI system by a structured uncertainty. By using this uncertain system, it is able to design the robust control system. In this paper we consider a guaranteed cost control problem of two link RR manipulator with uncertainty in the joint angle. The first purpose is to derive the uncertain LTI system of a two link RR manipulator which includes uncertainty in a rotate angle of two joints. The uncertainty is expressed in the system structure matrix in an explicit form. For this system we apply guaranteed cost control. At last, we show the effectiveness of our method by a numerical example.
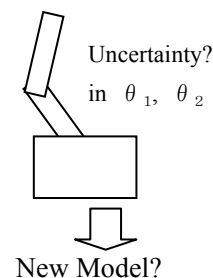
OS5-4 Analysis of manipulator in consideration of relative motion between tray and object

Asaji Sato[1], Osamu Sato[2], Nobuya Takahashi[2], Akira Uekubo[2], and Michio Kono[2]
([1]Miyakonojo National College of Technology, Japan)
([2]University of Miyazaki, Japan)

In this paper, equations of motion of a manipulator, whose mechanism has a passive revolute joint, are derived in consideration of characteristics of driving source. Considering the final condition about displacement and velocity of the passive joint, trajectories of velocity for saving energy are calculated by iterative dynamic programming. In order to adjusting the motion of object, the center of gravity of the tray is adjusted in consideration of analysis about relative motion between the tray and object. And, the dynamic characteristics of manipulator controlled based on the trajectory for saving energy are analyzed theoretically and investigated experimentally.
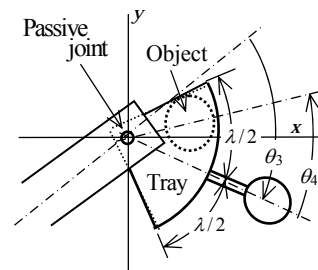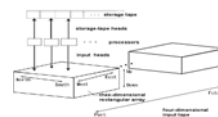
OS5-5 Parallel turing machines on four-dimensional input tapes

Takao Ito[1], Makoto Sakamoto[2], Ayumi Taniue[2], Tomoya Matsukawa[2],
Yasuo Uchida[1], Hiroshi Furutani[2], Yuchao Ma[2], and Michio Kono[2]
([1]Ube National College of Technology, Japan)
([2]University of Miyazaki, Japan)

A parallel Turing machine (PTM) proposed by Wiedermann is a set of identical usual sequential Turing machines (ST M's) cooperating on two common tapes − storage tape and input tape. On the other hand, due to the advances in many application areas such as motion picture processing, computer animation, virtual reality systems, and so forth, it has become increasingly apparent that the study of four-dimensional pattern has been of crucial importance. Thus, we think that the study of four-dimensional automata as a computational model of four-dimensional pattern processing has also been meaningful. In this paper, we propose a four-dimensional parallel Turing machine (4-PTM), and investigate its some properties, based on hardware complexity.



Three-dimensional
parallel Turing machine.

OS5-6 Some properties of four-dimensional parallel turning machines

Yasuo Uchida[1], Makoto Sakamoto[2], Ayumi Taniue[2], Ryuju Katamune[2],
Takao Ito[1], Hiroshi Furutani[2], and Michio Kono[2]
([1]Ube National College of Technology, Japan)
([2]University of Miyazaki, Japan)

Informally, a parallel Turing machine (PTM) proposed by Wiedermann is a set of identical usual sequential Turing machines (STM's) cooperating on two common tapes — storage tape and input tape. Moreover, STM's which represent the individual processors of the parallel computer can multiply themselves in the course of computation. On the other hand, during the past about seven years, automata on a four-dimensional tape have been proposed as computational models of four-dimensional pattern processing and several properties of such automata have been obtained. In this year, we proposed a four-dimensional parallel Turing machine (4-PTM). In this paper, we continue the study of 4-PTM, which each side-length of each input tape is equivalent, and investigate some accepting powers of it.
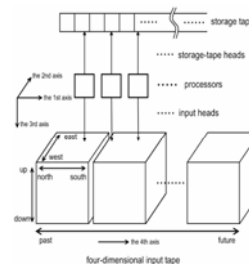

Session: OS6
Computer vision and robotics
OS6-1 An improvement of MSEPF for visual tracking

Yuki Nakagama and Masahiro Yokomichi
(University of Miyazaki, Japan)

Recently, many approaches on applying particle filter to visual tracking problem have been proposed. However, it is hard to implement it to the real-time system because it requires a lot of computation and resources in order to achieve higher accuracy. As a method for reduce the computation time, Shan and coworkers proposed combining particle filter and Mean-Shift in order to keep the accuracy with small number of particles. In their approach, the state of each particle moves to the point in the window with the highest likelihood value. It is known that the accuracy of estimation depends on the size of the window, but the larger window size make the computation slower. In this paper, the authors propose method for exploring the highest likelihood more quickly by means of random sampling. Moreover, our approach defines likelihood in terms of not only color cue but also motion cue for higher-accuracy object tracking. The effectiveness of the proposed method is evaluated by real image sequence experiments..
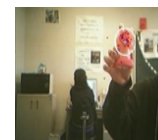
OS6-2 A system for synchronizing nods of a CG character and a human using thermal processing and moving average model

R. Kato, Y. Yoshitomi, T. Asada, and M. Tabuse
(Kyoto Prefectural University, Japan)

In the present study, an image registered by infrared rays which describes the thermal distribution of the face and neck has been used for developing a system for communication between a human and a CG character. In the present system, the CG character can synchronize its nod with a person's nod by predicting his or her nod angle. The measured feature parameter is inputted to a fuzzy algorithm system to obtain the nod angle of a person in front of an infrared ray camera, and then the Moving Average model is used for predicting the nod angle of the person. The average error of the nod angle obtained by the present system has been estimated as about 5°.

OS6-3 Quadruped walking with parallel link legs

Takumi Yaginuma[1], Etsurou Shimizu[1], Masanori Ito[1], Junnichiro Tahara[2], and Takesi Takesima[1]
([1]Tokyo University of Marine Science and Technology, Japan)
([2]Japan Agency for Marine-Earth Science and Technology, Japan)

We are proposing an underwater robot for the work. In this study, we designed the robot, which has body of rectangular plane and 4 legs at each corner. The leg is consisted with parallel mechanism of 2 cylinder, and the end of each cylinder is attached on the robot body with free rotational joint and the end of both piston rods are connected with pin joint. This leg can move to forward or backward direction freely but cannot move to side direction. We are studying the control scheme of walking for this robot, which is putting mind especially on smooth and steady movement without rolling, pitching, yawing or heaving motion and keeping the body horizontally. We confirmed the validity of control scheme with simulation and experiments. We would like to report those results on the symposium as much as possible.

OS6-4 Development of under water use humanoid robot

Yunyi Li, Etsurou Shimizu, and Masanori Ito
(Tokyo University of Marine Science and Technology, Japan)

In this research, we have developed a swimming robot with flutter kick of two legs, which can swim freely both on the surface of water and in the water, and established the control method for all kinds of motion of this robot, such as straight swimming, turning, down going or up going. Furthermore, with optimizing the three-dimensional action of underwater robot, we can expect improvement of the performance for work.
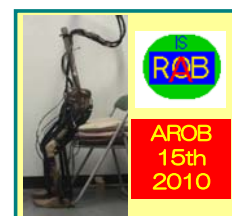
OS6-5 Improvement of underwater vehicle remote control environment with parallel link operation base

Kimiyo Inabe[1], Etsurou Shimizu[1], Masanori Ito[1], and Junnichiro Tahara[2]
([1]Tokyo University of Marine Science and Technology, Japan)
([2]Japan Agency for Marine-Earth Science and Technology, Japan)

This research is about remote control of ROV, and is carried out to solve the problem that has long annoyed ROV's operator because of disagreement between the motion of mother ship and the image of underwater vehicle indicated at the station including the motion of ROV. The main point of the survey is to make environment as if an operator rides on underwater vehicle, getting rid of ship's motion and unite with motion of underwater vehicle. To recreate ship's motion in laboratory by a Stewart parallel link system, and ask a subject to ride on it, show him(or her) the image which was taken on the vehicle. After getting rid of the ship's motion and recreate the motion of underwater vehicle, we will compare the level of seasickness. We suppose the user can't operate more than 30 minutes because of the difference between the motion of the ship and the vehicle but after getting rid of ship's motion he(or she) can operate much longer.

OS6-6 Spinning control of basketball with robot fingers

Yuuki Ohtake, Masanori Ito, and Feifei Zhang
(Tokyo University of Marine Science and Technology, Japan)

A robot hand has deft fingers is important element for intelligence humanoid robot. There is plenty of studies about robot hands has deft fingers, but it is not practically as such. And so, I am engaged in study of spinning control of basketball with robot fingers, as subject of research that robot has deft fingers. This is like basketball player plays spinning a ball on his fingertip. As approach for bring this control to pass, we need study motion of spinning ball on fingertip, how we make robot to control it. In this paper, I explain that process control spinning ball on fingertip, and I propose technique for control it by robot fingers.
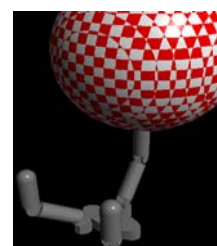
Session: OS7
Soft robotics
OS7-1 GA simulation of evolution of the hierarchical module structure on gene networks

Shinji Nakashima and Koji Kurata
(University of Ryukyus, Japan)

The animal body plan is controlled by the genetic networks of the hierarchical modular structure. For example, homeotic selector genes function at many levels in the regulatory hierarchy, so that homeotic mutations result in the transformation of one body segment into another, which is recognized by the misplaced development of structures that are normally present elsewhere in the embryo. The purpose of this research is to search for the mechanism of the evolution of such genetic networks. We modeled simplified genetic networks, and simulated the evolution of the genetic networks by GA. The simulation results show that the environmental perturbation possibly gave rise to the evolution of the hierarchical modular structure.
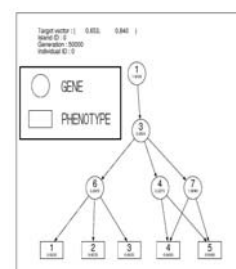
OS7-2 Swing-up control of the acrobot using genetic programming considering an actuator dynamics

Ryo Fukushima and Eiho Uezato
(University of the Ryukyus, Japan)

We present a control method for a 3-DOF acrobot which is a model of a gymnast on a horizontal bar with three links, two active joints, and a passive joint. This robot is a non-holonomic behavior and underactuated system, the swing-up control of the acrobot is therefore difficult. We model the 3-DOF acrobot considering the dynamics of the DC servomotor. We propose a control method for the 3-DOF acrobot. First, swing-up control is performed by genetic programming (GP), and stabilizing control is handled by a linear quadratic regulator (LQR). GP can search widely for the optimum input for swing-up so that the acrobot is able to reach a near balancing point. In the simulation results, the 3-DOF acrobot could swing-up to the desired position, and the proposed method could control the acrobot effectively.
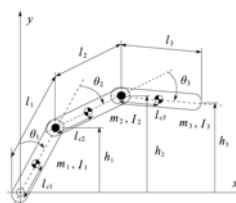
OS7-3 Neurocontrol for a rotary crane system with disturbance

Kosuke Tamanoi and Kunihiko Nakazono
(University of the Ryukyus, Japan)

In this paper we propose a neuro-controller (NC) for suppression of load swing with disturbance in a crane system rotating around the vertical axis. As in a nonholonomic system, the traditional control method using a static continuous state feedback law cannot stabilize the load swing. It is necessary to design a time-varying feedback controller or a discontinuous feedback controller. Previous research had been successful in constructing the suppression controller of the load swing with a single initial rotation angle when disturbance appeared. In this paper, the performance of the NC optimized by genetic algorithm will be examined with three initial rotation angles.
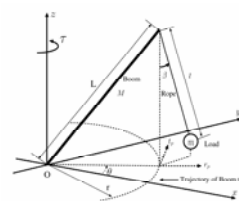
OS7-4 Particle swarm optimization with genetic recombination - A hybrid evolutionary algorithm

Sam Chau Duong[1], Hiroshi Kinjo[1], Eiho Uezato[1], and Tetsuhiko Yamamoto[2]
([1]University of the Ryukyus, Japan)
([2]Tokushima Technology College, Japan)

This article presents a hybrid evolutionary algorithm (HEA) based on particle swarm optimization (PSO) and real-coded genetic algorithm (GA). In the HEA, PSO is used to search for optimal solution where genetic recombination operator is added to produce offspring individuals based on the parents that are selected in proportion to their relative fitness. Through the recombination, new offspring enter the population and the individuals with poor fitness are eliminated. The performance of the proposed hybrid algorithm is compared to those of the original PSO and GA where the impact of the recombination probability to their performances is also analyzed. Various simulations of multivariable functions and neural network optimizations are carried out, showing that the proposed approach is superior over the canonical means.
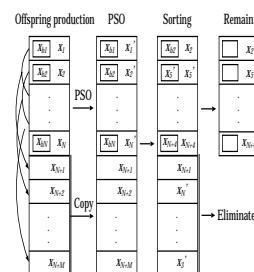
Session: OS8
Intelligent control and applications
OS8-1 Production scheduling and process planning based on mixed-integer evolutionary algorithm

Yung-Chin Lin[1,2], Yung-Chien Lin[1], Kuo-Lan Su[2]
([1]WuFeng Institute of Technology, Taiwan)
([2]National Yunlin University of Science and Technology, Taiwan)

Production scheduling and process planning are both of the most important decision-making problems in the manufacturing industry. Both of problems are complex due to coupling with combinatorial property and constrained requirements. To describe production scheduling and process planning problems, two mixed-integer nonlinear programming (MINLP) models are developed to formulate these two decision-making problems. On the other hand, in order to effectively make an optimal decision, a mixed-integer evolutionary algorithm is proposed to solve these two MINLP problems. Finally, experimental examples are used to test the algorithm. The experimental results demonstrate the proposed algorithm can effectively handle these two decision-making problems.
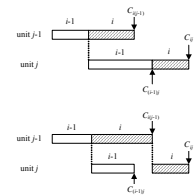
OS8-2 Further study on camera position estimation from image by ANFIS

Shao-Fan Lien[1], Kuo-Hsien Hsia[2], Chun-Chieh Wang[3], Ting-En Lee[1], Juhng-Perng Su[4]
([1]National Yunlin University of Science and Technology, Taiwan)
([2]Far East University, Taiwan)
([3]Chienkuo Technology University, Taiwan)
([4]Overseas Chinese University, Taiwan)

It is clear that different images will be obtained when one takes pictures with different camera positions. One can easily determine the characteristics of the captured image by projective geometry. However, it is hard to estimate the camera position only from an image. Machine learning methods are very useful for the nonlinear relation identifying. In this research, released situations of the images comparing to the earlier works are considered. An adaptive neuro-fuzzy inference system (ANFIS) network design is deployed and used for camera position estimating in this paper. From the experimental results, it is evidently that the proposed method can estimate the center of the camera correctly and effectively.
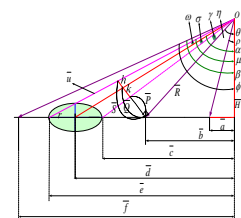
OS8-3 Gaussian radial basis function neural network controller of synchronous reluctance motor in electric motorcycle applications

Chien-An Chen[1], Huann-Keng Chiang[2], and Wen-Bin Lin[2]
([1]Automotive Research and Testing Center, Taiwan)
([2]National Yunlin University of Science and Technology, Taiwan)

In this paper, a sliding mode control(SMC) design based on Gaussian radial basis function neural network(GRBFNN) is proposed for the synchronous reluctance motor(SynRM) system in electrical motorcycle applications. The conventional sliding mode control is assumed that the upper lumped boundary of parameter variations and external disturbances is known and the sign function is used. It causes high frequency chattering and high gain phenomenon. In order to avoid above drawback, the proposed method utilizes the Lyapunov stability method and the steep descent rule to guarantee the convergence asymptotically and reduce the magnitude of the chattering or avoid the chattering. Finally, numerical simulations are shown to illustrate the good performance of our controller design.
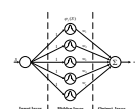
Fig. 4. The structure of the RBFNN model

OS8-4 Implementation of robust complex extended Kalman filter with LabVIEW for detection in distorted signal

Wen-Bin Lin[1], Huann-Keng Chiang[2], Kuang-Rong Shih[3], and Chien-An Chen[4]
([1]Far East University, Taiwan)
([2]National Yunlin University of Science and Technology, Taiwan)
([3]National Formosa University, Taiwan)
([4]Automotive Research and Testing Center, Taiwan)

This paper presents the PC-based LabVIEW as a software to develop the algorithm of the robust complex extended Kalman filter (RCEKF) for detection of the parameters of voltage signal in power systems. The hardware of this paper is to take sample-and-hold card and DAQ (Data Acquisition) card for extracting the datum from the outside system to the PC, and the program compute the amplitude, frequency, and phase of the voltage signal with RCEKF. For validating the performance of RCEKF in this paper, the voltage signal from function generator is applied to check the feasibility of algorithm firstly, and then this application was also used in the TPC (Taiwan Power Company) secondary substation in Sijhou, Taiwan.
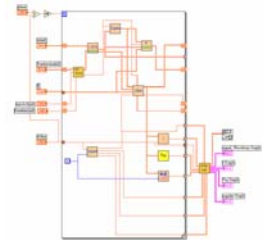
## OS8-5 Fuzzy PID control for an overhead crane using hybrid optimization approach

Chia-Nan Ko[1], Chi-Ching Yang[2], Guan-Yu Liu[1], and Kuo-Lan Su[3]
([1]Nan-Kai University of Technology, Taiwan)
([2]Hsiuping Institute of Technology, Taiwan)
([3]National Yunlin University of Science and Technology, Taiwan)

In this paper, a hybrid optimization approach is proposed to design fuzzy PID controllers for asymptotical stabilization of a two-dimensional overhead crane. In the proposed method, a fuzzy PID controller is expressed in terms of fuzzy rules, in which the input variables are the error signals and their derivatives, while the output variables are the PID gains. In this manner, the PID gains are adaptive and the fuzzy PID controller has more flexibility and capability than the conventional ones with fixed gains. To tune the fuzzy PID controller simultaneously, a hybrid optimization procedure integrating genetic algorithm (GA) and particle swarm optimization (PSO) method is proposed. The simulation results illustrate that the proposed controller can effectively perform the asymptotical stability of the prototype overhead crane.
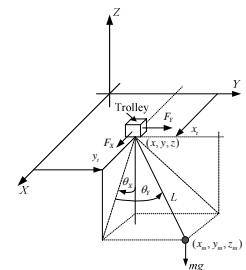
OS8-6 Parameter estimation of chaotic systems by nonlinear time-varying evolution PSO method

Chia-Nan Ko[1], Yu-Yi Fu[1], Cheng-Ming Lee[1], and Chia-Ju Wu[2]
([1]Nan-Kai University of Technology, Taiwan)
([2]National Yunlin University of Science and Technology, Taiwan)

An important issue in nonlinear science is parameter estimation for Lorenz chaotic system. Much attention has attracted increasing interests for the identification in various research fields, which could be essentially formulated as a multi-dimensional optimization problem. A novel evolutionary computation algorithm, nonlinear time-varying evolution particle swarm optimization (NTVEPSO) is employed to estimate the parameters. In the NTVEPSO method, the nonlinear time-varying evolution functions are determined by using matrix experiments with an orthogonal array, in which a minimal number of experiments would have an effect that approximates the full factorial experiments. The NTVEPSO method and other PSO methods are then applied to identify of Lorenz chaotic system. Numerical simulation and the comparisons demonstrate the feasibility and the superiority of the proposed NTVEPSO method.
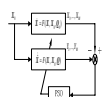
Session: OS9
Intelligent system and application
OS9-1 The development of the omnidirectional home care mobile robot

Jie-Tong Zou[1] and Feng-Chun Chiang[2]
([1]National Formosa University, Taiwan)
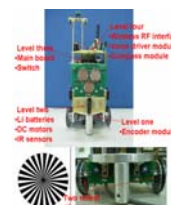([2]WuFeng Institute of Technology, Taiwan)

Rapid progress of standard of living and health care resulted in the increase of aging population. More and more elderly people do not receive good care from their family or caregivers. Intelligent mobile robot combining sensing technologies and wireless communication technologies is a very important in reducing the cost of medical resources. Nowadays, service robots are very popular in robot family. For developing the intelligent mobile robot, we combine the mechatronics technology with the safety technology in this research. The first objective of this research is to develop a service mobile robot for taking care of elderly people. The mobile platform will be designed with 3D CAD software (Solidwork). The kinematic equations of the robot platforms will be developed in this research. The PC-based controller can control the mobile robot platform. This service mobile robot is equipped with "Indoor positioning system" and "Laser Range Finder". The indoor positioning system is used for rapid and precise positioning and guidance of the mobile robot. The laser range finder can detect static and dynamic obstacle

OS9-2 Path planning of the multiple mobile robot system

[1]Sheng-Ven Shiau, [1]Kuo-Lan Su, [2]Chun-Chieh Wang, and [1]Jr-Hung Guo
([1]National Yunlin University of Science and Technology, Taiwan)
([2]Chienkuo Technology University, Taiwan)

We present the path planning techniques on the multiple mobile robot system. The mobile robot has the shape of cylinder and its diameter, height and weight is 8cm, 15cm and 1.5kg. The controller of the mobile robot is MCS-51 chip, and can acquire the detection signals from sensors through I/O pins, and receives the command from the supervised compute via wireless RF interface, and transmits the status of the mobile robots to the supervised computer via wireless RF interface. The mobile robot is module based system, and contains a controller module (including DC motor driver devices), an obstacle detection module, a voice module, a wireless RF module, and a compass detection module. We proposed the evaluation method to arrange the position of the multiple mobile robot system, and develop path planning interface on the supervised computer for the mobile robot system. In the experimental results, mobile robots can receive the command from the supervised computer, and move the next position according to the proposed method.

OS9-3 Multi-level multi-sensor based security system for intelligent home

Song-Hiang Chia[1,2], Kuo-Lan Su[1], Sheng-Ven Shiau[1], and Ting-Li Chien[2]
([1]National Yunlin University of Science and Technology, Taiwan)
([2]Wu-Feng Institute of Technology, Taiwan)

The paper develops a multi-level multi-sensor based security system that has multiple interfaces to be applied in intelligent home. The security system contains four levels. There is passive detection level, active detection level, system supervised level and remote supervised level. The control unit of these passive modules is HOLTEK microchip. Each passive module has two variety interfaces (wireless RF and voice). These modules can use voice to alarm users for event condition, and transmit the real-time status and image signal to the active detection level and system supervised level via wireless RF interface. The remote supervised level, supervised level and active detection level can communicate with the other level via wireless Internet. It can display status of these modules on the monitor. Finally, we present some experimental results using passive and active detection modules on the security system.

OS9-4 Multisensor fusion based gas detection module

Jr-Hom Guo[1], I-Chao Chien[2], Kuo-Lan Su[1], and Chia-Ju Wu[1]
([1]National Yunlin University of Science and Technology, Taiwan)
([2]National Cenrral University, Taiwan)

The paper develops a gas detection module for the intelligent home. The module uses many sensors to detect environment of the home and building. The gas sensors have two carbon monoxide sensors, air pollution sensor, alcohol sensor, HS sensor, smoke sensor, CO sensor and gas sensor (TGS800), and can detect more than eight type gas using multisensory fusion algorithm. In the logical filter method, we can use AND or OR filter on the gas detection module. Then we can calculate the system reliability of AND filter and OR filter. The controller of the gas detection module is HOLTEK microchip. The module can communicate with the supervised computer via wireless RF interface, and caution the user using the voice module. Finally, we present some experimental results using the gas detection module on the security system.

OS9-5 A fast parameters estimation for nonlinear multi-regressions based on choquet integral with quantum-behaved particle swarm optimization

You-Min Jau, Chia-Ju Wu, and Jin-Tsong Jeng
(National Yunlin University of Science and Technology, Taiwan)

In the study of data mining and information fusion, a nonlinear multi-regression model based on Choquet integral is suitable to deal with these problems of the inherent interaction among attributes. In this paper, an effective QPSO (EQPSO) algorithm which is used to estimate parameters of nonlinear multi-regression model was proposed. This algorithm applied the concept of the genetic algorithm to the QPSO algorithm that can improve the convergent speed with premature phenomenon, stagnation and reducing the inference of the creative coefficient β in the QPSO algorithm. From the simulation results, the proposed EQPSO has better performance than the genetic algorithm for the nonlinear multi-regression model.

Table 1: The results of example 1

|	q	c	MSE	time
GA	2.51	5.98	0.014	28.06
PSO	2.25	6.33	0.095	44.01
QPSO	2.39	6.12	0.095	43.78
IQPSO	2.43	6.07	0.088	86.30
EQPSO	2.50	6.00	0.001	8.84

OS9-6 Application of a remote image surveillance system in a robotic weapon

Chun-Chieh Wang[1], Kuo-Hsien Hsia[2], Kuo-Lan Su [3], Yi-Chun Hsieh[1], and Chyun-Luen Lin[1]
([1]Chienkuo Technology University, Taiwan)
([2]Far East University, Taiwan)
([3]National Yunlin University of Science & Technology, Taiwan)

As one of the major steps toward fully intelligent autonomous robotic weapon, this paper works have accomplished in three major areas: (1) design of the surveillance system by AVR microcontroller, (2) implementation of the mechanism design, and (3) performance of the human machine interface surveillance system via LabVIEW graphical programming environment, such that the supervisor can control the vehicle by keyboard or genius mouse. In order to accomplish all these three achievements, there have been major additions and overhaul in both system software code and system circuit board developments. All these development including the developed algorithm, and hardware implementation are covered in this paper. To illustrate the effectiveness of the design, we plan an urban fight space as the scenario setting such that the robot can finish all functions. The experimental results have shown the practicality of the AVR microcontroller, LabVIEW graphical programming environment, and the ZigBee wireless technology applied to robotic weapon.
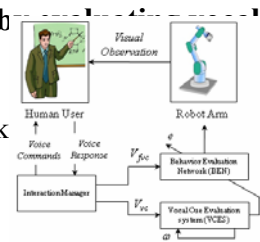
Robotic weapon
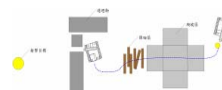
Indoor orientation diagram

Actual response

Session: OS10
Biomimetic machines and robots
OS10-1 Adaptation of robot perception on fuzzy linguistic information by evaluating vocal cues for controlling a robot manipulator

A.G.B.P. Jayasekara[1], Keigo Watanabe[2], Kazuo Kiguchi[1], and Kiyotak
([1]Saga University, Japan)
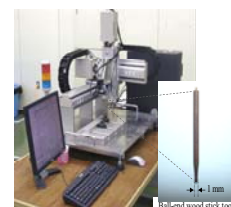([2]Okayama University, Japan)

This paper proposes a method for adapting robot's perception on fuzzy linguistic information by evaluating vocal cues. Robot's perception on fuzzy linguistic information such as "very little" depends on the environmental arrangement and the user's expectations. Therefore robot's perception on the corresponding environment is modified by acquiring user's perception through vocal cues. Fuzzy linguistic information related to primitive movements is evaluated by a behavior evaluation network (BEN). Vocal cue evaluation system (VCES) is utilized to evaluate the vocal cues for modifying the BEN. The proposed system is implemented by a PA-10 robot manipulator. The user's capability of using voice commands including fuzzy linguistic information for coarse and fine movements is enhanced.

OS10-2 Stick-slip motion control for an orthogonal-type robot

F. Nagata[1], T. Mizobuchi[1], S. Tani[1], T. Hase[2], Z. Haga[2], K. Watanabe[3], and M. K. Habib[4]
([1]Tokyo University of Science, Japan)
([2]R&D Center, Meiho Co. Ltd., Japan)
([3]Okayama University, Japan)
([4]American University in Cairo, Egypt)

A new desktop orthogonal-type robot, which has abilities of compliant motion and stick-slip motion, is presented for lapping small metallic molds with curved surface. The robot consists of three single-axis devices with a high position resolution of 1 μm. A thin wood stick tool is attached to the tip of the z-axis. The tool tip has a small ball-end shape. In order to improve the lapping performance, a small stick-slip motion control is considered in the control system. The small stick-slip motion is orthogonally generated to the direction of the tool's moving direction. The effectiveness of the stick-slip motion control is examined through an actual lapping test of an LED lens mold with a diameter of 3.6 mm.

OS10-3 Modeling an autonomous underwater vehicle with four-thruster

Zainah Md. Zain[1], Keigo Watanabe[1], Tomomi Danjo[1], Kiyotaka Izumi[2], and Isaku Nagai[1],
([1]Okayama University, Japan)
([2]Saga University, Japan)

In order to reduce the drag forces against stream for an X4-autonomous underwater vehicle (AUV), a new type of hull shape is considered with an ellipsoid body. The associated dynamical model is derived by using a Lagrangian mechanics, as well as taking account of the effect of added mass and inertia.
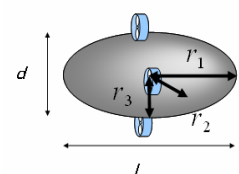
OS10-4 The number of unscented transformations and the effect of noise estimates in an unscented kalman filtering problem

Saifudin bin Razali[1], Keigo Watanabe[1], Shoichi Maeyama[1], and Kiyotaka Izumi[2]
([1]Okayama University, Japan)
([2]Saga University, Japan)

The unscented transformation is known as a technique to firstly generate a set of $2n + 1$ sigma points and their weights, and secondly to propagate each sigma point value through a nonlinear function, where n denotes the dimension of the random state variable. Note however that there are two cases in a discrete-time filtering problem: one is the case where such a transformation is applied two times to the nonlinear model function and the nonlinear measurement function separately by using different mean and covariance, whereas the other is the case where such a transformation is basically applied to the nonlinear model function and the same sigma point values are only propagated to the nonlinear measurement function. So, we here examine the performance difference between them in a particular estimation problem. In addition, it is sometimes to encounter the case where for an unscented Kalman filter, the original state is augmented with other system and measurement noises simultaneously as if the original state and measurement noises are included in nonlinear functions, even though they are actually to be additive to each model function. Therefore, we further check how much the performance improvement or degradation is, compared to the case where there is no inconsistency in the model assumptions.

OS10-5 Research on movements in formation of multiple mobile robots

Tatsuya Kato, Keigo Watanabe, and Shoichi Maeyama
(Okayama University, Japan)

Multi-robot systems are expected to improve the ability of processing tasks, a work efficiency, and an extendability of a robot system by cooperating each other. However, using multiple robots complicates its control system. As one of the associated problems, robot movements are picked up. Since a robot formation is useful to transfer multiple robots to their destinations effectively, many studies have been performed. This paper describes a method, which is called "IET method," for forming a formation with multiple robots. The method can specify the position of each robot in a group and change the shape of a formation. Note that each robot is assumed to have different ability and identified each other. Alternatively, the method needs a system that obtains the ID and relative position of the robots. We describe how to construct the measurement system using wireless communication and ultrasonic sound, and evaluate it through some simulation experiments.
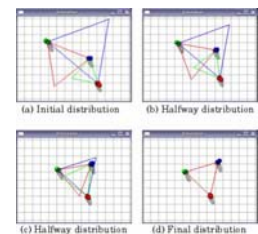
Session: OS11
Robot control
OS11-1 Adaptive image filtering for tracking control of robots

Di Cao[1], Yingmin Jia[1], and Junping Du[1]
([1]Beihang University, China)
([1]Beijing University of Posts and Telecommunications, China)

In this paper, a new adaptive image filtering scheme is first proposed based on color and pixel features, in which a compensation algorithm for the background difference of global illumination, and the H/S Model based adaptive image filtering algorithm are developed respectively. Then a tracking control strategy of robots is given, and
the corresponding experimental results are provided to demonstrate the effectiveness of the proposed scheme.

OS11-2 Non-fragile control for trajectory tracking of mobile robot systems with time-delay

Na Ni[1], Yingmin Jia[1], and Junping Du[2]
([1]Beihang University, China)
([2]Beijing University of Posts and Telecommunications, China)

This paper is devoted to the problem of non-fragile controller design for the trajectory tracking of mobile robots. Firstly, the model of the mobile robots is exactly linearized via non-linear state feedback and proper coordinate transformation under certain conditions. Secondly, the time-delay is added to the linearized model and the non-fragile controller is designed for the trajectory tracking by employing linear matrix inequalities (LMIs) approach. Finally, simulation examples are included to illustrate the effectiveness of the proposed controller.

OS11-3 Experimental comparison among three typical data-driven control algorithms

Shangtai Jin, Yongqiang Li, Yuanming Zhu, Jiangen Hao, and Zhongsheng Hou
(Beijing Jiaotong University, China)

The differences, similarities and insights of three typical data-driven control algorithms, model free adaptive control (MFAC), iterative feedback tuning (IFT) and virtual reference feedback tuning (VRFT), are briefly discussed, and these differences, similarities and insights are certified through a series of experiments on the three-tank water system in our university lab.
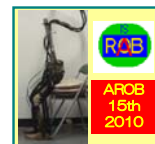
OS11-4 Adaptive identification and prediction control for time delay nonlinear systems based on neural networks

Jing Na and Xuemei Ren
(Beijing Institute of Technology, China)

This paper presents the identification, prediction and control design for nonlinear strict-feedback systems with an input time-delay. The system is firstly transformed into a normal form by defining new state variables. A dynamical identification with a neural network (NN) is proposed to estimate the system states. The predictive NN
weights are obtained without iterative calculations and utilized in constructing the adaptive predictor. Feedback control design using the predictive states is finally studied. Simulations are included to validate the effectiveness of the proposed method.

Session: OS12
Bio-symphony
OS12-1 Onto-biology: clarifying also spatiotemporal structure

Ken Naitoh
(Waseda University, Japan)

A protocol describing the origins and evolutions of life is outlined, based on the seven principles of information, topology, function, diversity, discontinuity, temporal cycle, and metabolic conservativity. This is derived based on the nonequilibrium quantum chemistry on time-dependent electron clouds: the general mobilization of thermo-fluid dynamics, stochastic mechanics, traditional quantum mechanics, chemistry, and mathematics as warp and the biologies related to molecular biology, morphogenesis, bioinformatics, origin of life, and medicine as weft. This also reveals the procedure to generate left-right asymmetric liver and symmetric kidneys and also the standard clock common to stem-cell cycle and circadian clock.
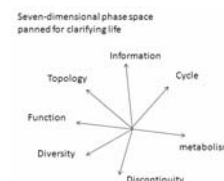
OS12-2 Morphogenetic-cycle model: Clarifying several stages of embryo, brain, lung, and heart

A. Suzuki and K. Naitoh
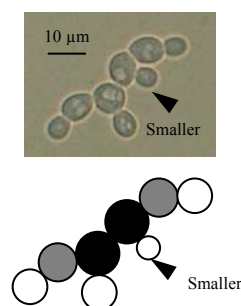(Waseda University, Japan)

Development processes of multi-cellular systems have attracted attention for a long time. The macroscopic model having six categories of molecules shows that the antagonism between the negative controllers and the positive replication factors induces bifurcations in stem and pluripotent cells at rhythmic intervals comprising about 6-7 cell divisions. Our research in the morphogenetic process of human beings shows that this cycle of 6-7 cell divisions, i.e., branching time between periodic bifurcation events, corresponds to the emergence timings of early developing stage, the nervous system, the respiratory system, and the circulatory system.
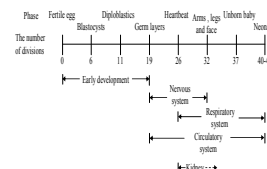
OS12-3 Inner-asymmetry and outer-symmetry underlying life

K. Ogata and K. Naitoh
(Waseda University, Japan)

Fusion of symmetry and asymmetry can be observed in biological molecules and cells. For example, the frequencies of purines and pyrimidines in double-strand DNA in a symmetric ratio of 1:1, while the asymmetric density ratios of purines and pyrimidines in RNA are between 1:1 and approximately 2:3.Size ratios of cells are also in the symbiotic fusion of symmetry and asymmetry. The cyto-fluid dynamic theory and onto-biology reported previously (Naitoh, 2001 & 2008) clarify the physics on the inevitability of symmetry and asymmetry underlying life. An important point is relatively inner cells among a colony divide into asymmetric ones, while outer cells on the colony surface proliferate symmetrically with an identical size. In this report, we examined the concept of inner-asymmetry and outer-symmetry by experiments.

OS12-4 Entrainment of a circadian clock in vitro

Hiroshi Ito[1], Takuya Yoshida[2], Yoriko Murayama[2], Masato Nakajima[2], and Takao Kondo[2]
([1]Ochanomizu University, Japan)
([2]Nagoya University, Japan)

Circadian rhythms are the physiological oscillations with about 24 h periods that have period stability under various circumstances. While gene regulatory feedback loop has been proposed for the model of the origin of the circadian oscillation, my colleagues and I had proposed an alternative model. The cyanobacterial circadian clock can be reconstituted in vitro only by mixing the three clock proteins, KaiA, KaiB, and KaiC, with ATP. Namely, the ratio of phosphorylated KaiC oscillates every 24 h in the mixture. This simple biochemical reaction shows self-sustained oscillation like Belosov Zhabotinsky reaction. Thus, KaiC phosphorylation rhythm can be core oscillator producing cyanobacterial circadian clock. In this paper, I will discuss synchronization of the "in vitro clock" between KaiC molecules and entrainment by temperature cycles.
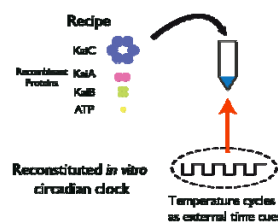
OS12-5 Delay, noise and resonance: Human balancing and temporal non-locality

Toru Ohira
(Sony Computer Science Labs. Inc., Japan)

We would like to present here a rather peculiar observation of effect during human stick balancing at his fingertip. It is observed that the balancing time improves when the subject moves objects with the other hand as shown in the figure. This is particularly so with many subject with medium skilled stick balancers. Based on this example, we would like to consider how this seemingly simple task is composed of intricate mixtures of feedback delay, fluctuations, and predictions. We will present some simple models of dynamics in which these factors lead to complex behaviors. It is inferred, from these examples, that the concept of "non-locality" could possibly play an important role in characterizing biological and physiological systems.

Session: OS13
Intelligent systems
OS13-1 Emotion inspired mechanism in the intelligent system

JeongYon Shim
(Kangnam University, Korea)

In recent years, the researches on the emotion have started in the engineering part as the human friendly Intelligent systems have been developed. The emotion plays a very important role of memorizing, recalling, thought processing and Decision making in the human brain. For developing more intelligent system, more sophisticated system including the emotional function should be designed. Accordingly , in this paper Emotion inspired Mechanism was proposed. We defined an Emotional factor which quantifies Emotional states and Energy. Using this Emotional factor, emotional associative memory and its managing mechanism was designed and tested.
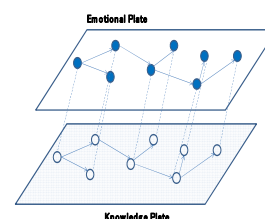
OS13-2 Object recognition algorithm using vocabulary tree and pre-matching array

Ho-Yong Seo and Ju-Jang Lee
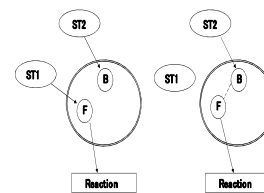(Korea Advanced Institute of Science and Technology (KAIST), Korea)

Vocabulary Tree algorithm builds a tree structure by performing the off-line learning method using the large number of training image datasets. After constructing, we can retrieve a query image class very quickly by searching the tree structure. Because of the great improvement for computation time reduction, this algorithm comes into the spotlight recently. In this paper, we suggest a method which improves the classification accuracy via searching our tree with multiple times per one test data. The information which given by pre-matching array determines how the tree is visited. Taking our new algorithm, we can reduce miss-classification rate considerably. On the other hand, losses from computation time and memory allocation are negligible.

OS13-3 Memory association and reaction by conditioning

JeongYon Shim
(Kangnam University, Korea)

In early days, Pavlov discovered the fact that conditioning is made by associative learning in his experiments. The recent Neuro Scientist is supporting his theory with Hypothesis that conditioning mediated by the transmission of information in a small almond shaped area, amygdala. It means that conditioning has much effects on the memory reconfiguration and reaction. For more flexible memory design, the concept of conditioning should be included in the knowledge processing system. In this paper, adopting the concept of conditioning, the mechanism of memory association and reaction was proposed. We applied this system to the Virtual Memory and tested with sample data.

OS13-4 Application of neuro-fuzzy PID controller for post chlorine process

Ho-Hyun Lee[1], Chang-Mok Oh[1], Ju-Jang Lee[1], An-Kyu Lee[2], and Dong-Hoon Lee[2]
([1]Korea Advanced Institute of Science and Technology(KAIST), Korea)
([2]Korea Water Resources Corporation, Korea)

Drinking water can be contaminated by microorganisms which can be re-grown in case of not controlling chlorine concentration well in water treatment plant (hereafter WTP). It can be harmful to public health. Most WTPs have used chlorine as disinfectant. It can be used in pre-chlorination, post-chlorination and re-chlorination. In post-chlorination, it is injected after filtration to keep residual chlorine from being contaminated by microorganisms. Post-chlorine process without re-chlorination is directly serviced to citizens. If the concentration is low, drinking water can be contaminated by bacterial re-growth. On the other hand, the high chlorine can lead to customer complaints about taste and odor. Therefore, it is necessary to predict chlorine decay in clear well to maintain desired chlorine levels. In this paper, it is shown that artificial neuro-fuzzy inference system could be used to model chlorine decay in the process and control residual chlorine better than present controller, in which cascade control is considered to compensate the error in the output.
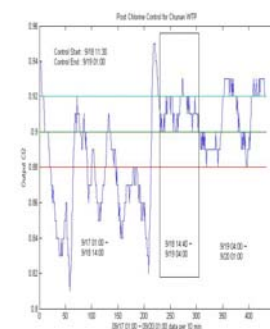
Session: OS14
Intelligent robots
OS14-1 Behavior based autonomous navigation system for mobile robots

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

Mechanized and roobotized solutions properly sized with suitably modularized structure and well adapted to local conditions of minefields can greatly improve the safety of personnel as well as efficiency and flexibility. Such flexible machines with some level of decision-making capabilities can speed the clearance process when used in combination with other mine detection. A population of lightweight, robust, adaptable, low-cost, and multi operational mode robots that can integrate high speed mine detection and deactivation system is a clear answer to the problem of demining vast condemned areas. They will work together under close supervision of a monitoring station. The robot has three levels of control: Local scan, navigation (GPS and odometry) and collective behavior through radio coordination. Ground pressure of the developed robot is low enough not to make the mine explode. Pemex-B has to scan a large area, and assure the coverage of every part of it.

OS14-2 The optical FBG contact force measurement system for the haptic feedback of minimal invasive surgery robot

Ho-seok Song, Jung-wook Suh, Young-ik Yoo, and Jung-ju Lee
(Korea Advanced Institute of Science and Technology(KAIST), Korea)

Haptic feedback plays a very important role in medical surgery, but it is difficult to provide haptic information in MIS (minimally invasive surgery) or MIRS (minimally invasive robotic surgery). Recently, many sensors are being developed for MIS or MIRS, but they have some obstacles such as size limit and sterilizability in their application to real situations of medical surgery. Optical fiber sensors are one of the most suitable sensors for this environment. Especially, optical fiber Bragg grating (FBG) sensor is not influenced by intensity of light source. In this paper, we would like to present the initial results of study on the application of the FBG sensor to measure reflected forces in MIRS environments and then suggest the possibility of successful application to the MIRS systems.
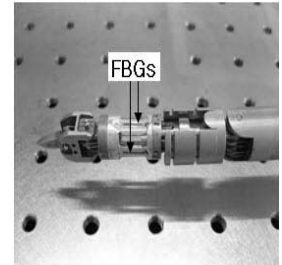
OS14-3 Impedance model force control using a neural network-based effective stiffness estimator

F. Nagata[1], T. Mizobuchi[1], T. Hase[2], Z. Haga[2], K. Watanabe[3], and M. K. Habib[4]
([1]Tokyo University of Science, Yamaguchi, Japan)
([2]R&D Center, Meiho Co. Ltd., Japan)
([3]Okayama University, Japan)
([4]American University in Cairo, Egypt)

We propose a desktop NC machine tool with compliance control capability to automatically cope with the finishing process of LED lens molds. The NC machine tool has an ability to control the polishing force acting between an abrasive tool and a workpiece. The force control method is called impedance model force control. The most effective gain is the desired damping of the impedance model. Ideally, the desired damping is tuned by using the effective stiffness of the NC machine tool. However, one of the actual problems is that the effective stiffness has undesirable nonlinearity. The nonlinearity gives bad influences to the force control stability. In this paper, a fine tuning method of the desired damping is considered by using neural networks. The neural networks acquire the nonlinearity of the effective stiffness.

OS14-4 Fuzzy sliding mode control for under-actuated system with mismatched uncertainties

Seung-Yong Shin and Ju-Jang Lee
(Korea Advanced Institute of Science and Technology (KAIST), Korea)

This paper presents a robust fuzzy sliding mode controller. The structure of sliding surface is designed as follows. First, decouple the entire system into second-order systems such that each subsystem has a separate control target expressed in terms of a sliding surface. Second, from sliding surface of subsystems, organize the main sliding surface system. Third, generates a control input for main sliding surface to make whole subsystems moving toward their sliding surface. A fuzzy controller is used for obtaining smooth boundary layer of sliding surface. Finally presented fuzzy sliding mode controller is used to control under-actuated nonlinear system and confirms the validity of the proposed approach and its robustness for uncertainties.
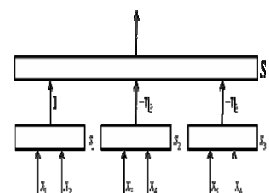
Session: OS15
Artificial intelligent
OS15-1 Fast shape matching and retrieval based on approximate dynamic space warping

Naif Alajlan
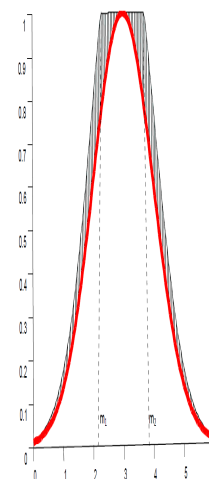(King Saud University, Saudi Arabia)

Dynamic space warping (DSW) has emerged as a very effective tool for matching shapes. However, a central computational difficulty associated with DSW arises when a boundary's starting point (or rotation angle) is unknown. In this paper, the HopDSW algorithm is proposed to speed up the starting point computation. Rather than performing an exhaustive search for the correct starting point as in classical approaches, the proposed algorithm operates in a coarse-to-fine manner. The coarse search is global and uses a hopping step to exclude points from the search. Then, the search is refined in the neighborhood of the solution of the coarse search. A criterion that governs selecting the hopping step parameter is given, which reduces the number of starting point computations by an order. For shape representation, triangle area signature (TAS) is computed from triangles formed by the boundary points. Experimental results on the MPEG-7 CE-1 database of 1400 shapes show that the proposed algorithm returns the solution of the exhaustive search with a high degree of accuracy and a considerable reduction in the number of computations.
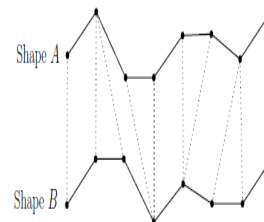
OS15-2 Prediction model of permeability from well logs using type-2 fuzzy logic systems

Sunday Olusanya Olatunji[1], Ali Selamat [1], and Abdul Azeez Abdul Raheem[2]
([1]University of Technology Malaysia, Malaysia)
([2]King Fahd University of Petroleum and Mineral, Saudi Arabia)

In this paper, the viability and capability of using Type-2 Fuzzy Logic Systems as a novel approach for predicting permeability from Well Logs has been investigated and implemented. Type-2 fuzzy logic is powerful in handling uncertainties, including uncertainties in measurements and data used to calibrate the parameters. In the formulation used, the value of a membership function corresponding to a particular permeability value is no longer a crisp value; rather, it is associated with a range of values that can be characterized by a function that reflects the level of uncertainty. In this way, the model will be able to adequately account for all forms of uncertainties associated with predicting permeability from well log data, where uncertainties are very high and the need for stable results are highly desirable. Comparative studies have been carried out to compare the performance of the proposed framework with those earlier used methods, using real industrial reservoir data. Empirical results from simulation show that Type-2 FLS approach outperforms others in general and particularly in the area of stability and ability to handle data in uncertain situations, which are the common characteristics of well logs data. Another unique advantage of the newly proposed model is its ability to generate, in addition to the normal target forecast, prediction intervals as its by-products without extra computational cost.

OS15-3 Real-time iris detection

Mohamed Rizon[1], Chai Tong Yuen[2] and Ali S. AlMejrad[1]
([1]King Saud University, Saudi Arabia)
([2]Universiti Tunku Abdul Rahman, Malaysia)

A real-time algorithm to automatically detect human face and irises from color images has been developed. Haar cascade-based algorithm has been applied for simple and fast face detection. The face image is then converted into grayscale image. Three types of image processing techniques have been tested respectively to study its effect on the performance of iris detection algorithm. Then, iris candidates are extracted from the valley of the face region. The iris candidates are paired up and the cost of each possible pairing is computed by a combination of mathematical models. The pairing with the lowest cost is considered as iris. The algorithm has been tested by quality images from Logitech camera and noisy images from Voxx CCD camera. The proposed algorithm has achieved a success rate of 83.60% for iris detection in an open office environment.

OS15-4 Comparison of human emotion classification through different set of EEG channels

M. Murugappan[1], Mohamed Rizon[2], R. Nagarajan[1], Ali S. AlMejrad[2], and S. Yaacob[1]
([1]Universiti Malaysia Perlis, Malaysia)
([2]King Saud University, Saudi Arabia)

Assessing human emotional state through EEG is one of key research area in developing intelligent man-machine interfaces. We have compared the efficacy of original set of channels (64 channels) with reduced set of channels (24 channels), which is proposed by the earlier work based on localization of brain region for assessing emotions. In our work, "db4" wavelet function is used to derive a new set of statistical features based on frequency band power for classifying the emotions. In this work, KNN outperforms LDA by offering the average classification accuracy of 79.783 % for 24 channels and 82.898 % for 62 channels. Finally we present the average classification accuracy and individual classification accuracy of two different classifiers for justifying the performance of our emotion recognition system.

→Feature Extraction
↓
Emotion Classification

OS15-5 Design of intelligent system for speech monitoring and treatment of low and excessive vocal intensity

Ali S. AlMejrad
(King Saud University, Saudi Arabia)

Number of people and especially children suffer from speech problems such as too low or often excessive vocal intensity which is one of the behavioral problems that may be encountered in people with intellectual disability. Also it may happen due to the aggressive behaviors which produce disturbance which is rejected by others. The persons with this behavior may often be unaware of their problems. To limit these negative outcomes an intelligent system has been designed for monitoring, to provide a patient with information about speech intensity outside the clinic and for controlling of the treatment of excessive and low vocal intensity without the need to the continuous therapeutic follow-up in speech pathology clinic. The use of the intelligent system proves to be an effective due to the many features of this system. The technical design considerations, the system features and system evaluation will be discussed.
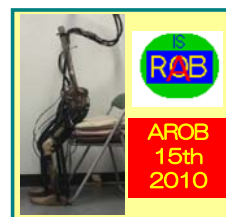
OS15-6 Modified relevance feedback for content based image retrieval using support vector machine

Ali Selamat and Pei-Geok Lim
(Universiti Teknologi Malaysia, Malaysia)

The rapid growth of the computer technologies and the advent of World Wide Web have increased the amount and the complexity of multimedia information. Content-based image retrieval (CBIR) system has been developed as an efficient image retrieval tool whereby user can provide their query to the system to allow it to retrieve the user's desired image from image database. However, the traditional relevance feedback of CBIR has some limitations that decrease the performance of the CBIR system that are the imbalance of training set problem, classification problem, limited information from user problem, and insufficient training set problem. Therefore, in this paper we propose a modified relevant feedback method to support the user query and user profiles based on the weight ranking of the image retrieved. The Support Vector Machine (SVM) has been used to support the learning process in order to reduce the semantic gap between user and the CBIR system. From the experiments, the proposed learning method has enabled the users to improve their search results based on the precision and accuracy.
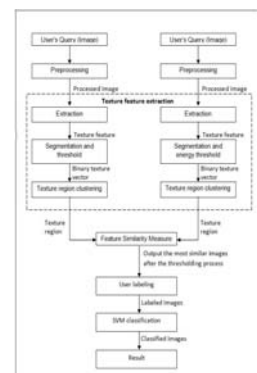
Session: OS16
Embracing complexity in natural intelligence
OS16-1 Evaluations for an immunity-based anomaly detection with dynamic updating of profiles

Takeshi Okamoto[1] and Yoshiteru Ishida[2]
([1]Kanagawa Institute of Technology, Japan)
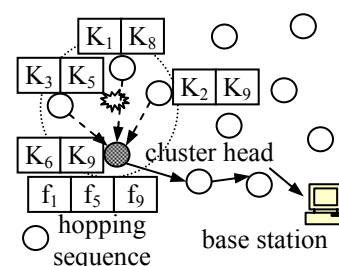([2]Toyohashi University of Technology, Japan)

This paper presents evaluations for an immunity-based anomaly detection with dynamic updating of profiles. Our experiments showed that the updating of both self and nonself profiles markedly decreased both the false alarm rate and the missed alarm rate in masquerader detection. In computer worm detection, all the random-scanning worms and simulated metaserver worm examined were detected. The detection accuracy of the simulated passive worm was markedly improved. The figure shows ROC curves of internal and external masquerader detection for the method without updating any profiles, the method with updating only the self profiles, with updating only the nonself profiles, and with updating both profiles.
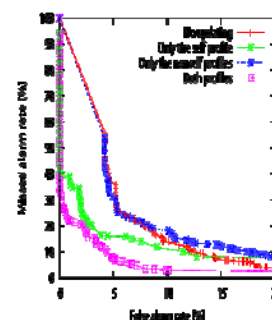
OS16-2 A secure routing scheme for mobile wireless sensor networks

Yuji Watanabe and Tong Tran Nhat Linh
(Nagoya City University, Japan)

Frequency-hopping (FH) is a well-known spread-spectrum method of transmitting radio signals by hopping frequency channels along a predefined hopping sequence. Although FH is resistant to jamming by external malicious nodes which have no knowledge of the sequence, it is of no effect against attacks by internal compromised nodes which know the sequence. In this paper, we propose a secure creation scheme of the hopping sequence based on the idea of a statistical en-route filtering (SEF). SEF exploits collective decision-making by multiple detecting nodes in the dense deployment of large mobile wireless sensor networks. We evaluate our scheme thorough simulations.

## OS16-3 Prediction of space weather by adaptive information processing

Masahiro Tokumitsu[1], Yoshiteru Ishida[1], Shinichi Watari[2], and Kentarou Kitamura[3]
([1]Toyohashi University of Technology, Japan)
([2]National Institute of Information and Communications Technology, Japan)
([3]Tokuyama College of Technology, Japan)

Space weather can be predicted with data from satellites. For example, condition of high-energy electron, which is vital in providing warning information for spacecraft operations. We investigate an adaptive predictor based on intelligent information processing. Adaptive and learning performances have been focused in the investigation. The predictor can forecast the conditions of high-energy electrons. The predictor was trained with the data set of ten years from 1998 to 2006. Our model succeeded in forecasting the high-energy electron flux 24 hours ahead.
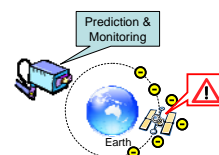
OS16-4 An adaptive sensor network for home intrusion detection by human behavior profiling

Masahiro Tokumitsu, Masashi Murakami, and Yoshiteru Ishida
(Toyohashi University of Technology, Japan)

An adaptive sensor network for home intrusion detection has been proposed. The sensor network combines a profile-based anomaly detection and an adaptive information processing based on Hidden Markov Models (HMM) that allows the system to train and tune the profiles automatically. The trade-off between miss-alarm and false-alarm has been experimentally studied. Several t;.¥¥¥¥¥ypes of hypothetical intrusion have been tested and successfully detected. However, hypothetical anomalies supposing a fall down of a resident due to sudden illness have been difficult to detect.
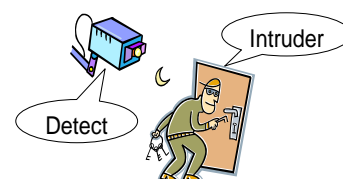
OS16-5 A network visualization of stable matching in stable marriage problem

Yoshihisa Morizumi, Tatsuya Hayashi, and Yoshiteru Ishida
(Toyohashi University of Technology, Japan)

The Stable Marriage Problem (SMP) seeks matching between n women and n men satisfying a stability, which could otherwise lead to divorce and extramarital affairs. We have introduced a network consisting of nodes representing matching and links between nodes which attains each other by exchanging a partner between two pairs. For visualization, the network is depicted with nodes layouted involving several coordinates such as either women's or men's or both satisfactions. With the network visualization, regularity and symmetry can be made conspicuous in specific instances of SMP such as Latin SMP.
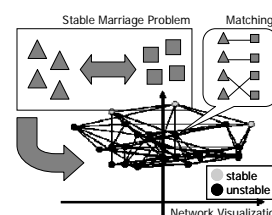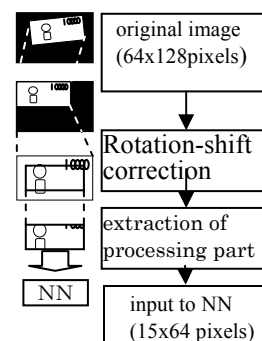
Session: OS17
Intelligent classification
OS17-1 Intelligent classification of bills by neural networks

Sigeru Omatu, Michifumi Yoshioka, and Hidekazu Yanagimoto
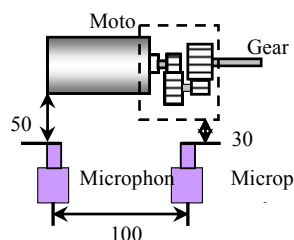(Osaka Prefecture University, Japan)

For the pattern classification problems the neuro-pattern recognition which is the pattern recognition based on the neural network approach has been paid an attention since it can classify various patterns like human beings. In this paper, we adopt the learning vector quantization (LVQ) method to classify the various money. The reasons to use the LVQ are that it can process the unsupervised classification and treat many input data with small computational burdens. We will construct the LVQ network to classify the Italian Liras. Compared with a conventional pattern matching technique, which has been adopted as a classification method, the proposed method has shown excellent classification results.

original image
(64x128pixels)

Rotation-shift correction

extraction of processing part

input to NN
(15x64 pixels)

NN

OS17-2 Signal separation by independent component analysis

Sigeru Omatu, Michifumi Yoshioka, and Hidekazu Yanagimoto
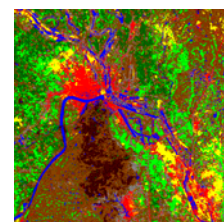(Osaka Prefecture University, Japan)

In this paper, a method of separating the acoustic signals of motors and gears of mechanical devices by using the independent component analysis (ICA) with band-pass filters is proposed. The frequency distribution of a recorded acoustic signal of the operating mechanical device can be divided into three fields, the low-frequency field, which corresponds to the frequency characteristics of the gear, the medium-frequency field, which is mixed with the frequency characteristics of the gear and the motor, and the high-frequency field, which corresponds to the frequency characteristics of the motor. Since only the medium-frequency components are the mixture of acoustic signals of gears and motors, the ICA with band-pass filters is expected to separate the acoustic signals of motors and gears more accurately than the conventional ICA.

Moto
Gear
50
30
Microphon
Microp
100

OS17-3 The land cover estimation with ALOS satellite image using neural-network

Y. Tsuchida, S. Omatu, and M. Yoshioka
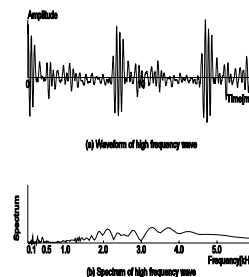(Osaka Prefecture University, Japan)

On May 12th 2008, large earthquake occurred in Sichuan, China. We try to analyze this disaster damage by using satellite image from ALOS, Japanese satellite. At first, land cover classification was operated by the image captured on AVNIR-2.The AVNIR-2 image can't monitor frequently because of the cloud and solar irradiation, so near earthquake center area was covered by clouds. The goal of this paper is to land cover classify using PALSAR image. The PALSAR can be got 350km wide area independent on weather. The PALSAR is single band sensor, and the inputs consist of many pixels by using nearest pixel values. The supervisor signal is estimated classes by AVNIR-2.

OS17-4 The analysis of Japanese voice sound by using real-time spectral analysis

Hideto Nakatsuji and Sigeru Omatu
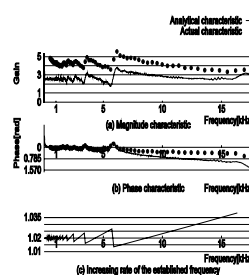(Osaka Prefecture University, Japan)

Five vowels in Japanese are /a/, /i/, /u/, /e/ and /o/. Vowel consists of fundamental, harmonics and high frequency waves. In /i/ and /e/, one or more high frequency waves necessarily exist, and these wave decide each vowel. In /a/, /u/ and /o/, the high frequency wave does not necessarily exist. The high frequency waves are audible as each vowel. By using this new analytic method, we have analyzed the high frequency waves of /a/, /i/, /e/ and /o/, and the spectrum of fundamental, harmonics an high frequency wave have appeared. The spectrum of fundamental and harmonics exist, and it turns out that it becomes the same characteristics of the original voice, and the high frequency waves are audible as each vowel. It seems to be fractal.

OS17-5 Selection of parameters in design of real-time spectral analysis

Hideto Nakatsuji and Sigeru Omatu
(Osaka Prefecture University, Japan)

This analytic method uses the inner products of multiple-periods sine wave and cosine wave with a signal, and by using one input data, the spectrum is obtained by updating. We call these waves "cutting out wave" and the frequency of these waves "established frequency", and multiple-periods "number of period". We show that the signal is decomposed into each wave and these waves are decomposition waves. A wave made by adding all decomposition waves is a reconstruction waves and approximate accuracy to original waveform depends on the magnitude characteristic and the phase characteristic, and these characteristics depend on three parameters. These parameters are sampling frequency, number of period and increasing rate of established frequency. This study shows how to decide these parameters.

Session: OS18
Intelligent signal processing
OS18-1 Face image make up system by using ε-filter

M. Yoshioka, S. Omatu, and H. Yanagimoto
(Osaka Prefecture University, Japan)

Recently, it becomes easy for consumers to make up face images in photographs for special events through the spread of digital cameras and photo editing tools. However, it is still difficult to make up spots and wrinkles naturally. In order to solve these problems, many artificial make up systems have been proposed. One of these methods using ε filter has good performance. However, this method requires many parameter tunings for achieving good performance. In order to improve these points, we have developed auto parameter tuning system by using templates. As the result of simulations, it is proved that the proposed method has good performance with auto tuned parameters.

OS18-2 Image segmentation using probability density estimation

K.Imaguma, M. Yoshioka, S. Omatu, and H.Yanagimoto
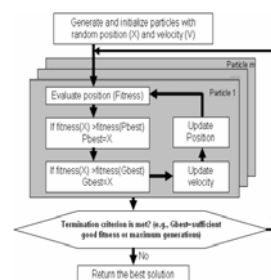(Osaka Prefecture University, Japan)

The image recognition is an important technology that analyzes the content from the image data. Human unconsciously does this process, but it is difficult for the computer. To improve the accuracy of the image recognition, an optimal region segmentation technique is needed. In this paper, we propose a new region segmentation technique. To reflect human sensory perception, we use the HSI color space. We approximate the probability density function by using the HSI histogram and the kernel density estimation for clustering. At last, We superimpose those results and obtain the final output. As the result of the simulation, the effectiveness of our proposed method is confirmed.

OS18-3 Particle swarm optimization with a modified sigmoid function for gene selection from gene expression data

Mohd Saberi Mohamad[1], Sigeru Omatu[1], Safaai Deris[2], and Michifumi Yoshioka[1]
([1]Osaka Prefecture University, Japan)
([2]Universiti Teknologi Malaysia, Malaysia)

In order to select a small subset of informative genes from gene expression data for cancer classification, recently, many researchers are analyzing gene expression data using various computational intelligence methods. However, due to the small number of samples compared to the huge number of genes (high-dimension), irrelevant genes, and noisy genes, many of the computational methods face difficulties to select the small subset. Thus, we propose binary particle swarm optimization to select a small subset of informative genes that is relevant for the classification. By performing experiments on several benchmark gene expression data sets, we have found that the performance of the proposed method is superior to the conventional version of binary particle swarm optimization.

OS18-4 Selecting informative gene for cancer classification by using particle swarm optimization

Mohd Saberi Mohamad[1], Sigeru Omatu[1], Safaai Deris[2], and Michifumi Yoshioka[1]
([1]Osaka Prefecture University, Japan)
([2]Universiti Teknologi Malaysia, Malaysia)

Microarrays technology offers the ability to measure the expression levels of thousands of genes simultaneously in biological organisms. Microarray data are expected to be of significant help in the development of efficient cancer diagnoses and classification platforms. The main problem that needs to be addressed is the selection of a small subset of genes from the thousands of genes in the data that contributes to a cancer disease. Therefore, this article proposes particle swarm optimization (PSO) with the constraint of particle's velocities to select a near-optimal (small) subset of informative genes that is relevant for cancer classification. The performance of the proposed method was evaluated by several well-known microarray data sets and obtained encouraging results as compared with the standard version of binary PSO.

OS18-5 Radon transform for face recognition

Jamal Ahmad Dargham[1], Ali Chekima[1], Ervin Moung[1], and Sigeru Omatu[2]
([1]University Malaysia Sabah, Malaysia)
([2] Osaka Prefecture University, Japan)

Face recognition is an important biometric because of its potential applications in many fields, such as access control, surveillance, and human-computer interface. In this paper, an investigation of the effect of the step size for both the angle and vector of the Radon transform on the performance of a face recognition system based on Principal Component Analysis (PCA) and Euclidean distance is carried out. It was found out the change of either the vector or the angle step size affects the performance of the system. However, the best equal error rate is achieved when the step size for both angle and vector is set to 1.
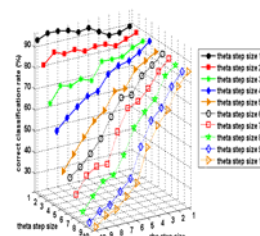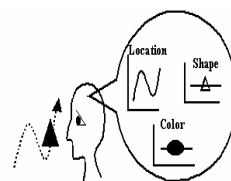

Session: OS19
Intuitive human-system interaction
OS19-1 Towards natural intelligence modeling as a formal system based on mental image directed semantic theory (Part 1)

Masao Yokota[1], Haosheng Li[1], Hailan Quan[1], Kaoru Sugita[1], and Tetsushi Oka[2]
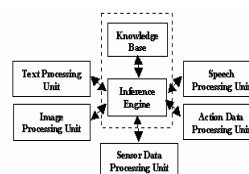([1]Fukuoka Institute of Technology, Japan)
([2]Nihon University, Japan)

Yokota,M. has proposed his original semantic theory "Mental Image Directed Semantic Theory (MIDST)" and has been challenging to model natural intelligence as a formal system. This paper presents the fundamentals of the formal system and how to formalize mental operations and natural concepts within it.

OS19-2 Towards natural intelligence modeling as a formal system based on mental image directed semantic theory (Part 2)

Masao Yokota[1], Taiki Tometsuka[1], Rong Zhao[1], Kaoru Sugita[1], and Tetsushi Oka[2]
([1]Fukuoka Institute of Technology, Japan)
([2]Nihon University, Japan)

Yokota, M. has proposed his original semantic theory "Mental Image Directed Semantic Theory (MIDST)" and has been challenging to model natural intelligence as a formal system. This paper presents a brief sketch of the attempt on systematic representation and computation of subjective spatiotemporal knowledge based on certain hypotheses of mental image in human.

OS19-3 Commanding a humanoid to move objects in a multimodal language

T. Oka[1], K. Sugita[2], and M. Yokota[2]
([1]Nihon University, Japan)
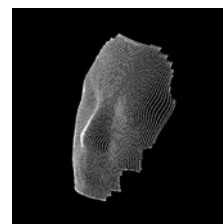([2]Fukuoka Institute of Technology, Japan)

This paper describes a study on a humanoid robot that moves objects on requests of its users. The robot understands commands in a multimodal language which combines spoken messages and two types of hand gestures. All of the ten novice users directed the robot using gestures when they were asked to spontaneously direct the robot to move objects after learning the language for a short period of time. The success rate of multimodal commands was over 90 % and the users thought that gestures were more preferable than and as easy as verbal phrases to inform the robot action parameters such as direction, angle, step, width, and height. The results of the study show that the language is fairly easy for non-experts to learn and can be more effective for directing humanoids to move objects by sophisticating the language and our gesture detector.

OS19-4 Face detection and face authentication based on 3D face image

Hiroya Kamitomo and Cunwei Lu
(Fukuoka Institute of Technology, Japan)

The technique of the face authentication is needed which can be used also by cases, such as the make-up face or illumination change. The past technique based on 2-D color image shows low authentication rate, in the case of a photography environmental variation or makeup. We propose a technique of the face authentication based on 3-D face image. In order to solve the above problem, we use the 3D image measurement technique to acquire 3D face image, and using the 3D face image to perform face recognition. In this paper, the 3-D face image measurements are explained. First and, the application to the direction detection of the 3-D face is explained after that. Finally, the application to the 3-D face authentication for security or an access control is explained.

OS19-5 Stripes extraction technique of projection pattern for 3D shape measurement

Ke Sun and Cunwei Lu
(Fukuoka Institute of Technology, Japan)

3D Shape Measurement has been in great anticipation of practicability with the popularization of digital camera and projector recently, which is premised on the situation that it must get reflex pattern image with essential number of slit and intensity distribution. But as for the object without specification on the surface reflectance and distribution of surface color, some problems would happen. So we propose a FFT (Fast Fourier transform) based analysis technique on one initial observation image in my study. Furthermore, we strove for 3D image detection by using one initial observation image by single pattern projection through merging the technique of monochrome projection-color analysis (MPCA) with the optimal intensity modulated projection (OIMP) together.

OS19-6 A software framework for universal multimedia access

Yusaku Maeda[1], Kaoru Sugita[1], Tetsushi Oka[2], and Masao Yokota[1]
([2]Nihon University, Japan)
([1]Fukuoka institute of technology, Japan)

Recently, immense multimedia information has come to be exchanged on the Internet, where 3DCG, video, image, sound, and text are involved in various circumstances with terminal devices, networks and users different in their competences and performances. This fact may easily lead to 'digital divide' so called unless any special support is given to the weaker. We have already proposed a new concept of 'universal multimedia access' intended to narrow the digital divide. In this paper, we discuss a software framework for our new concept and its implementation.
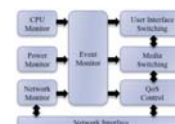
Session: OS20
Special environment localization and navigation
OS20-1 A robust control of mobile inverted pendulum using single accelerometer

Hyunuk Ha, Sungmin Ryu, and Jangmyung Lee
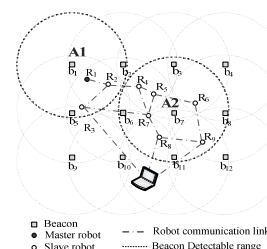(Pusan National University, Korea)

This paper proposed a new single accelerometer filtering algorithm of mobile inverted pendulum to simplify the control system to lower the price. Low pass filter is one of the good sensors to reducing the variation of an accelerometer, but it has time delay. This time delay disturbs real-time mobile inverted pendulum control. Like this, other various algorithms are used for this system, but each one has its own short-coming. So this paper proposes median filter and EKF to reducing fluctuation of accelerometer. Median filter is used to image processing to reject impulse elements like salt and pepper noise. And EKF is one of the adaptive estimator to robust the signal. As the major performance evaluation parameter for the accelerometer, the high-frequency to low frequency ratio from FFT (Fast Fourier transform) and PSD(Power Spectral Density) are used. Effectiveness of the proposed algorithms has been verified through the real experiments and the results are demonstrated.

OS20-2 Localization of multiple robots in a wide workspace

JaeHyun Park, WonSeok Jang, and JangMyung Lee
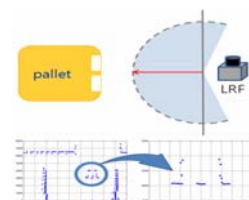(Pusan National University, Korea)

This paper proposes a localization method for the multiple robots navigation in a multi-block workspace. Indoor localization schemes using ultrasonic sensors have been widely studied due to its cheap price and high accuracy. However, ultrasonic sensors have some shortages of short transmission range and interferences with other ultrasonic signals. In order to use multiple robots in wide workspace concurrently, it is necessary to resolve the interference problem among the multiple robots. This paper introduces an indoor localization system for concurrent multiple robots in a wide service area which is divided into multi-block for the reliable sensor operation. A beacon scheduling algorithm is developed to avoid the signal interferences and to achieve efficient localization with high accuracy and short sampling time.

OS20-3 Pallet recognition and driving method for pallet-engaging of unmanned autonomous forklift

JungJe Park, Jungmin Kim, Kyunghoon Jung, and Sungshin Kim
(Pusan National University, Korea)

This paper present error minimization using angular histogram for engaging pallet of forklift AGV(autonomous guided vehicle). Existing pallet recognition methods using LRF(laser range finder) have used various linearization methods for error minimization of LRF. However, to apply forklift AGV which need near real-time control, those methods need large amount of operation. Hence we studied error minimization of LRF using angular histogram to search suited linearization for forklift AGV. For experiment, we attach LRF on forklift AGV that we made ourselves, and recognize pallet. In result, we verify that pallet's angle have max. $1.93°$ when distance between forklift AGV and pallet is $2m$.

OS20-4 Monitoring the level in a large structure localization method

Jong-Min Kim and Hee-Je Kim
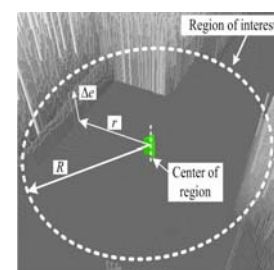(Pusan National University, Korea)

In many manufacturing processes and robotic applications, localizing geometric structure is very important and useful. A large structure localization on the sea deals with uncertain sensory information as well as uncertain data association. In this paper, we propose a new method of a large structure localization. This method is mainly based on using inexpensive PC included a LD, a PD, and a real time data transmission (RTDT) system to verify the precise level measurement.
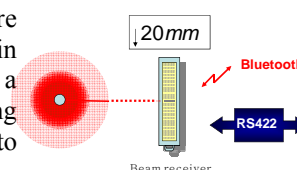
OS20-5 Performance improvement of outdoor localization using elevation moment of inertia

Tae-Bum Kwon, Jae-Bok Song, and Yong-Ju Lee
(Korea University, Korea)

This research proposes a novel approach to outdoor localization based on map matching. The main map for localization is an elevation map which is a grid map with elevation information on each cell. This research presents an elevation moment of inertia (EMOI) which represents the distribution of elevation around a robot in the elevation map. A robot continues to build a local elevation map using a laser sensor and calculates its EMOI. This EMOI is then compared with the EMOIs for all cells of the given reference elevation map to find a robot pose with respect to the reference map. The experimental results of particle filter-based localization show that the proposed EMOI-based approach can be successfully used for outdoor localization with an elevation map.

OS20-6 Collision detection of robot manipulator in cryogenic environments

Seung-Heui Lee, Ki-Ho Yu, and Min Cheol Lee
(Pusan National University, Korea)

This paper studies a method how a robot can detect collision between the canister on the end-effector of a robot and a pin of a slot in a rack of the vessel during operating the manipulator of an automatic cryogenic storing vessel which can improve a ratio of survival of a cord blood. The cord blood is kept in liquid nitrogen in the cryogenic vessel. The integrated robot control system for storing a cord blood is developed, which is based on mechanism of SCARA robot. The robot manipulator consists of four axes. To overcome difficulty in detecting collision between canister and the pin of the slot in cryogenic circumstances around -196°C, a collision detection algorithm for the robot manipulator is proposed. To improve performance of the integrated system, the proposed algorithm for the collision avoidance is applied to the end effecter of the robot manipulator.


[Side view of canister and rack slot pin]
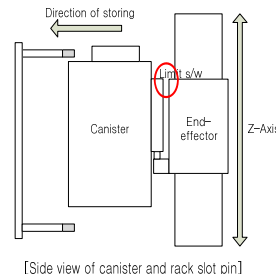
Session: OS21
Molecular computing
OS21-1 P-system communications architectures configuration based on growing SOM

A. Gutiérrez, S. Delgado, and S. Gómez
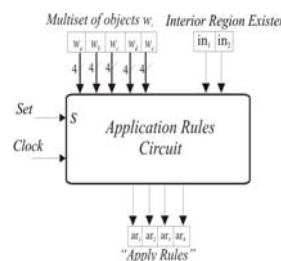(Universidad Politécnica de Madrid, Spain)

The architectures that implement P-Systems over distributed cluster of processors have a major drawback: the distribution of these architectures in a balanced tree of processors that can minimize external communications and maximize the parallelism grade. In a recent paper the feasibility of using SONN with growing capability to help in the selection process of a distribution for a given P-System has been demonstrated, although the nature of two-dimensional patterns used in the study limited the possibility of defining more flexible degrees of communication. In this paper the capacity of GCS model of projecting high-dimensional spaces in bi-dimensional graphs is explored.
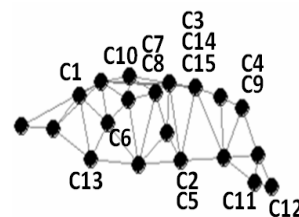
OS21-2 Hardware circuit for the application of evolution rules in a transition P-system.

Víctor Martínez, Santiago Alonso, and Abraham Gutiérrez
(Universidad Politécnica de Madrid, Spain)

P systems or Membrane Computing are a type of systems based on biological membranes. Transition P systems perform computation through transition between two consecutive configurations by applying the evolution rules which are in each region. In fact, the circuit obtained in this article counts the number of times that the active rules are applied. In first place, the initial specifications are defined in order to outline the synthesis of the circuit of active rules application. Later on, the design and synthesis of the circuit will be shown, as well as the operation tests, required to present the experimental results obtained.

OS21-3 Calculating maximal multisets of objects by using RAM as support

Alberto Arteta, Fernando Arroyo, and Angel Goñi
(Universidad Politécnica de Madrid(UPM), Spain)

Within the membrane computing research field, there are many papers about software simulations and a few about hardware implementations. In both cases, algorithms are implemented. These algorithms implement membrane systems in software and hardware that try to take advantages of maximal parallelism. P-systems are parallel and non deterministic systems which simulate membranes behavior when processing information. This paper describes the evolution rules application process and it presents software techniques for calculating maximal multisets on every evolutionary step. These techniques improve the best performance achieved when applying evolution rules over multisets of objects.
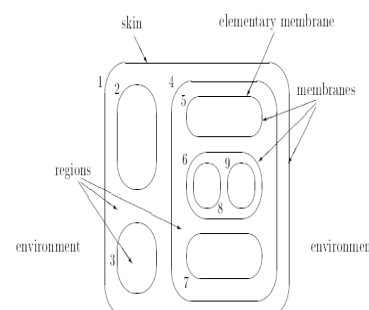
OS21-4 Investigation of the efficient protection from Influenza pandemic using CARMS

Kenji Tsunoda[1], Kyoko Shinya[2], and Yasuhiro Suzuki[1]
([1]Nagoya University, Japan)
([2]Kobe University, Japan)

The new influenza A virus, H1N1-pdm, is spreading out all over the world including Japan. Since almost all the people are non-immunized for this new influenza virus, it spreads all over the world quickly. Currently, we have two options for the disease prevention, i.e. vaccination and antiviral drags. And among them, vaccination is the best way for mass protection. However current system of vaccine production has limitation for production number and preparation time. To understand "the most efficient mass protection", we simulate the influenza spreading by using the Cellular Abstract Rewriting System on Multusets, CARMS.
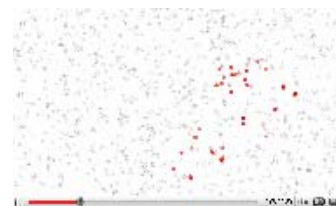
OS21-5 Organization levels in P systems

Marion Oswald
(Hungarian Academy of Sciences, Hungary)

We discuss different (structural) organization forms of a formal model of computation that is abstracted from the structure and functioning of living cells: P systems, introduced in 1998 by Gh. Păun. After a brief review of some of the main classes of P systems, having an underlying tree or graph structure, we present some indications that suggest to use a more general hierarchical structure. We highlight some examples and point out further applications where this broader approach could be useful.

Session: OS22
Brain-like intelligence and biomedical applications
OS22-1 A guess for natural neural activity and a suggestion on the modification of the ANN

Yongguang Zhang[1] and Masanori Sugisaka[2]
([1]Institute of Systems Science, Academia Sinica, China)
([2]Nippon Bunri University, Japan)

Based on the knowledge of brain and neural science, The authors have a guess on the basic brain neural activity, that every stimulation from vision or other sensitive organs forms a micro-lighting in brain. The activity in brain neral organ, in fact, is a successive micro-lighting process. Also, the author suggest to modify the structure of Artificial Neural network(ANN), based on the guess above.

OS22-2 Research on automatic text summary based on latent semantic indexing

Dongmei Ai, Zheng Yuchao, and Zhang Dezheng
(University of Science and Technology Beijing, China)

Automatic abstracting is a common–concerned topic of computational linguistics and information science, the computer system of text summary is considered one of an effective means of dealing with information resources. In this paper, the method of text summary which based on latent semantic indexing was put forward, and the method of using semantic indexing to calculation the sentence similarity is proposed. It improves the sentence similarity calculation and the accuracy of subject delineation , and helps the generated abstracts universally coverage the documents as well as reducing its redundancy . The effectiveness of the method is proved in the experimental results , compared to the traditional VSM-based method of automatic text summary, the quality of generating abstracts was significantly improved.
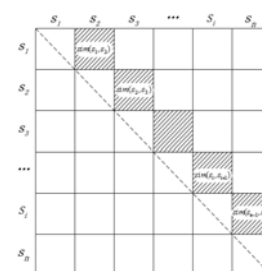
OS22-3 Sensitivity improvement of automatic pulmonary nodules detection in chest X-ray CT images

Satoshi Shimoyama, Noriyasu Homma, Tadashi Ishibashi, and Makoto Yoshizawa
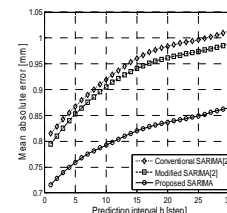(Tohoku University, Japan)

We develop an automatic detection method of non-isolated pulmonary nodules as a part of computer-aided diagnosis (CAD) system for lung cancers in chest X-ray CT images. An essential core of the method is to separate non-isolated nodules from connecting structures like chest wall and blood vessels. The isolated nodules can be detected more easily by CAD syetems developed previously. To this end, we propose a binarization technique byusing two thresholds as a preprocessing for nodule candidates. We evaluate the performance using the receiver operating characteristic (ROC) analysis in clinical chest CT images. The results suggest that detection ability of nonisolated nodules by the proposed method is superior to that by the conventional preprocessing methods.
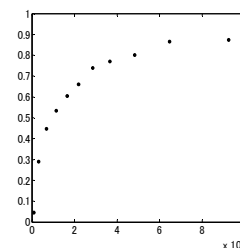
OS22-4 A time variant seasonal ARIMA model for lung tumor motion prediction

Kei Ichiji, Masao Sakai, Noriyasu Homma,Yasuhiro Takai, and Makoto Yoshizawa
(Tohoku University, Japan)

We propose a prediction method of lung tumor motion for real-time tumor following radiation therapy. An essential core of the method is a model building of time variant nature of the lung tumor motion. The method is based on a seasonal ARIMA model with an estimator of the time variant nature. The estimator provides the time variant period of the lung tumor motion by using a correlation analysis. The time variant SARIMA model can then predict complex lung motion by using the estimated period. The proposed method achieved highly accurate prediction of the average error 0.820 ± 0.669[mm] at 0.5[sec] ahead prediction. This result is superior to other conventional methods at short- or mid-term prediction.

OS22-5 Pulse transmission time based on temporal difference in the instantaneous phase between electrocardiogram and photoplethysmogram signals

M. Murakoshi, M. Yoshizawa, N. Sugita, M. Abe, N. Homma, T. Yambe, and S. Nitta
(Tohoku University, Japan)

Analysis of the baroreflex characteristics is useful for the earlier detection of diseases such as hypertension. However, a continuous blood pressure signal must be measured with a comparatively-expensive device for this analysis. In this study, pulse transmission time (PTT), which is known to be correlated with blood pressure (BP), was calculated by using not only a traditional method but also a new algorithm based on the temporal difference in the instantaneous phase between electrocardiogram and photoplethysmogram signals. Analysis of 94 healthy subjects' data showed that information which has a relatively high correlation with the Mayer wave (0.05-0.15Hz) component of BP could be obtained from the two PTTs by selecting one of them on the basis of their powers in the Mayer wave-related band.
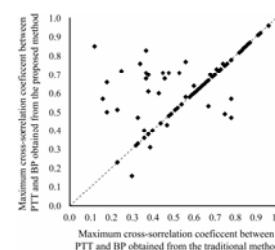
Session: OS23
Bio-inspired theory and application
OS23-1 Study upon cooperative optimization problem between two humans by mutual tracking

Yoshikatsu Hayashi[1], Yurie Tamura[2], Fumihiko Ishida[3], Ken Sugawara[2], and Yasuji Sawada[1]
([1]Tohoku Institute Technology, Japan)
([2]Tohoku Gakuin University, Japan)
([3]Toyama National College of Technology, Japan)

Verbal communication is essential for human society. Nonverbal communication, on the other hand, is more widely used not only by human but also other kind of animals. Predictive function is important for human and other animals to adapt for the constantly changing environment and to communicate smoothly with other members of the society. In our study, we investigated how human overcome the inevitable time delay and generated synchronized motion, based on the mutual tracking experiment.
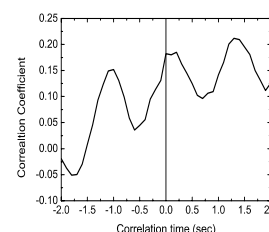
OS23-2 A study on the behavior of a few ant workers

Ken Sugawara[1], Mai Yuki[1], Yoshikatsu Hayashi[2], Tomonori Kikuchi[3], and Kazuki Tsuji[3]
([1]Tohoku Gakuin University, Japan)
([2]Tohoku Institute Technology, Japan)
([3]University of the Ryukyus, Japan)

It is well-known that social insects such as ants show interesting collective behaviors. To expand understanding of collective behaviors of ants, we focused on the ants, *Diacamma sp*, and analyzed the behavior of a few individuals. We placed a few ant workers in hemisphere without a nest, food, the queen, and the trajectory of them is recorded. As a result, we found following characteristics: 1. Activity of individuals increases and decreases periodically in anti-phase. 2. Spontaneous meeting process is observed between two ants and it may cause an anti-phase synchronization.
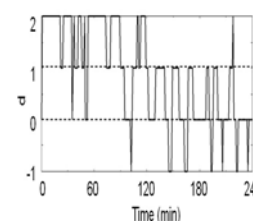
OS23-3 Estimation of average hitting time in genetic algorithms by Markov chain

Ma QingLian, Zhang Yu-an, Makoto Sakamoto, and Hiroshi Furutani
(University of Miyazaki, Japan)

Recently, the hitting time T is an important topic in the theory of Genetic Algorithms (GAs), there have been many theoretical attempts for obtaining the mean first hitting time of optimum solution(s). In this paper, we develop a new approach to estimate the mean first hitting time of optimum solution in GA. We consider the success probability S of GA on the multiplicative landscape and study the relation between S and T by Markov chain. The success probability S is defined as that there is at least one optimum solution in a population at the stationary distribution. We performed numerical experiments with and without crossover, and found that crossover accelerates the speed of evolution. T becomes very short when crossover is included in GA calculation.
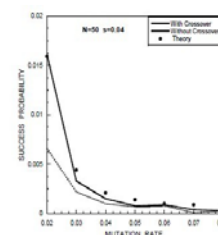
Figure 3: p_m-dependence of success probability S with $N = 50$ and $s = 0.04$. Crossover rate are $p_c = 1, 0$. The horizontal axis represents mutation rate p_m.

OS23-4 Quest for genetic information hidden behind disorder in DNA sequences

Yuka Koyama[1], Kentaro Nishimuta[1], Kunihito Yamamori[1], Ikuo Yoshihara[1], and Moritoshi Yasunaga[2]
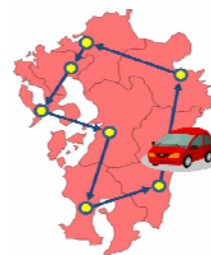([1]University of Miyazaki, Japan)
([2]University of Tsukuba, Japan)

We try to find hidden information in DNA sequences. We focus on disorder of base sequences, because disorder analysis is available, even if we do not know particular function of genes. We use the exponent α of $1/f^\alpha$ fluctuation and self-information as indices of disorders. Our experimental data are ribosomal protein of eukaryotic species. The exponent α is calculated from three kind's data which is divided into exon regions, intron regions and whole base sequences. The average over exon regions are smaller than that over intron regions. It suggests that exon regions involve more particular base sequences than that in intron regions. Self-information is calculated for sub-sequences cut out from whole base sequences with respect to codon. SOM is used to look for similarity of species by self-information and shows classified species.
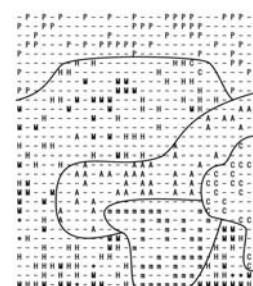
OS23-5 Development of a novel crossover of hybrid genetic algorithms for large-scale traveling salesman problems

Masafumi Kuroda[1], Kunihito Yamamori[1],
Masaharu Munetomo[2], Moritoshi Yasunaga[3], and Ikuo Yoshihara[1]
([1] University of Miyazaki, Japan)
([2] Hokkaido University, Japan)
([3] University of Tsukuba, Japan)

We propose a novel crossover operator for solving traveling salesman problems (TSPs) with Hybrid Genetic Algorithms (HGAs) involving Lin-Kernighan (LK) heuristic for local search. We call it Sub-tour Recombination Crossover (SRX), which divides parent tours into many sub-tours under some rules and reconnects them from the parents so as to construct a new tour. Our method is evaluated by ten well-known benchmarks provided at the web page of Georgia Institute of Technology. We compare SRX with the conventional crossover operators; MPX3, GSX2 and ERX6, and show that SRX succeeded in finding better solution within shorter computation time than those of conventional methods.

OS23-6 Signal integrity improvement method and its robustness evaluation for VLSI and VLSI-packaging

M. Ishiguro[1], H. Nakayama[1], Y. Shimauchi[1], N. Aibe[1], Y. Yamaguchi[1], I. Yoshihara[2], and M. Yasunaga[1]
([1]University of Tsukuba, Japan)
([2]University of Miyazaki, Japan)

Signal-propagation with low distortion is getting difficult more and more as the frequency increases. In order to solve this problem and to ensure the signal integrity, we have proposed a novel transmission line called "Segmental transmission Line (STL)" already. In the STL, a transmission line is divided into multiple segments of individual characteristic impedance. We have shown effectiveness of the STL designed to GHz-clock-signal on the computer simulations. And, we have fabricated two scale-up STL prototypes for clock-signal using real PCBs. In this paper, we input random-signal changing its frequency to the scale-up STL prototype designed to 150MHz clock-signal. As the result, the eye-height and the eye-width in the STL were larger and longer than those in the conventional transmission line by 2.75 times and 1.23 times, respectively.
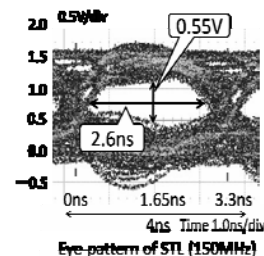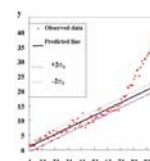
Session: OS24
Real time methods for structural change detection of ongoing time series data
OS24-1 Structural change point detection by sequential probability ratio test and Chow test

Tetsuo Hattori[1], Katsunori Takeda[1], Izumi Tetsuya[2], and Hiromichi Kawano[3]
([1]Kagawa University, Japan)
([2]Micro Technica Co., Ltd., Japan)
([3]NTT Advanced Technology, Japan)

Time series analysis is used in various fields. The problem of predicting time series can be classified into three. The first problem is how to make a prediction model, that adequately represents the characteristics of the past time series data. The second problem is how to correctly and promptly detect the structural change, when the estimated prediction model does not meet the data. The third problem is how to quickly find the new prediction model after the change. This paper focuses on the second problem and proposes a method based on a probability ratio test. This paper also shows some experimental results comparing with a conventional method, Chow test, and presents the effectiveness.

## OS24-2 Extended SPRT for structural change detection of time series based on multiple regression model

Katsunori Takeda[1], Tetsuo Hattori[1], Izumi Tetsuya[2] and Hiromichi Kawano[3]
([1]Kagawa University, Japan)
([2]Micro Technica Co., Ltd., Japan)
([3]NTT Advanced Technology, Japan)

It is important to quickly detect the structural change of time series as a trigger to remodel the forecasting model. The well-known Chow Test has been used as a standard method for the change detection, especially in economics. On the other hand, we have proposed the application of sequential probability ratio test (SPRT) for the change detection of single regression modeled time series data. In this paper, we show experimental results by SPRT and Chow Test when applying to time series data that are based on multiple regression models. And we clarify the effectiveness of the SPRT comparing with the Chow Test, in the sense of ability of early and correct change detection and computational complexity.
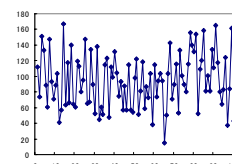
OS24-3 Application of SPRT to image data sequence for remote monitoring system

Katsunori Takeda[1], Tetsuo Hattori[1], Izumi Tetsuya[2], Hiromichi Kawano[3], and Shinichi Masuda[4]
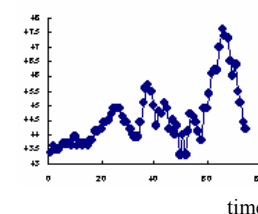([1]Kagawa University, Japan)
([2]Micro Technica Co., Ltd., Japan)
([3]NTT Advanced Technology, Japan)
([4]C Micro Co., Ltd., Japan)

Recently, remote monitoring camera systems are widely used for security. In such systems, we need an important function that it automatically detects the some change of the scenes from monitoring cameras. Generally, in wireless remote monitoring camera systems, the scene images are sent as compressed data (e.g., JPEG file), because of the wireless channel capacity. In this paper, we show the automated detection of the change point for the time series data of compressed JPEG file quantity (Kbytes) from monitoring camera, applying sequential probabilistic ratio test (SPRT) and Chow test that is well known as a standard method for structural change detection of time series data.

JPEG (Kbytes)

time

OS24-4 Early structural change detection as an optimal stopping problem (I) -Formulation using dynamic programming with action cost
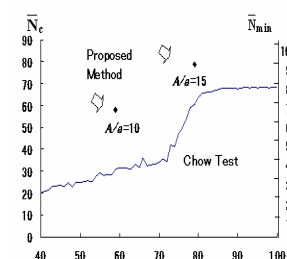
Tetsuo Hattori[1], Katsunori Takeda[1], Izumi Tetsuya[2], and Hiromichi Kawano[3]
([1]Kagawa University, Japan)
([2]Micro Technica Co., Ltd., Japan)
([3]NTT Advanced Technology, Japan)

Even if an appropriate prediction expression and/or model is constructed to meet a time series, the model gradually begins to fail the prediction of the time series from some time point. In such case, it will be important not only to quickly and correctly detect the failing situation but also to renew the prediction model after the detection as soon as possible. In this paper, we formulate the structural change detection of time series as an optimal stopping problem, using Dynamic Programming (DP). The cost function is defined as the sum of a loss cost by failing and an action cost after the detection. And, we present the optimal solution and its correctness by numerical calculation, and also clarify the effectiveness by numerical experimentations.

OS24-5 Early structural change detection as an optimal stopping problem (II) --Solution theorem and its proof using reduction to absurdity

Hiromichi Kawano[1], Tetsuo Hattori[2], Katsunori Takeda[2], and Izumi Tetsuya[3]
([1]NTT Advanced Technology, Japan)
([2]Kagawa University, Japan)
([3]Micro Technica Co., Ltd., Japan)

Change point detection (CPD) problem in time series is to find that the structure of generating data has changed at some time point by some cause. We formulate the structural change detection in time series as an optimal stopping problem using the concept of DP (Dynamic Programming). And we present the optimal solution and its correctness by numerical calculation. Moreover in this paper, we give the mathematical solution theorem and its proof using reduction to absurdity.
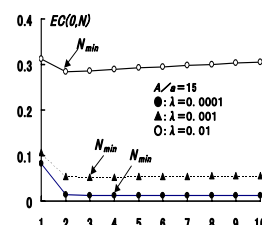
Session: OS25
Artificial application & artificial and green technology (I)

OS25-1 Spatial information of game for body interface using webcam

Young Jae Lee
(Jeonju University, Korea)

In this paper, we propose an efficient game spatial division and analysis algorithm that gives special information for collision avoidance of game objects and natural interface. We divide into 9 parts of game space and part 4, 5, 6 are divided into 2 more detail parts for check the enemy position and movement information of gamer. And we calculate optimal path for collide avoidance of the enemy. To evaluate the method, we implemented a motion based game that consists of a webcam, a player, an enemy, and we obtained some valid results of our method for the collision avoidance and interesting interactions. The results demonstrated that the proposed approach is robust. If movement information is in front of enemy, then the enemy waits or turns back and finds the place and runs to avoid attack. This algorithm can be used basic development of effective body interface and level control for motion based game.

OS25-2 A study on accurate time synchronization protocol with improved SNTP for smart AMR *(withdrawal)*

Se-young Oh and Chang-Hwa Lee
(ADMOTECH Inc., Korea)

For wired or wireless sensor network(eg. distributed AMR system), time synchronization assures the concurrence of event timing for measured data. There are NTP(Network Time Protocol) and SNTP (Simple Network Time Protocol), RBS (Reference Broadcast Synchronization), TPSN (Time synchronization Protocol for Sensor Networks) for time synchronization for network systems. This paper explains suggested SNTP protocol - makes conventional SNTP's ± 2 second accuracy to few millisecond - using precise meta data exchange and agile interrupt handling techniques and shows the time synchronization performance analysis results.
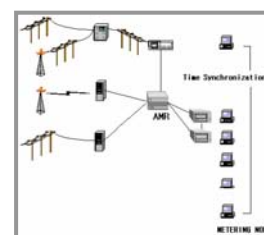
OS25-3 Calculation of arm parameter for surface scanning with axis moment

Jae-Chan Jeong[1], Ho-Chul Shin[1], Dong-Doo Lee[2], and Chang-Hwa Lee[2]
([1]University of Science and Technology, Korea)
([1]ADMOTECH Inc., Korea)

In this paper proposed about the system for measuring the diffusion of the electric wave in 3D space. The end-effecter having the Pan-tilt joint in the cartesian coordinate system robot was set up and it comprised of the robotic arm of 5 degree of freedoms. In an end-effecter, the sensor measuring the diffusion of the electric wave was set up. In the cartesian coordinate system robotic section, it was comprised of the stepping motor. And the Servo Motor was used to an end-effecter. By using the proposed robotic arm, the shape of the electric wave was measured.
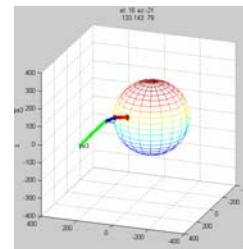
OS25-4 Development of interactive wireless AMR with distribution automation system

Chang-Hwan Yoon, Dong-Doo Lee, and Chang-Hwa Lee
(ADMOTECH Inc., Korea)

Recently WSN has become one of the most interesting ubiquitous networking technologies and its application for the AMR is rapidly growing. To introduce this concept, interactive wireless automatic meter reading node integrated with distribution automation system has been developed in the ADMOTECH Inc.. In our developed system, wireless communication is based on IEEE 802.15.4 and half duplexer interactivity is implemented. Our prototype can handle up to 75 AMR nodes and can be easily extended to larger scale for interactive meter reading application. This paper presents the conceptual structure of system layout and shows details of physical hardware, communication protocols and UI. Furthermore, our system is capable of measure, record various data - such as energy consumption, power factor and additional parameters - and control electric load operation.
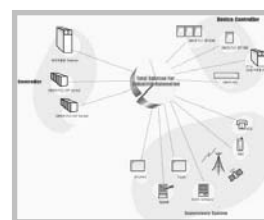
OS25-5 Improved SNTP for accurate time synchronization in smart AMR systems

Se-young Oh, Dong-Doo Lee, and Chang-Hwa Lee
(ADMOTECH Inc., Korea)

In distributed sensor network such as distributed AMR system, accurate time synchronization is necessary to assure the concurrence of event timing for measured data. There are NTP(Network Time Protocol) and SNTP (Simple Network Time Protocol), RBS (Reference Broadcast Synchronization), TPSN (Time synchronization Protocol for Sensor Networks) in time synchronization for distributed network systems. In this paper, we suggested improved SNTP using precise meta data exchange and agile interrupt handling techniques and showed that our method has accuracy of few millisecond compared to conventional SNTP with accuracy of few second from the time synchronization performance analysis results.
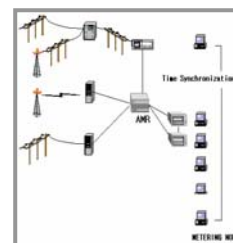
OS25-6 Personal color decision system using fuzzy logic

JungMin Oh, Min-Seok Hong, Jin-Taek Kim, Do-Won Lee, Choul-Woong Son, and Geuk Lee
(Hannam University, Korea)

This paper, which is based on the research in the personal color diagnosis system, uses the fuzzy logic. We propose the method which constructs more systematic color selection system using personal color database and fuzzy logic. This paper will refer to this system as FPCS (Fuzzy logic Personal Color System). The FPCS program proposed in this study is able to produce rapid and accurate results without the complex processes of existing color diagnosis therefore it is convenient and can save time and money.

Session: OS26

Artificial application & Artificial and green technology (II)

OS26-1 Online-based therapeutic services for individuals who are searching for new challenges in life

Ji Hyang Lim[1] and Hyo Woon Yoon[2]
([1]Daegu Cyber University, Korea)
([2]Gachon University of Medicine and Science, Korea)

The aim of the present study is to describe the social interests and practical progress, which related with therapeutic services for the individuals, who are searching new challenges in life. In order to achieve this goal, the database from the national statistic institute was cited, especially in the field of social welfare related with children, adolescents and family life. In addition, some examples from DCU are presented for educating expertise in this field for reporting practical progress. The interests as well as the inquiries of demand due to therapeutic service are significantly increasing in last few years. This phenomenon is probably based on some factors such as family relation changes, increased portion of small families etc and unexpected social problems as a consequence. Among them the care of juvenile population in the unstable family relations should be treated with priority. Thus, the large number of expertise is necessary for counseling / making therapeutic service of such population. DCU tries to establish special program for educating expertise in the field of therapeutic services currently. For example, DCU provides Interdisciplinary approach, Transregional approach, and International collaboration etc in order to satisfy nationwide necessity of therapeutic service expertise education. Even though this program is not fully completed, the special program of DCU is a big positive example to fulfill social interests in terms of therapeutic services as well as Life Long & Higher Education.

OS26-2 Multimodal context-awareness system for automated monitoring-control
(withdrawal)

Sungdo Park, Hyokyung Chang, Bokman Jang, Bonghoi Kim, and Euiin Choi
(Hannam University, UBNC Co. Ltd, Korea)

Multi-modal is a technology which can convert information to suitable format for the optimum communication between the system and the user. Monitoring-control system is a supervisor system which can provide prevention and management for various facilities from hazards. However, current Monitoring-control system has been a system centered monitoring and the control has restricted by the place. Therefore, this paper presents a more improved automated monitoring-control system using context-awareness reasoning, that correctly grasps and response for the situation according to context information modeling, and multi-modal interaction, that is possible to manage facilities using various mobile devices for ubiquitous computing environment, than existing one.
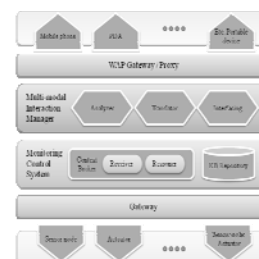
OS26-3 The design of GHG(Greenhouse Gas) reduction control system

Yong-sik Choi, Sang-kyun Cha, Kyeong-jae Cheon, and Hwan-chul Kim
(Comesta, Inc. Korea)

In this era, the GHG(Green House Gas) is regarded as a very important issue of world wide economics. After declaring United Nations Framework Convention on Climate Change, world wide economy environment needs GHG Reduction, changes accelerative by Emission Trading System, and etc. Therefore, the environment regulation for GHG becomes a new trade barrier. This paper shows the design of GHG Reduction Control System based on smart metering that can reduce GHG in the manner of dynamic management and planning for the progress of production. Also, we propose the simulation environment that can verify and validate the required functionalities of GHG Reduction Control System

OS26-4 Analysis of soil cement characteristics using recycled fine aggregates for landfill *(withdrawal)*

Young-Muk Kim
(Hanbat National University, Korea)

In this study, it was proposed that soil cement using recycled fine aggregate was a good method to construct of subbase of pavement or foundation as soil replacement material has been used a lot of crushed stone. Generally, recycled fine aggregate contains a little of cement component, and it may be a factor of environmental source in the case of landfill. Soil cement is a good method to reduce of leakage of cement component. Recycled fine aggregates were used to main materials of soil cement, and then specimen were produced and tested. The results of experiment was showed that soil cement of cement content 12% was appeared good strength using the recycled fine aggregate of unconfined compression strength.

OS26-5 Design of LCL filter for renewable energy sources using bacterial foraging optimization

Dong-Hwa Kim[1] and Jae-Hoon Cho[2]
([1]Hanbat National University, Korea)
([2]Chungbuk National University, Korea)

As the traditional resources have become rare, renewable energy sources are developing quickly. The grid connected renewable sources is one of the most importance problem in smart grid fields. To reduce harmonic in this grid, many filter techniques have been developed. Compared traditional L filter, a LCL filter is more effective on reducing harmonic distortion at switch frequency. So, it is important to choose the LCL filter parameters to achieve good filtering effect. In this paper, a design method of LCL filter by bacterial foraging optimization is proposed. Simulation result and calculate data are provided to prove that the proposed method is more effective and simple than traditional methods.
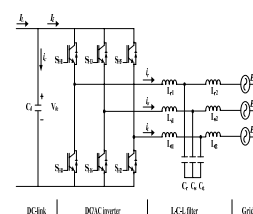
OS26-6 Semantic query processing based on SQL

Hyun-Chang Lee and Heung-Seon Hwang
(WonKwang University, Korea)

According to the development of ubiquitous technology, the concept of ontology is widely used in the fields such as a telematics and intelligent robots that require information processes for context. Web-based ontology languages like RDF/S and OWL represent resources in the web to a type of triple (subject, predicate, object). However, the use of languages is restrictive. Therefore, in this paper, we propose an OWL context relational model and semantic query processing mechanism based on SQL.

Session: OS27
Machine learning and computer vision
OS27-1 Biomimetic control architecture for robotic cooperative tasks

Nicu George Bizdoaca[1], Hani Hamdan[2], Daniela Coman[1], Anca Petrisor[1], and Elvira Bizdoaca[1]
([1]University of Craiova, Romania)
([2]SUPELEC, France)

The paper proposes control algorithms applied to MIROSOT robot league architecture. The MIROSOT league soccer game concept is fairly simple: two teams of robots, with tree/five robots per side which play football completely autonomously. In order to develop an efficient control strategy and architecture, it has to use the strategy from the real human soccer game. Using software Simi Scout, a suitable tactics analysis can be extracted from the games. Analyzing the soccer game, a number of attributes are specified and are embedded at different levels. The specified levels are interconnected and the game analysis is processed for optimization. Using this information, the robot program is adapted and the tests/games are experimented. The results are commented and improved control architecture, based on practical results, is proposed.
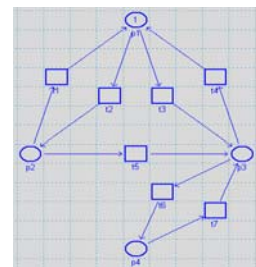

Petri net model for

the soccer robot.

OS27-2 ANN dexterous robotics hand optimal control methodology grasping and manipulation forces optimization

Ebrahim Matter Al-Gallaf[1], Khaled Al Mutib[2], and Hani Hamdan[3]
([1]University of Bahrain, Kingdom of Bahrain)
([2]King Saud University, Saudi Arabia)
([3]SUPELEC, France)

This article presents an efficient scheme for computing optimal grasping and manipulation forces for dexterous robotics hands. This is formulated as Quadratic Optimization problem formulation. Computation has been based on non-linear model of fingertips contacts and slips. In achieving grasping while in motion, hand inverse Jacobian is considered an important matrix to be computed, however, it is considered as highly intensive to be computed. Consequently, we investigate an efficient approach by using Artificial Neural Networks (ANN) for learning grasped optimal forces. ANN is used to learn the optimal contact forces relating hand joints torques to object result force. Results have indicated that ANN have reduced the computational time reasonable values, this is due to the ability to map nonlinear relations. Furthermore, results have revealed that ANN are capable of learning highly nonlinear relations relating distributed fingertips forces and the joints toques.
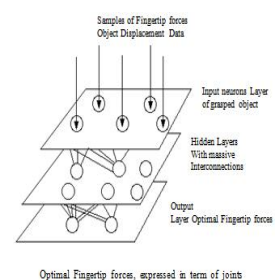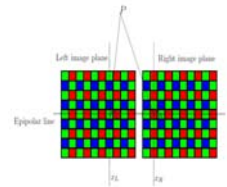

A four layers mapping ANN.

OS27-3 Dense stereovision using mono-CCD color cameras

Hachem Halawana[1] and Hani Hamdan[2]
([1]LAGIS, Université des Sciences et Technologies de Lille 1(USTL)**,** France)
([2]SUPELEC, France)

Most of the stereo algorithms were based only on the analysis of the luminance information. However with the advances in camera technology, in addition to the fact that color information can robustly improve matching, color stereovision gained more and more interest. Color stereovision setups are usually based on single-sensor cameras which provide Color Filter Array (CFA) images. In those, a single color component is sampled at each pixel rather than the three required ones (R, G, B). We show that standard demosaicing techniques, used to interpolate missing components, are not well adapted when the resulting color pixels are matched for estimating image disparities. In order to avoid this problem while exploiting color information, we propose a new matching cost designed for dense stereovision based on pairs of CFA images.

CFA stereovision problem.