

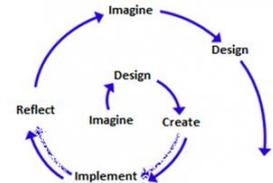
## ABSTRACTS

### IS

#### IS1-1 Playware Research – Methodological Considerations

Henrik Hautop Lund (Centre for Playware, Technical University of Denmark, Denmark)

Several sub-disciplines of engineering are driven by the researchers' aim of providing positive change to the society through their engineering. Based on two decades research in developing engineering systems with a societal impact (e.g. in robotics, embodied AI, and playware), in this paper we suggest a cyclic research method based on a mix between participatory and experimental processes. In particular, inspiration from the action research method applied to interdisciplinary technology development becomes a participatory approach characterized by rapid prototyping cycles which allow iterative technology specification and development together with people in their real world environment. With the mixed research method, we suggest that there are cases, where approaches from the positivistic and interpretivistic epistemologies can and should be merged. We exemplify this with health care technology and playware.



#### IS1-2 ALife for Real and Virtual Audio-Video Performances

Luigi Pagliarini<sup>1,2</sup> Henrik Hautop Lund<sup>1</sup>

(<sup>1</sup> Centre for Playware, Technical University of Denmark, Denmark)

(<sup>2</sup> Academy of Fine Arts of Macerata, Italy)

MAG is an electronic art piece in which an ALife software attempts to “translate” musical expression into a corresponding static or animated graphical expressions. The mechanism at the base of such “translation” is based on artificial learning techniques. MAG use population of neural networks that can use both genetic and reinforcement learning algorithms to evolve appropriate behavioral answers to inputs. The combination of artificial evolution and the flows of a repeated song or different musical tunes allows the software to obtain a special relationship between sound waves and the aesthetics of consequent graphical result. Further, we are exploring the concept of run-time creation of both music and graphical expression. To do that we use MusicTiles app that allows users to remix music by connecting musical building blocks. When combining MusicTiles app and MAG software, we provide the possibility to melt both musical expression and graphical expression in parallel and at run-time, and therefore creating a audio-video performance that is always unique.



### **IS1-3 Heart-pulse Biofeedback in Playful Exercise using a Wearable device and Modular Interactive Tiles**

Tomoya Shimokakimoto<sup>1</sup>, Henrik H. Lund<sup>2</sup>, Kenji Suzuki<sup>3</sup>  
(<sup>1</sup> University of Tsukuba, Japan)  
(<sup>2</sup> Technical University of Denmark, Denmark)  
(<sup>3</sup> University of Tsukuba/ JST, Japan)

We developed a playful biofeedback system using a wearable device and modular interactive tiles. We suppose that patients could regulate exercise intensity on their own through biofeedback. We propose biofeedback play system called “bioToys” based on exercise with the modular interactive tiles. The system consists of a wearable device and modular interactive tiles. We combine the two systems to provide users with heart pulse biofeedback in playful exercise. We show that using the developed system it is possible for the users to regulate the exercise intensity on their own with biofeedback, and also possible to analyze exercise activity using number of steps on the tiles and heart beat rate.

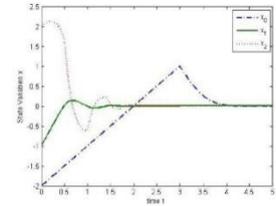


## OS1 Intelligent Control

### OS1-1 Finite-Time Stabilization for Nonholonomic Chained Form Systems with Communication Delay

Hengjun Zhang, Chaoli Wang  
(University of Shanghai for Science and Technology, P.R.China)

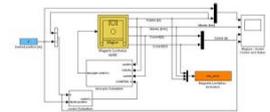
In this paper, the problem of finite-time stabilization is developed for nonholonomic chained form systems with communication delay in the input. The finite-time control laws are presented by utilizing the switching control strategy and the theory of finite-time stability, which can make the states of the nonholonomic chained form systems to converge from any non-equilibrium state to the equilibrium or a given point in a finite time. Finally, the simulation results show the effectiveness of the proposed control approach.



### OS1-2 Sliding Mode Variable Structure Control for Magnetic Levitation Vehicles

Juanjuan He, Yingmin Jia  
(Beihang University, P.R.China)

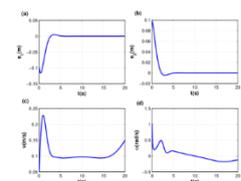
This paper focuses on stability control for the levitated positioning of the magnetic levitation vehicle system. For the nonlinear magnetic levitation system model, the output feedback linearization method is first employed to derive a global linearization error model. However, there exists uncertain item in the error model. To stabilize this error model, the adaptive sliding mode variable structure control method is used to design stability controller. Simulations show that the magnetic levitation system can be stable and track the desired signals quickly under the proposed control scheme.



### OS1-3 Variable-Poled Tracking Control of a Two-Wheeled Mobile Robot using Differential Flatness

Liming Chen, Yingmin Jia  
(Beihang University, P.R.China)

This paper investigates the tracking controller design of a two-wheeled mobile robot in its kinematic model and dynamic model. Differential flatness and linear time-varying (LTV) systems' PD-spectral theory are used. Based on differential flatness, original system is transformed via a state prolongation and state transformation into a normal form to apply feedback linearization. Then using PD-spectral theory, variable poles of tracking error dynamics are assigned to realize trajectory tracking stability. Finally, simulation results are presented to demonstrate the feasibility and effectiveness of the proposed method.



## OS1-4 Adaptive Consensus Control of Multi-Agent Systems with Large Uncertainty and Time Delays

Dongxu Zou, Weicun Zhang  
(University of Science and Technology Beijing, China)

A weighted multi-model adaptive control method is proposed to achieve consensus of multi-agent system with large parameter perturbation and communication delays, in which  $H^{inf}$  control is adopted to construct the controller set. Moreover a simple and effective weighting algorithm is also presented. The simulation results demonstrate the effectiveness of the proposed method.

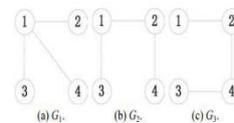
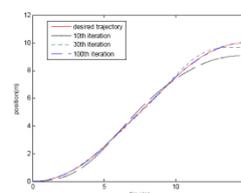


Fig. 1 simplified undirected graph

## OS1-5 Iterative Learning Control for Overhead Crane Systems

Xuhui Bu, Fuzhong Wang, Sanyi Li, Fashan Yu  
(Henan Polytechnic University, P.R.China)

In many factories, overhead crane often transfers the same loads from one place to another following a predefined position and speed diagrams. This unique feature offers overhead crane an opportunity of improving its performance through learning iteratively. In this paper, we apply the iterative learning control approach to overhead crane systems. Based on the linearization dynamic model of overhead crane, an ILC scheme contains both feedforward learning control part and state feedback control is proposed. By providing a 2D formulation, the ILC design for crane systems can be transformed into the problem of state feedback control for 2-D systems described by Roesser models. It is shown that the proposed approach can guarantee the trolley position asymptotically converges to its desired profile with small swing angle. Simulations are illustrated to show the feasibility and effectiveness of the proposed approach.



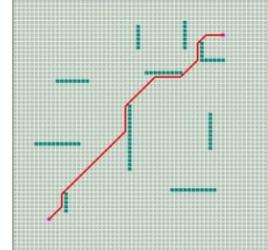
## OS2 Environment Navigation and Localization

### OS2-1 A Hybrid Path Planning Algorithm for UGV by Combining A\* and B-spline Curve Equation

Min-Ho Kim, Hee-Mu Lee and Min-Cheol Lee

(Pusan National University, Busan, South Korea)

This article presents a hybrid path planning algorithm to make a smooth path for an UGV. A main theme of the proposed algorithm is to combine of the A\* algorithm and the B-spline curve equation. A\* is one of the well-known path planning algorithm which finds the optimal path on the given map by using the heuristic cost function. However, since A\* is based on the grid map, the result path consists of straight lines with only 8 directions. It's not suitable of UGV's navigation. Therefore in this paper to overcome this issue, B-spline curve equation is proposed to make a smooth and continuous path with control points which are selected from the A\* result path. And the optimal control point selection algorithm is proposed to make the hybrid path. At last, to verify the proposed algorithm, the hybrid path results are compared with A\* algorithm by using a developed simulation program.

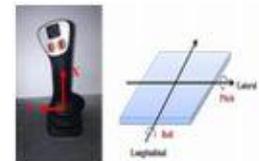


### OS2-2 The actuator device design for the implementation of haptic joystick

Dong-hyuk Lee, Sun-kyun Kang, Bo-Yeon Hwang, Ki-jung Kim, Jang-myung Lee

(Pusan National University, Korea)

In this paper, we designed the actuator device for haptic implementation in the general joystick. Each linear servo actuator as pillars to support the joystick mounting plate can move up and down. And this movement will generate the inclination of the plate. The haptic can be implemented by the change of the inclination. The actuator device was designed through the performance analysis of actuator device structure. The haptic will represent information from obstacle cognition device by using the designed actuator device. The haptic performance of the actuator device was verified through experiments.



## OS2-3 Design of Fuzzy Controller using Variable Fuzzy Membership Function Factors for Inverse Ball Drive Mobile Robot

Keon-woo Jeong, Shin-nyeong Heo, Seung-Ik Hwang, Han-Dong Yoo, Jang-myung Lee

<sup>1</sup>

(Pusan National University, Korea)

In this paper, a fuzzy controller for a inverse ball drive mobile robot is implemented to have more stable balancing capability than the conventional control system. Fuzzy control structure is chosen for a inverse ball drive mobile robot, and fuzzy membership function factors for the control system are obtained for 3 specified weights using a trial-and-error method. Next a linear Interpolation method is employed to generate fuzzy membership function factors for more stable control performance when the weight is arbitrarily selected. Through some experiments, we find that the proposed fuzzy controller using the neural network is superior to the conventional fuzzy controller.

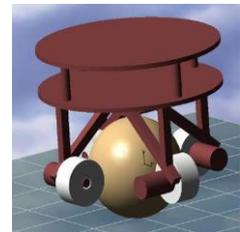


## OS2-4 Error Correction of Angular Velocity for Gyroscope using Genetic Algorithm and FIR filter

Jaeyong Kim, Hyunhak Cho, Sungshin Kim

*Pusan National University, Korea*

This paper is research which sensitivity of gyro sensor is optimization. Recently, the MEMS-gyroscope is usually used at mobile robots and AGV by development of MEMS technology. However, the MEMS-gyroscope has measurement error, cumulate error, bias drift, etc. To reduce these errors, measurement of angular velocity using MEMES-gyroscope required high precision and exactly sensitivity. The sensitivity, is a constant to change angular velocity form ADC value, is changed by external factors as installed location and gradient because the MEMS-gyroscope measure angular velocity with inertia. Therefore, this paper proposes to reduce variance of ADC value and to optimize the sensitivity of MEMS-gyroscope using genetic algorithm. To verify performance of proposed method, we attached MEMS-gyroscope to automatic guided vehicle (AGV) of fork type. In experimental result, we verified that the sensitivity using the proposed method is accurate than the sensitivity in specification.

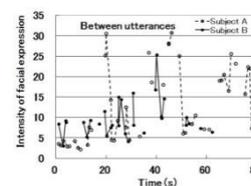




## OS3-2 Facial Expression Analysis While Using Video Phone

T. Asada<sup>1</sup>, Y. Yoshitomi<sup>1</sup>, A. Tsuji<sup>2</sup>, R. Kato<sup>1</sup>, M. Tabuse<sup>1</sup>, N. Kuwahara<sup>2</sup>, J. Narumoto<sup>3</sup>  
(<sup>1</sup> Kyoto Prefectural University, Japan)  
(<sup>2</sup> Kyoto Institute of Technology, Japan)  
(<sup>3</sup> Kyoto Prefectural University of Medicine)

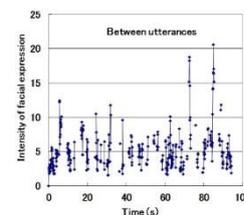
We have proposed a method for analyzing facial expressions of a person while speaking with use of a video phone system (Skype). The video is analyzed using image processing software library (OpenCV) and the newly proposed feature vector of facial expression, which is extracted in the mouth-part area with use of 2D-DCT performed for each domain having  $8 \times 8$  pixels. The facial expression intensity defined as the norm of difference vector between the feature vector of neutral facial expression and that of observed one can be used for analyzing a chance of facial expression. Combining the video signal obtained from the Skype with the sound signal obtained with the other way, we can distinguish the facial expression with speaking from that without speaking. The judgment of speaking is performed with a threshold of the sound intensity. Some experimental results show the usefulness of the proposed method.



## OS3-3 Method of Facial Expression Analysis Using Video Phone and Thermal Image

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

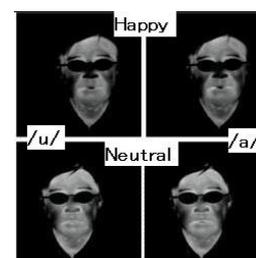
In this study, using thermal image processing, we have proposed a method for analyzing facial expressions of a person while speaking with a video phone system (Skype). The newly proposed feature vector of facial expression, which is extracted in the mouth-part area with use of 2D-DCT performed for each domain having  $8 \times 8$  pixels. The facial expression intensity defined as the norm of difference vector between the feature vector of neutral facial expression and that of observed one can be used for analyzing a chance of facial expression. Combining the video signal obtained from the Skype with the sound signal obtained with the other way, we can distinguish the facial expression with speaking from that without speaking. The judgment of speaking is performed with a threshold of the sound intensity. Some experimental results show the usefulness of the proposed method.



## OS3-4 Facial Expression Recognition Using Thermal Image Processing and Efficient Preparation of Training-data

Y. Nakanishi<sup>1</sup>, Y. Yoshitomi<sup>2</sup>, T. Asada<sup>2</sup>, M. Tabuse<sup>2</sup>  
(<sup>1</sup> ITOKI CORPORATION, Japan)  
(<sup>2</sup> Kyoto Prefectural University, Japan)

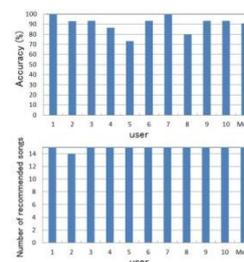
We investigated the influence of training data on the facial expression accuracy using the training data of "taro," whose first and last vowels are /a/ and /o/, for the three intentional facial expressions of "angry," "sad," and "surprised," and the training data of 25 pairs of vowels for the two intentional facial expressions of "happy" and "neutral." Using the proposed method, the facial expressions of one subject were discriminable with accuracies of 100%, 70.0%, and 47.2% for "taro," "koji" (the first and last vowels of which are /o/ and /i/), and "tsubasa" (the first and last vowels of which are /u/ and /a/), respectively, for the three facial expressions of "happy," "neutral," and "other" when one of the five intentional facial expressions of "angry," "happy," "neutral," "sad," and "surprised" was exhibited.



## OS3-5 Music Recommendation System through Internet for Improving Recognition Ability Using Collaborative Filtering and Impression Words

Y. Yoshitomi<sup>1</sup>, T. Asada<sup>1</sup>, R. Kato<sup>1</sup>, Y. Yoshimitsu<sup>1</sup>, M. Tabuse<sup>1</sup>, N. Kuwahara<sup>2</sup>, J. Narumoto<sup>3</sup>  
 (<sup>1</sup> Kyoto Prefectural University, Japan)  
 (<sup>2</sup> Kyoto Institute of Technology, Japan)  
 (<sup>3</sup> Kyoto Prefectural University of Medicine)

In our previously reported system, the recommendation process using collaborative filtering was terminated when no users in the reference list have the same preference for recommended music as that of a new user. Based on the scores for impression words, the second recommendation process finds the most similar music to the successfully recommended music among music that has not yet been recommended. In the present study, based on our previously reported system, we propose a system for music recommendation through the Internet using a videophone system (Skype). The effectiveness of the proposed system is verified. The recommendation accuracy of the proposed system was 90.6% for 10 trials by five elderly subjects. The average number of recommended pieces of music for the subjects by the proposed system was 14.9 per trial.

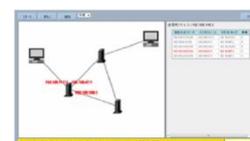


## OS4 Applications in Kansei Engineering

### OS4-1 Kansei Engineering based Evaluation for an e-Learning System with IP-based Network Design and Animation

Yoshiro Imai, Chiaki Kawanishi, Tetsuo Hattori  
 (Kagawa University, Japan)

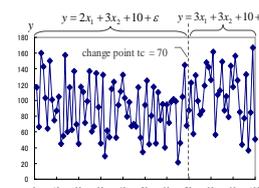
An e-Learning system has been developed, which is designed for network education with facilities of specification of IP-based network topology and demonstration of packet-transferring animation. This system can execute on the major browsers by means of accessing a specific Web server. It is frequently used in some lectures of university from beginners of network to the students of information related course. Kansei Engineering approach is utilized and applied in order to improve and evaluate the e-Learning system.



### OS4-2 Model Introduced SPRT for Structural Change Detection of Time Series(I)

Yoshihide KOYAMA<sup>1</sup>, Tetsuo HATTORI<sup>1</sup>, Hiromichi KAWANO<sup>2</sup>  
 (<sup>1</sup> Kagawa University, Japan)  
 (<sup>2</sup> NTT AT, Japan)

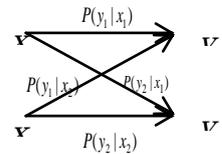
Previously, we have proposed a method applying Sequential Probability Ratio Test (SPRT) to structural change detection problem of ongoing time series data. In this paper, we introduce a structural change model with Poisson process into the system that outputs a set of time series data, moment by moment. Then we can calculate the value of  $P(Z | H1)$  that denotes the probability of observing the data  $Z$  under the condition that  $H1$  (alternative hypothesis) is true. Also, we concretely show the theory of change detection of time series by the model introduced SPRT.



## OS4-3 Model Introduced SPRT for Structural Change Detection of Time SeriesII) --- Kansei Channel Corresponding to the SPRT ---

Yoshihide KOYAMA<sup>1</sup>, Tetsuo HATTORI<sup>1</sup>, Hiromichi KAWANO<sup>2</sup>  
(<sup>1</sup>Kagawa University, Japan)  
(<sup>2</sup>NTT AT, Japan)

We present an application of the notions in Information Theory to Kansei Engineering toward a mathematical methodology for the analysis in the Kansei Engineering field. In this paper, first, we propose a definition of correlation using the mutual information in Information Theory. Second, we explain a relation between the Bayes' Updating using the notion of binary channel and Sequential Probability Ratio Test (SPRT). Moreover, we show the Channel Matrix corresponding to the SPRT where a model introduced.



## OS4-4 Automated Color Image Arrangement Method and Kansei Impression

Yusuke Kawakami<sup>1</sup>, Tetsuo Hattori<sup>1</sup>, Yoshiro Imai<sup>1</sup>, Haruna Matsushita<sup>1</sup>,  
Hiromichi Kawano<sup>2</sup>, R.P.C. Janaka Rajapakse<sup>3</sup>  
(<sup>1</sup>Kagawa University, Japan),  
(<sup>2</sup>NTT AT, Japan),  
(<sup>3</sup>Tainan National University of the Arts, Taiwan)

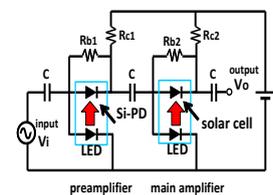
This paper proposes a new color image arrangement method using an elastic transform on some kinds of axes. In this paper, we present the principle of our method using HMGD (Histogram Matching based on Gaussian Distribution). And we describe that the automated method applies the HMGD to input color image only when the image has single-peakedness in its histogram on the focused axis. We also show that the method gives a good Kansei effect in the case of applying the HMGD onto Lightness axis.



## OS4-5 Novel Transistor by Opt-coupling of LED and PD and its Application to Audio Amplifier

Junichi Fujita, Tetsuo Hattori, Daisuke Sato, Kensho Okamoto  
(Kagawa University, Japan)

This paper presents a simple transistor-like amplification function by the optical coupling of LED (Light Emitting Diode) and Photodiode where the Photodiode current by photo electromotive force is feed backed into the LED, in the same way as the case of common emitter circuit of the conventional Bipolar Transistor. And also, this paper shows that an audio amplifier can be realized in a simple form. Since the proposed audio amplifier provides good sound with very low noise characteristic, we consider that the audio system becomes a promising Kansei product.

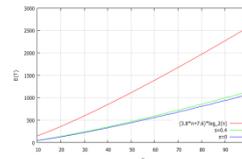


## OS5 Analysis of Randomized Algorithms

### OS5-1 Markov Chain Analyses of Random Local Search and Evolutionary Algorithm

Hiroshi Furutani, Hiroki Tagami, Ichihi To, Makoto Sakamoto  
(University of Miyazaki, Japan)

In this paper, we report the computational complexity of algorithms (1+1)EA and Random Local Search (RLS). It has been noted the close resemblance of RLS with the coupon collector's problem (CCP). The CCP has a long history of probabilistic research, and many interesting results are obtained. This study makes use of such results with some modifications. We also show the results for (1+1)EA and RLS using absorbing Markov chain.



### OS5-2 Runtime Analysis of OneMax Problem in Genetic Algorithm

Ichihi To<sup>1</sup>, QuinLian Ma<sup>1</sup>, Makoto Sakamoto<sup>3</sup>, Hiroshi Furutani<sup>1</sup>, Yu-an Zhang<sup>2</sup>  
(<sup>1</sup>University of Miyazaki, Japan)  
(<sup>2</sup> Qinghai University, China)

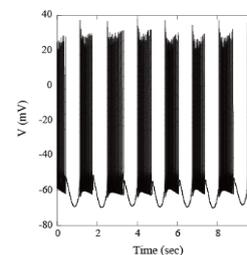
Genetic algorithms (GAs) are stochastic optimization techniques that simulate the biological evolution. Theoretical study of the evolution of the genetic algorithm is very important for the application of GA. We have studied the effects of stochastic fluctuation in the process of GA evolution. We consider the task of estimating the hitting time of the optimal solution in GA for OneMax problem. This task is performed by using the Markov chain representing the behavior of population in the stationary state of evolution.



### OS5-3 A Model for Low-Frequency Burst in Subthalamic Nucleus Neuron

S. Kubota<sup>1</sup>, J. E. Rubin<sup>2</sup>  
(<sup>1</sup>Yamagata Univ., Japan)  
(<sup>2</sup>Pittsburgh Univ., USA)

Bursting oscillation in the subthalamic nucleus (STN) is suggested to be linked to the motor symptoms in Parkinson's disease. In this study, to investigate the effects of interactions among STN, the cortex, and globus pallidus (GP), on the burst characteristics, we examine a model of STN neuron that contains NMDA conductances activated through the cortical inputs and GABAergic conductances associated with GP activities. To reproduce cortical slow oscillation consisting of two phases, the NMDA conductances are activated by inhomogeneous Poisson spikes whose firing rate is stochastically and periodically modulated. The results show that a higher level of GABA inhibition leads to strong burst with larger coefficient of variation of interspike intervals, while the strengthening of NMDA activation mainly acts to increase the firing rate.



Burst response of the STN neuron model

## OS6 Empirical research on Network and MOT

### OS6-1 An Empirical Examination of Inter-firm Capital Relationships in Mazda's Yokokai using the IDE Spatial Model

M. Sakamoto<sup>4</sup>, S. Tagawa<sup>1</sup>, T. Ito<sup>1</sup>, S. Matsuno<sup>1</sup>, R. Mehta<sup>2</sup>, V. Berdonosov<sup>3</sup>, S. Ikeda<sup>4</sup>

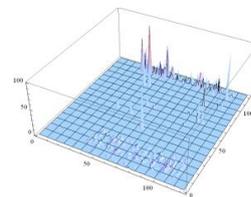
(<sup>1</sup>Ube National College of Technology, Japan)

(<sup>2</sup>New Jersey Institute of Technology, U.S.A)

(<sup>3</sup>Komsomolsk-on-Amur State University of Technology, Russia)

(<sup>4</sup> University of Miyazaki, Japan)

In this paper, we focused on examining the capital relationships in Yokokai, the Mazda's Keiretsu. Employing regression analysis, three significant indices, influence, degree, and efficiency, were selected from nine indices, including others that include dyadic redundancy, dyadic constraint, effective size, constraint, hierarchy, and density. We propose a new approach, called IDE spatial model, to calculate the strength of the inter-firm's relationships. In order to ascertain the rational inter-firm relationships, network indices and corporate performance are analyzed. This research suggests a new perspective to examine the rational inter-firm relationship that can be used in any network organization.



### OS6-2 A Comparative Study of Transactional Network between Kyohokai and Yokokai

M. Sakamoto<sup>4</sup>, M. Hasama<sup>1</sup>, T. Ito<sup>1</sup>, Y. Uchida<sup>1</sup>, R. Mehta<sup>2</sup>, Y. Park<sup>3</sup>, M. Sakamoto<sup>4</sup> M.

Sakamoto<sup>4</sup> S. Ikeda<sup>4</sup>

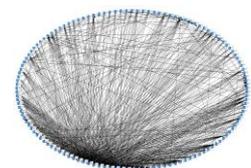
(<sup>1</sup> Ube National College of Technology, Japan)

(<sup>2</sup> New Jersey Institute of Technology, U.S.A)

(<sup>3</sup> Prefectural University of Hiroshima, Japan)

(<sup>4</sup> University of Miyazaki, Japan)

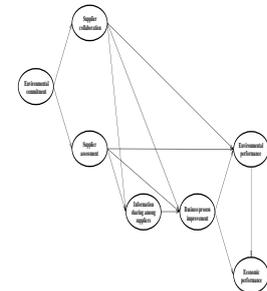
Consistent with the stream of research on the coordination of internal resources and external inter-firm relationships, the purpose of this research is to identify and contrast the best practices of Toyota to Mazda using a comparative approach. This paper reviews relevant studies of network organizations to focus on the differences between Kyouhokai and Yokokai. Specifically, it makes a contribution to the literature by proposing a new perspective to identify the determinants of corporate performance and clarify the difference among the external inter-firm's relationships between Kyohokai and Yokokai, thus ascertaining the rational structure of network organizations.



### OS6-3 A path analytic model and measurement of the relationships between green supply chain management implementation and corporate performance

S. Matsuno, M. Hasama, Y. Uchida, and T. Ito  
(Ube National College of Technology, Japan)

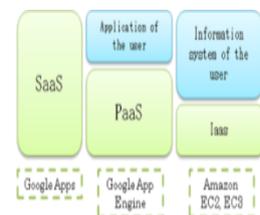
We propose and empirically test a model of the relationships between green supply chain management (GSCM) activities and corporate performance. Five constructs, namely, environmental commitment, supplier collaboration, supplier assessment, information sharing among suppliers, and business process improvement are used to form a structural model explaining the environmental and economic performance. The model was analyzed using the data from a survey of sample of manufacturing firms in Japan. The results suggest that the degree of supplier collaboration has an influence on the environmental performance directly. While, the impact of supplier assessment on the environmental performance is mediated by the information sharing and/or business process improvement.



### OS6-4 A Study of Open Source Cloud System for Small and Medium Enterprise

Y. Uchida<sup>1</sup>, S. Matsuno<sup>1</sup>, T. Ito<sup>1</sup>, M. Hasama<sup>1</sup>, M. Sakamoto<sup>2</sup>  
(<sup>1</sup>Ube National College of Technology, Japan)  
(<sup>2</sup>University of Miyazaki, Japan)

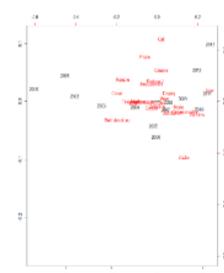
The use of cloud services among SMEs remains low, and R&D and technical support for SMEs is an urgent problem. Even so, there have been almost no academic studies on the relationship between cloud computing and SME information infrastructure, or on the future direction of this. With this background, we considered and designed a cloud system framework suitable for SMEs, built a prototype model and investigated the ease of implementation. Services that deliver functionality equivalent to Amazon EC2 which is representative cloud service but delivered through other technologies are called EC2 clones. OpenStack is not EC2 clone, and is a typical open source project for providing Infrastructure as a Service (IaaS) type cloud services. OpenStack was used in this study to implement a simple cloud service model.



### OS6-5 Visualization of Patent Strategies in Japanese ICT Companies Based on Text-Mining

T. Tokumitsu<sup>1</sup>, T. Okada<sup>1</sup>, I. Nakaoka<sup>1</sup>, Y. Park<sup>2</sup>  
(<sup>1</sup>Ube National College of Technology, Japan)  
(<sup>2</sup> Prefectural University of Hiroshima, Japan)

We deduce that a major reason of the continual poor business performances in most Japanese ICT companies is that they have lost their technology innovation strategies. Especially in smartphone market, Japanese ICT companies have lagged behind foreign companies such as Samsung and Apple. Therefore, we conduct longitudinal research of three Japanese large ICT companies, SONY, Panasonic and Sharp, in smartphone market based on text-mining approach covering their patent information. A visualized result of patent strategies by SONY is shown in the figure. We analyze the other two companies, Panasonic and Sharp, in the same way, and reveal characteristics of their patent strategies.

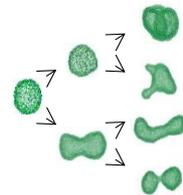


## OS7 Intelligence in Biological Systems

### OS7-1 Dissipative Particle Dynamics of shape changes of vesicle

Yoshiyuki Oofuji, Naohito Urakami, Takashi Yamamoto (Yamaguchi University, Japan)  
Masayuki Imai (Tohoku University, Japan)  
urakami@yamaguchi-u.ac.jp

Spherical vesicles change to various shapes such as oblate type, prolate type, stomatocyte, etc., according to the osmotic pressure difference between the inner and the outer vesicle. The shape changes of vesicles are very important to understand the living cell activities. In the research, we investigated the process of the shape changes of vesicles by carrying out dissipative particle dynamics simulations. The shape changes of vesicles were reproduced by the variation of two parameters, the number of water molecules inside the vesicle and the difference between the number of lipid forming the inner and the outer leaflets in the vesicle. The vesicle shapes obtained in our simulations were in good agreement with the experiments. The simulation result indicates that the vesicle shapes are determined by two parameters.

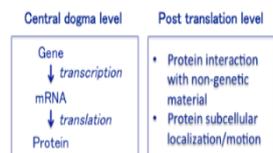


Shape changes of vesicles

### OS7-2 Intelligent mechanisms in *E. coli* in processing carbon sources

Zhongyuan Tian, Hiroshi Matsuno (Yamaguchi University, Japan)

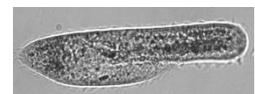
*E. coli* is “wise” enough to take suitable responding time, and suitable responding behaviors, when facing different lengths or intensities of stimuli. According to the time cost of a respond to a signal, we divide the intracellular processes into 2 levels: the *central dogma level* and the *post translation level*. Firstly, we constructed a systematical network of glucose, PTS, glycogen and chemotaxis system. And this network plays a function as a switch, which controls *E. coli*'s motion within the first few seconds. By using this switch, we unveiled a fact that shorter time stimuli result in the *post translation level* reactions for quicker response. But longer time stimuli will activate more time consuming the *central dogma level* reactions. Secondly, different intensities of signals result in different kinds of actions, was illustrated by ppGpp example.



### OS7-3 An autonomous propagation of ciliary metachronal wave on elastic surface of *Paramecium* cells.

N. Narematu and Y. Iwadate  
(Yamaguchi University)

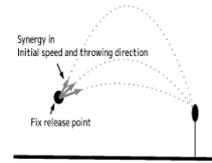
Ciliary movements in protozoa show metachronal coordination so as to maintain a constant phase difference between adjacent cilia. This coordination is called as “metachronal wave”. It is now generally thought that metachronal waves arise from hydrodynamic coupling between adjacent cilia at extracellular fluid. However, under the breakdown the hydrodynamic coupling of ciliary movements at a restricted portion of a *Paramecium* cell, metachronal waves pass over the portion. We will discuss the mediator of propagation of metachronal waves.



## OS7-4 An analysis of the synergy in a ball throwing task

Hiroshi KIMURA, Jun NISHII  
(Yamaguchi University, Japan)

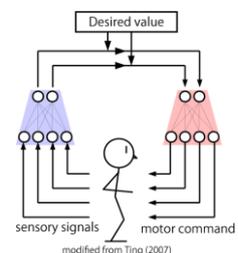
To throw a ball into a given target, we must adequately select the initial state of the ball, the position, speed, and throwing direction at ball release. There are two ways in the choice of these variables. The first solution is to learn a desired value set for these state variables and try to adjust the variables to the desired values. Another solution is to allow the variance of each variable in every trial but compensate for the values each other in a cooperative manner so as to hit the target. The purpose of this study is to find how good throwers select the state variables in throwing and elucidate the knack of the ball throwing task.



## OS7-5 A low dimensional feedback control model that exploits abundant degrees of freedom of freedom

Jun Nishii, Tohru Hamamura  
(Yamaguchi University, JAPAN)

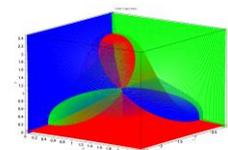
When animals perform skilled motor task, they often adaptively choose a solution depending on the circumstances by utilizing abundant degrees of freedom (DOFs) of their body. For instance, a spinal frog can wipe an irritating stimulus off by its foot even if a leg joint is fixed so as not to be able to bent. In this example, multiple leg joints cooperatively work so as to control the foot position by utilizing available joints. Such compensative control among multiple joints is called joint synergy. We propose a simple neural network model that realizes synergetic control that exploits abundant degrees of freedom.



## OS7-6 Extension of Genetic Toggle Switch Based on the Effective Search of State Transitions

M. Sugii, A. Fauré and H. Matsuno (Yamaguchi University, Japan)  
manabu@yamaguchi-u.ac.jp

In the context of synthetic biology, artificial genetic circuits are designed in the following way: after setting a biological target phenomenon to be investigated, reaction parameter estimations among related molecules are conducted based on the dynamic analyses with mathematical models. Finally a system of biological reactions is developed with these molecules in vivo or in vitro. We propose a new procedure to effectively design a mathematical model in two steps. The first step is the creation of possible network architectures under a logical formalism. The second step is the creation of dynamic models. We report an extension of a genetic toggle switch from 2-state to 3-state by our proposed procedure.



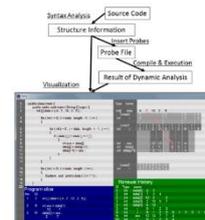
Nullclines of  
3-state toggles witch

## OS8 Software Development Support Method

### OS8-1 Proposal of a Visualizing Method of Data Transitions to Support Debugging for Java Programs

Hiroto Nakamura<sup>1</sup>, Tetsuro Katayama<sup>1</sup>, Yoshihiro Kita<sup>2</sup>, Hisaaki Yamaba<sup>1</sup>,  
Naonobu Okazaki<sup>1</sup>,  
(<sup>1</sup>University of Miyazaki, Japan)  
(<sup>2</sup>Kanagawa Institute of Technology, Japan)

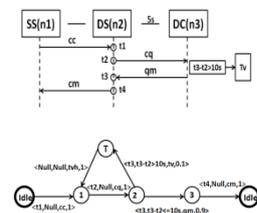
Finding the cause of a bug needs to comprehend a flow and data transitions in executing programs. It is difficult to grasp behavior in executing the programs whose behavior is unexpected by a bug. We propose a visualizing method of data transitions to support debugging for Java programs in order to improve efficiency of debugging by supporting to find the cause of a bug. We have implemented TVIS in order to show efficiency of the proposed method. The data transitions diagram is the most characteristic function of TVIS which shows the data transitions in executing programs as a table. It can show visually abnormal behavior: no data renewed at all, data abnormally renewed, and so on. Because abnormal behavior is detected in the data transitions diagram at first glance, it is useful for programmers in finding the cause of a bug.



### OS8-2 Proposal of a Method to Build Markov Chain Usage Model from UML Diagrams for Communication Delay Testing in Distributed Systems

Zhijia Zhao<sup>1</sup>, Tetsuro Katayama<sup>1</sup>, Yoshihiro Kita<sup>2</sup>,  
Hisaaki Yamaba<sup>1</sup> and Naonobu Okazaki<sup>1</sup>  
<sup>1</sup>University of Miyazaki, Japan <sup>2</sup>Kanagawa Institute of Technology, Japan  
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yamaba@cs.miyazaki-u.ac.jp, oka@cs.miyazaki-u.ac.jp

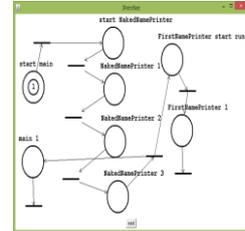
As the growth of network technology with high parallelism and high reliability of distributed systems, they have been widely adopted in the enterprise and society. But, how to design for testing the real-time or a communication delay of distributed systems is not been discussed much. This paper proposes a new method to automatically build Markov Chain Usage Model. The proposed method establishes the time points and builds a new UML diagram called De-sequence diagram by combining the deployment diagram and sequence diagram which can test the communication delay of a distributed system to improve its reliability. We have confirmed the usefulness of the proposed method to adapt it to practical examples.



### OS8-3 Proposal of a Supporting Method for Debugging to Reproduce Java Multi-threaded Programs by Petri-Net

Shoichiro Kitano<sup>1</sup>, Tetsuro Katayama<sup>1</sup>, Yoshihiro Kita<sup>2</sup>, Hisaaki Yamaba<sup>1</sup>, Naonobu Okazaki<sup>1</sup>  
(<sup>1</sup>University of Miyazaki, Japan)  
(<sup>2</sup>Kanagawa Institute of Technology, Japan)

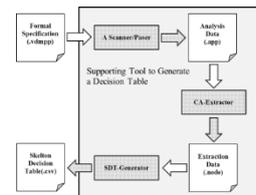
In multi-threaded programs, it is difficult to discover a cause of bugs. This paper proposes a supporting method using Petri-net for debugging so that programmers can discover cause of bugs in multi-threaded programs written in Java language. Specifically, in order to give reproducibility to multi-threaded programs, the proposed method generates a data file for an execution path of a multi-threaded program, and simulates the behavior of the program by Petri-net based on the data file. However, ordinal Petri-net cannot express the behavior of multi-threaded programs written in Java completely. Therefore, we have extended Petri-net so that we can treat with the behavior of multi-threaded Java programs. In addition, we have confirmed validity of our method by having implemented a supporting tool.



### OS8-4 Proposal of a Supporting Method to Generate a Decision Table from the Formal Specification

Kenta Nishikawa<sup>1</sup>, Tetsuro Katayama<sup>1</sup>, Yoshihiro Kita<sup>2</sup>, Hisaaki Yamaba<sup>1</sup>, Naonobu Okazaki<sup>1</sup>  
(<sup>1</sup>University of Miyazaki, Japan)  
(<sup>2</sup>Kanagawa Institute of Technology, Japan)

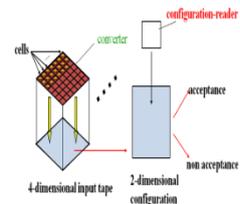
As a means for writing specifications strictly, the formal methods are proposed. By the way, as one of the test design techniques, the decision table is proposed in the testing process of the software cycle. However, it takes much time and effort to extract test items and understand contents written on specifications in designing manually the decision table. This paper proposes a supporting method to generate a decision table from the formal specification in order to improve efficiency of the test design with formal methods. We have implemented a supporting tool to generate a decision table. It automatically generates a skeleton decision table from the formal specification. By using the tool, it is considered that the efficiency of the test design is improved.



**OS9 Foundation of computation and its application**  
**OS9-1 Hierarchy Based on Neighborhood Template about k-Neighborhood Template**  
**A-Type Three-Dimensional Bounded Cellular Acceptor**

Makoto Sakamoto<sup>1</sup>, Makoto Nagatomo<sup>1</sup>, Xiaoyang Feng<sup>1</sup>, Tatsuma Kurogi<sup>1</sup>, Tuo Zhang<sup>1</sup>, Takao Ito<sup>2</sup>,  
 Yasuo Uchida<sup>2</sup>, Tsunehiro Yoshinaga<sup>3</sup>, Satoshi Ikeda<sup>1</sup>,  
 Masahiro Yokomichi<sup>1</sup>, Hiroshi Furutani<sup>1</sup>  
 (<sup>1</sup>University of Miyazaki, Japan)  
 (<sup>2</sup>Ube National College of Technology, Japan)  
 (<sup>3</sup>Tokuyama College of Technology, Japan)

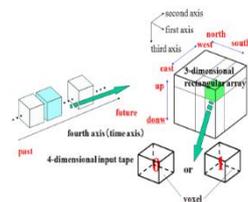
In this paper, we introduce a new computational model, k-neighborhood template A-type three-dimensional bounded cellular acceptor on four-dimensional tapes, and discuss some basic properties. This model consists of a pair of a converter and a configuration-reader. The former converts the given four-dimensional tape to three-dimensional configuration. The latter determines whether or not the derived three-dimensional configuration is accepted, and concludes the acceptance or non-acceptance of given four-dimensional tape. We mainly investigate how the difference of the neighborhood template of the converter affects the accepting powers of this computational model. It is well known that three-dimensional digital pictures have 6- and 26-connectedness. However, we include the remarkable picture in neighbor.



**OS9-2 Hierarchy Based on Configuration-Reader about k-Neighborhood Template A-Type**  
**Three-Dimensional Bounded Cellular Acceptor**

Makoto Sakamoto<sup>1</sup>, Tuo Zhang<sup>1</sup>, Tatsuma Kurogi<sup>1</sup>, Makoto Nagatomo<sup>1</sup>, Xiaoyang Feng<sup>1</sup>, Yasuo Uchida<sup>2</sup>,  
 Takao Ito<sup>2</sup>, Tsunehiro Yoshinaga<sup>3</sup>, Satoshi Ikeda<sup>1</sup>, Masahiro Yokomichi<sup>1</sup>, Hiroshi Furutani<sup>1</sup>  
 (<sup>1</sup>University of Miyazaki, Japan)  
 (<sup>2</sup>Ube National College of Technology, Japan)  
 (<sup>3</sup>Tokuyama College of Technology, Japan)

Question of whether or not processing four-dimensional digital patterns is more difficult than processing two- or three-dimensional ones is of great interest from both theoretical and practical standpoints. Thus, the study of four-dimensional automata as the computational models of four-dimensional pattern processing has been meaningful. From this point of view, we are interested in four-dimensional computational model, and we first proposed four-dimensional automata as computational models of four-dimensional pattern processing in 2002. In this paper, we introduce a new computational model, k-neighborhood template A-type three-dimensional bounded cellular acceptor on four-dimensional tapes, and mainly investigate how the difference of configuration-reader affects the accepting powers of this model.



### OS9-3 Handicap of Othello Game

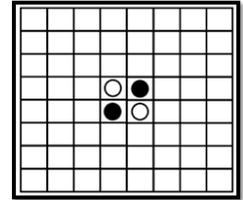
Y. Kato<sup>1</sup>, S. Ikeda<sup>1</sup>, T. Ito<sup>2</sup>, M. Sakamoto<sup>1</sup>

(<sup>1</sup>University of Miyazaki, Japan)

(<sup>2</sup>Ube National College of Technology, Japan)

In the game of Go, it is known experientially that Black (=the first move) is advantageous. Thus, in the game of Go, White (=the defensive hand) has received a handicap for this compensation. There is Othello game well known as the Go. However, the handicap of White in Othello game has been hardly considered until now. This research considered quantitatively the handicap in Othello game from a viewpoint of points. As our conclusions of Othello game is the followings.

- The advantage of the defensive hand on board of  $4 \times 4$  is -0.641 points on average.
- The advantage of the defensive hand on board of  $4 \times 6$  is 0.778 points on average.



### OS9-4 On Parameter Setting in Identifying the Same Languages Involved in Different Language Data

Ren Wu<sup>1</sup>, Hiroshi Matsuno<sup>2</sup>

(<sup>1</sup>Yamaguchi Junior College, Japan)

(<sup>2</sup>Yamaguchi University, Japan)

We have proposed a method based on tree structure and string alignment technique for identifying the same languages involved in two language classification trees provided by different linguists. Several kinds of similarity measure, such as language name similarity and language general similarity etc., and an algorithm are proposed in this method. Several unknown parameters are used there and need to be set to constants first for calculating the similarity values. This paper aims to determine all the values of these parameters and then get the identification results in order to confirm that our proposed similarity measures and the algorithm are useful and effective. We obtained better values for the parameters throughout the experiments.

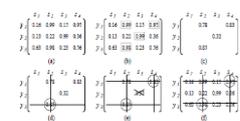


Fig. 4. Process of finding same languages

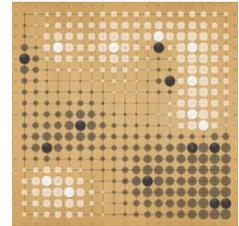
## GS

### GS1 Artificial intelligence & Complexity

#### GS1-1 Cognitive approach to Computer Go programming

N. Tenys, I. Tanev, K. Shimohara  
(Doshisha University, Japan)

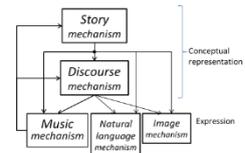
Go (Igo) is an ancient board game that is still one of the more difficult challenges for Artificial Intelligence research. While computers have defeated human champion in chess 16 years ago, to this day best computer Go programs play only at a high amateur level. Humans play Go using experience, heuristic values, pattern recognition and whole-board evaluations that computers are unable to match. Today's most successful Go programs use Monte Carlo search algorithm, but while this approach often finds good local moves on the board, due to its random nature it often fails to see the whole board position as well as human does. Our approach instead is implementation of human Go professional's "thinking" into a computer program that is, creating a system, where computer uses algorithms and data constructs that mimic human's mind.



#### GS1-2 Circulative Narrative Generation Based on the Mutual Transformation between Narrative Conceptual Structures and Music in the Integrated Narrative Generation System

Taisuke Akimoto, Takashi Ogata  
(Iwate Prefectural University, Japan)

We have proposed a new framework of narrative generation which generates narratives through the mutual transformation according to various pathways between narrative (conceptual representation) and music. This paper will continuously incorporate this framework into the integrated narrative generation system which is a comprehensive architecture for our narrative generation study and develop an experimental system combined with the integrated system. This new framework aims to apply various musical methods for composition and variation to narrative generation as a way to connect different types of media. An experiment of the mutual generation between music and narrative will show various transformation pathways or routes between music and narrative.



### GS1-3 Non-minimal Dynamics of Tensegrity Systems Subject to Arbitrary Joint Constraints

Youngsu Cho and Joono Choeng  
(Korea Univ., Korea)

This paper provides a dynamics formulation of tensegrity systems using non-minimal coordinates subject to arbitrary joint constraints. Advantages of non-minimal dynamics including the simplicity of formulation and scalability are enjoyed. We start from a matrix form of dynamics and then transform the dynamics into a vector form so that arbitrary constraints in the joints can be handled with ease. Due to the generality of the formulation, we can create a software module that can carry out dynamic simulation of numerous tensegrity systems. To illustrate the effectiveness of the proposed dynamics formulation, we show simulation results for a deployable tensegrity structure and a multi-stage tensegrity prism under various types of joint constraints such as pin, revolute, and planar types.

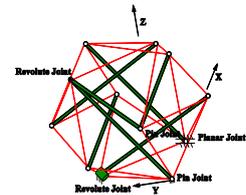


Figure 1. Tensegrity system with constraints

### GS1-4 Road map generation from Smartphone data

Masao KUBO, Chau viet DAN, Hiroshi SATO, Akira NAMATAME  
(National Defense Academy of Japan)

Smartphones become widespread quickly. This type of mobile phone has a built-in GPS, motion sensor, digital compass and large memory and battery. It is good for recording human activity. In this paper, we introduce a method to make occupancy grid map when the user drive outside. Usually, the vehicle behavior is analyzed by a time series of accelerations sensed by customized sensors installed on vehicle. The data is high quality for understanding but it is difficult to collect data from the public. The data recorded by a smartphone is lower accuracy and the pose is unknown. Our method uses GPS data mainly.



### GS1-5 Zigzag-Perceptually Important Points for Financial Time Series Indexing

Chawalsak Phetchanchai, Ali Selamat, Md Hafiz Selamat  
(University Teknologi Malaysia, Malaysia)

In this paper, we propose a zigzag based m-ary tree (ZM-Tree) to index financial time series. The index is done by mean of zigzag-perceptually important points (ZIPs). The tree represents the zigzag feature of financial time series which benefits in reversal pattern searching, and wave counting. We also propose a method of identifying ZIPs in multi-resolution. The identification process uses the vertical distance as a measurement to evaluate the point importance. The experiments demonstrate the performance of ZM-Tree in tree building, tree retrieval, tree pruning, and dimensionality reduction

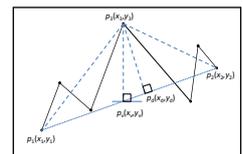


Fig. 2. Measurement of PIP-ED, PIP-PD, and PIP-VD

## GS2 Reinforcement Learning System & Genetic programming GS2-1 Development of phrase and music search engine by humming

Kiminori Satou, Eiji Hayashi  
(Kyushu Institute of Technology, Japan)

In recent years, the internet has become ubiquitous and is changing dramatically every aspect of how people live their lives. Users not only can purchase the CD at home but also can download the music files without leaving home using the internet, it is very easy and convenient for users who can find the lyrics. But the music's names are not able to be efficiently searched if users forget the music's names. Then, enter the voice, do a search using that voice's length and pitch, find the rhythm and pitch similar phrases, and thought that it is possible to determine the name of the song. Therefore, we developed a phrase and music search engine that searches a tune from various tunes with one phrase of voice data.



## GS2- 2 Human Recognition based on Gait feature and Genetic Programming

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

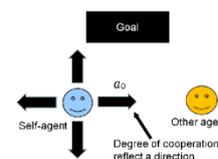
Human walking has always been the curious field of research for different disciple of Social and Information Science. The study of human walk or human gait in association with different behaviors and emotions has not only fascinated social science researcher, but its uniqueness has also attracted many computer scientist to work in this arena for the quest of uncovering reliable mechanism of biometric identification. In this research we use new method for human identification based on human gait features and genetic programming (GP) approach.



## GS2-3 An Action Selection Method Using Degree of Cooperation in a Multi-agent System

Masanori Kawamura, Kunikazu Kobayashi  
(Aichi Prefectural University, Japan)

In recent years, a concept of a dividual is proposed to interact properly with another person. To construct a model of the dividual, the degree of cooperation is assigned to the corresponding dividual. By introducing the degree of cooperation into multi-agent systems, we evaluate what kind of changes appears in the agent behavior. In addition, we propose an action selection method by introducing the degree of cooperation into the soft-max method in multi-agent systems. Using the proposed method, we confirm whether the cooperative action is promoted or suppressed through computer simulations.



## GS2-4 Cooperative Action Acquisition Based on Intention Estimation Method in a Multi-agent Reinforcement Learning System

Tatsuya Tsubakimoto, Kunikazu Kobayashi  
(Aichi Prefectural University, Japan)

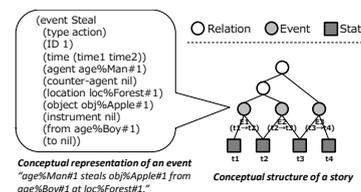
In this paper, we propose a method that can acquire cooperative action to reach an appropriate goal without controlling reward to realize cooperative action by designers. We assume every action of other agents as a process to achieve an ultimate goal and then treat it unimportant. In order to confirm the effectiveness of the proposed method, we carried out computer simulations. The simulation results show that the proposed method is superior to a standard Q-learning method and a Q-learning method with cooperation in terms of the number of successful cooperation.



## GS2-5 Integrating the Event Generation Mechanism in the Propp-based Story Generation Mechanism into the Integrated Narrative Generation System

Shohei Imabuchi, Takashi Ogata  
(Iwate Prefectural University, Japan)

In the Propp-based story generation mechanisms and the integrated narrative generation system which we have been developing, the former functions as a module in the latter. These systems have used respective event generation mechanisms to generate events which are the most important units in a narrative structural representation. A common event generation mechanism needs to be used in these two systems towards the complete blending. This paper will present the first tentative attempt as a prototype to be revised in the future.

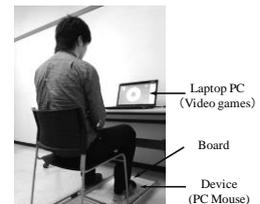


## GS3 Human-machine cooperative systems & Human welfare robotics

### GS3-1 Development of Measurement System for Quantitative Evaluation of Skillfulness of Lower Extremities

Kazunori Yamazaki<sup>1</sup>, Donggun Kim<sup>1</sup>, Yoshifumi Morita<sup>1</sup>, Hiroyuki Ukai<sup>1</sup>  
Kenji Kozakai<sup>2</sup>, Satoru Shibata<sup>2</sup>, Shigenori Onishi<sup>2</sup>, Akihiro Ito<sup>2</sup>, Daisuke Mizuno<sup>2</sup>  
Tatsuya Hirai<sup>3</sup>, Haruna Takeda<sup>3</sup>, Yuka Sugiura<sup>3</sup>  
(<sup>1</sup>Nagoya Institute of Technology, Japan),  
(<sup>2</sup>Sanyo Machine Works, Ltd., Japan),  
(<sup>3</sup>Tanakakai Nishio Hospital, Japan)

In this study, we developed a quantitative evaluation method of the skillfulness of the lower extremities. For this purpose, we used the measurement system which we have developed in our previous work and redesigned the target trajectories of foot movement. Moreover, we verified the reliability of the proposed quantitative evaluation method by calculating the intra-subject reliability for two trials ICC(1,1) of the evaluation results. We developed a measurement system comprising the straight course, the circular course and the star-shaped course. Because the ICC(1,1) of the circular course and the star-shaped course are higher than 0.7, the quantitative evaluation method of lower extremities with the circular course and the star-shaped course has sufficient reliability.



### GS3-2 Glove-Based Virtual Interaction for the Rehabilitation of Hemiparesis Stroke Patient

Khairunizam WAN, Aswad A.R, Rashidah Suhaimi, Nazrul H. ADNAN, D. Hazry,  
Zuradzman M. Razlan, Syed Faiz Ahmed  
(Universiti Malaysia Perlis, Malaysia)

This paper proposes the rehabilitation of a stroke patient by using dataglove called *GloveMAP*. *GloveMAP* is a low cost hand glove developed by using flexible bending sensor and accelerometer attached at the position of the fingers and wrist, respectively. The rehabilitation exercises are conducted in the virtual environment. In the studies, 22 fundamental movements of arm are evaluated and the results are employed to design the virtual environment. The combination of these fundamental movements focuses on Hemiparesis sufferers which are the most common in the stroke and have the inability to move one side of the body. The experimental results show that by combining several fundamental arm movements, glove based-virtual interaction supports the stroke patient do the rehabilitation by them without assisting from physiotherapist.

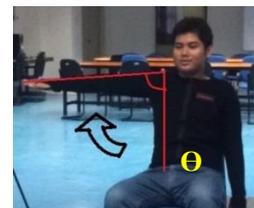
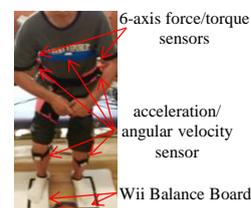


Figure. 1 Performing the fundamental arm movement

### GS3-3 Measuring system of therapist's guiding motion for standing up training of patient with hemiplegia after stroke and analysis results of patient's motion

JungTang Wang<sup>1</sup>, Kazunori Yamazaki<sup>1</sup>, Yoshifumi Morita<sup>1</sup>, Noritaka Sato<sup>1</sup>, Hirofumi Tanabe<sup>2</sup>  
(<sup>1</sup>Nagoya Institute of Technology, Japan)  
(<sup>2</sup>Self-Defense Force Central Hospital, Japan)

In this paper we developed a measuring system to analyze the therapist's guiding motion during the standing up training of a hemiplegic stroke patient. To confirm the usefulness of the developed measuring system, we measured the motion of a hemiplegic stroke patient during the standing up training with/without the therapist's guiding motion. By comparing the results of the patient's left/right weight balance during the standing up motion with/without the therapist's guiding motion, the effectiveness of the therapist's guiding motion was confirmed. Moreover, the measured patient's motion with/without the therapist's guiding motion agrees with the therapist's observation. Therefore, the usefulness of the measuring system was confirmed.



### GS3-4 Image Segmentation of Coronary Artery Plaque Using Intuitionistic Fuzzy C-Means Algorithm

Zahra Rezaeia, Ali Selamata, Mohd Shafry Mohd Rahima, Mohammed Rafiq Abdul Kadirb  
(Universiti Teknologi Malaysia)

Every year, hundreds of thousands of people die because of Coronary Heart Disease (CHD) in all over the world..Coronary Artery Disease (CAD) as a cardiovascular illness causes blood vessels narrowing that supply blood and oxygen to the heart . Atherosclerosis is known as the deadliest type of heart disease, which is caused by soft or "vulnerable" plaque (VP) formation in the coronary arteries. Acute Coronary Syndrome (ACS) is recognized as the first coronary atherosclerosis indicator which identifies high-risk plaques. Intravascular ultrasound (IVUS) can be applied for characterization of plaque and segmentation of vessel's walls borders. Recently, Virtual Histology as a new approach based on spectral analysis of IVUS has been introduced. In this work, we applied a clustering method based on Intuitionistic Fuzzy C-means (IFCM) in order to automatic segmentation of Coronary Artery plaque using VH-IVUS images.

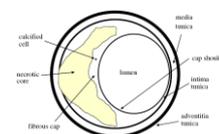


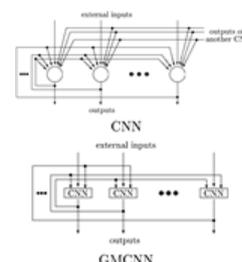
Figure 1. Arterial plaque geometry. Cross-sectional view [2].

## GS4 Neural Networks

### GS4-1 The recollection characteristics of Generalized MCNN using different control methods

Shun Watanabe<sup>1</sup>, Takashi Kuremoto<sup>1</sup>, Kunikazu Kobayashi<sup>2</sup>, Shingo Mabu<sup>1</sup>, Masanao Obayashi<sup>1</sup>  
(<sup>1</sup>Yamaguchi University, Japan)  
(<sup>2</sup>Aichi Prefectural University, Japan)

As an auto-association memory model, chaotic neural network (CNN) proposed by Adachi et al. is able to recollect multiple stored patterns dynamically. Kuremoto et al. proposed a multi-layer chaotic neural network (MCNN) combined multiple controlled CNN layers to realize mutual association of plural time series patterns. However, recollection simulation of MCNN was limited in a two-layer model and the recollection characteristics concerning with the different external inputs and the control methods were not investigated. In this paper, we extend the MCNN to be a general form (GMCNN) with more layers and use control method using particle swarm optimization (PSO). And the recollecting characteristics of different GMCNNs using different control methods were investigated by computer simulations.



### GS4-2 Revealing Terrorism Contents from Web Page Using Frequency Weighting Techniques

Thabit Sabbah, Ali Selamat, Md Hafiz Selamat  
(Universiti Teknologi Malaysia, Malaysia)

Intelligence and security informatics plays an important role in revealing terrorism in web content. However, the extremist groups are exploiting Internet facilities intensively to stimulate violence, hatred, and terrorism. Accurate classification of web content will increase the opportunities for the effective use of intelligence and security informatics in the early detection of terrorist activities. In this paper, we propose a feature selection method based on term weighting techniques TF, DF, and TF-IDF for revealing terrorism in web content. Firstly, we compare the performance of the individual term weighting techniques in revealing terrorism. Then, we present a method for enhancing the accuracy of classification. The method was tested with selected dataset from Dark Web Portal Forum. The experimental results show that classification using

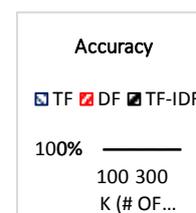
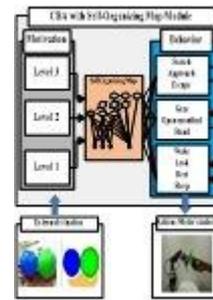


Fig. 1. Classification accuracy for individual term weighting techniques

### GS4-3 Application of Self Organizing Map for analyzing of robotic arm's action with Consciousness-Based Architecture module

Wisanu Jitviriyaya, Eiji Hayashi  
(Kyushu Institute of Technology, Japan)

Our research has been focused on developing human-robot interactions, The robot need to perform a high level of intellectual activity and user compatibility. Therefore, we considered the primary structure of a conscious human/animal action, which can be represented by the sequence process, Perception → Motivation → Action. We have improved a hierarchical structure model, which defines the relationship between the consciousness field and the behavior module. This model is called Consciousness-Based Architecture (CBA). Furthermore, the robot should select the action itself, we have investigated the application of brain-inspired technology so we introduced a Self Organizing Map (SOM) neural network that is trained using unsupervised learning to classify its behavior according to the motivation value in the CBA module. In this paper, we attempt to describe the integration of a Self Organizing Map (SOM) method into CBA module in order to classify and select autonomous behavior. We confirmed the effectiveness of the proposed system by the experimental results.



#### GS4-4 Study on Time Synchronization Algorithm of Wireless Sensor Networks Based on Maximum Likelihood Estimation

Ai Dongmei, Zeng Guangping, Tu Xuyan, He Di  
(University of Science and Technology Beijing, China)

Wireless Sensor Network (WSN) integrates technologies of wireless communication, sensing, network interconnection, and distribution. Comprised of a large amount of micro sensor networks, it can collect real-time information, monitor objects within a specific range, and send back usable information at the first time to observers. Unlike general computer networks, WSNs face the issue of constraints on energy. Hence, the time synchronization mechanism, a supporting technology for application of WSNs, isn't suitable when extensively applied to traditional network. This paper proposes High-Accurate Energy-Efficient Time Synchronization (HAEE) algorithm based on TPSN algorithm, which significantly improves the accuracy of time synchronization and reduces energy consumption, as proven by software simulation results.

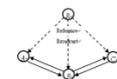


Fig. 1: Message Exchange in RBS

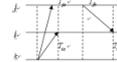


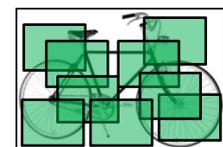
Fig. 2: RBS Synchronization Algorithm Message Transmission

#### GS5 Pattern recognition

##### GS5-1 Recognizing a Road Environment Using Multiple-window Bag of Features

Shou Morita, Joo Kooi Tan, Hyungseop Kim, Seiji Ishikawa  
(Kyushu Institute of Technology, Japan)

In this paper, we propose a method of recognizing a road environment employing bag of features considering positional information. This technique works by making multiple windows in an image. The proposed method makes a codebook in each window and computes histograms of local features found inside of the window. The original bag of features method disregards positional information in an image It is, however, important to recognition. The proposed method considers positional information in an image by introducing multiple windows. For recognition, we employ the support vector machine. Experimental results show satisfactory performance of the proposed method.



Multiple windows on an image.

##### GS5-2 Recognized Face Tracking for CONBE Robot

Sakmongkon Chumkamon, Eiji Hayashi  
(Kyushu Institute of Technology)

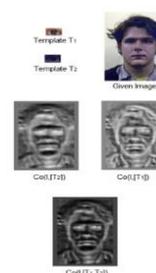
In our research we develop the robot to combine with the consciousness and behavior which is the conscious and behavior robot (CONBE). In this paper we present the basis system in the CONBE robot that consist of the two main sections as the face recognition and robot gaze tracking. This system uses the face recognition using Fisherfaces that also refer to linear discriminant analysis (LDA). For the robot gaze tracking, we implement with the head of the CONBE robot that has a camera, two displays used for robot eyes and the actuators of 2 degrees of freedom. The actuators use to control the robot gaze for tracking the face which the robot can recognize. In this paper, we experiment and present the results of the face recognition system such as frame rate, error rate; and the tracking control system such as the tracking error and time.



### GS5-3 Eye detection Using Composite Cross-Correlation form Face Images in Varied Illumination

Kutiba Nanaa, Mohamed Rizon, Mohd Nordin Abd Rahman  
(Universiti Sultan Zainal Abidin (UniSZA), Malaysia)

Facial feature detection is essential process in the field of face recognition. Template match based approach is widely used to implement the issue of facial detection. However, many obstructions adversely affect in template based implementation such as varied illumination, size, face pose and the status of eye in either open case or close case. the objective of this paper is to detect left eye and overcome the obstruction of low illumination in given image using composite cross-correlation. Two single template form the proposed composite template. First single template is created from an eye image in ordinary illumination while the second single template is created from an eye image in low illumination. The experimental results is concluded by applying our templates on the PICS Database whose varied illumination images and show that applying composite templates gives a better result than applying the both single templates individually



### GS5-4 Development of an autonomous-drive personal robot “An object recognition system using BoF and SOM”

Keisuke Ito, Eiji Hayashi (Kyusyu Institute of Technology, Japan)

In the near future, autonomous self-driving robots are expected to provide various services in human living environments. The ability to work autonomously and accurately recognize surrounding objects are required for the autonomous robot. In previous research, the robot has enabled the determination of the angle and type of the object by a matching system based on the Speeded Up Robust Features (SURF). In this paper, the authors developed the system in order to determine the type of the object by using the Self-Organizing map (SOM) and SURF features. This system can visualize the relationship of the object and determine the type of the object.

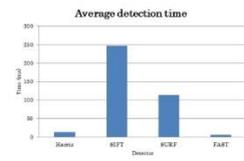


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### GS5-5 Comparison of Feature Detectors for Obstacles Detection

Shaohua Qian<sup>1</sup>, Joo Kooi Tan<sup>1</sup>, Hyoungeop Kim<sup>1,2</sup>, Seiji Ishikawa<sup>1</sup>  
Takashi Morie<sup>1</sup>, Takashi Shinomiya<sup>1</sup>  
(<sup>1</sup>Kyushu Institute of Technology, Japan)  
(<sup>2</sup>Japan University of Economics, Japan)

Detection of obstacles in a video sequence is a basic task in autonomous collision avoidance systems of intelligent vehicle. We have already proposed an obstacles detection method using a video taken by a vehicle-mounted monocular camera. In this method, accurate obstacles detection depends on whether we can accurately detect and match feature points. In order to improve the accuracy of obstacles detection, in this paper we make a comparison between four most commonly used feature detectors: Harris, SIFT, SURF and FAST detectors. The experiments are done using our obstacles detection method. The experimental results are compared and discussed, and then we find the most suitable feature point detector for our obstacles detection method.



## GS6 Robotics I

### GS6-1 Study on the pose under complex multiple targets environment for the industrial robot based on machine vision

Jiwu Wang<sup>1</sup>, Xianwen Zhang<sup>1</sup>, Huazhe Dou<sup>1</sup>, Sugisaka Masanori<sup>2</sup>  
 (<sup>1</sup> Beijing Jiaotong University, China)  
 (<sup>2</sup> Nippon Bunri University, Japan)

Effectively obtaining multiple targets pose is the key element to improve flexible applications of industrial robots under complicated working environments. Machine vision technology is the main method to solve this problem. In order to effectively reduce influence of changing conditions (such as the illumination, angle and scale etc.) on target pattern recognition, the fusion algorithms of scale invariant feature transform (SIFT) and geometric moment, is developed in this paper. To achieve accurate identification of multi-targets' pose when their position and orientation change in the two-dimensional space, the optical-section method is used to determine the depth information of some feature points of the target. Moreover, that data is used to correct the pose recognized by the traditional pattern technology. Finally, using SCARA-type industrial robots as a platform, the relative algorithms are verified with corresponding experiments.



Fig.5. The industrial robot recognition system

### GS6-2 Research and Development of an Intelligent Robot of Medical Assistance Based on Embedded RTOS

Yuan Li, Fengzhi Dai, Junhong Xi, Binyao Li, Guodong You  
 (Tianjin University of Science and Technology, P. R. China)

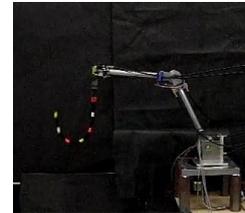
For practical purpose, this paper focuses on design and implementation of a wheeled intelligent robot that could be applied in hospitals or nursing homes for medical assistance. The hardware part includes two microcontrollers, MC9S12XS128 and STC89C52, assisted by a laptop as the control center of the system, various sensors and other robotic pieces. The software part is basically achieved on CodeWarrior 5.0, Keil  $\mu$ Vision4 and Visual C++ 6.0 with OpenCV library, porting  $\mu$ C/OS-II real-time operating system to MC9S12XS128 in order for improving stability and flexibility of the system. The robot has functions of infrared remote control, fuzzy rule-based path tracking, obstacle avoidance, real-time LCD display and voice broadcast, color recognition and robot arm grasping.



### GS6-3 High Acceleration Robotic Arm for Dynamic and Dexterous Manipulation of Deformable Object

Hiroaki Seki<sup>1</sup>, Hiroki Shibata<sup>1</sup>, Yoshitsugu Kamiya<sup>1</sup>, Masatoshi Hikizu<sup>1</sup>,  
Khairul Salleh Mohamed Sahari<sup>2</sup>  
(<sup>1</sup>Kanazawa University, Japan)  
(<sup>2</sup>Universiti Tenaga Nasional, Malaysia)

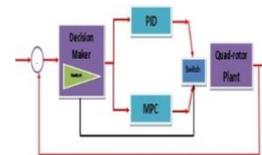
Deformable object manipulation is very important for home service robots. This paper discusses the development of a high acceleration robotic arm capable of performing dexterous manipulation of deformable object such as string. A mass-spring model of the string is first developed to study the design requirement of the robot as well as to determine the required motion of the robot to smartly manipulate the string. The developed system comprising of the string model and robotic arm is then used to manipulate unknown string. Based on some simple basic routine, the parameters of the string can be approximated based on the string model. Once the parameters are known, the string can be smartly manipulated by the robotic arm.



### GS6-4 Hybrid controller design for wind burst and noise rejection in smooth takeoff / landing and altitude controlling of quad-rotor

M. Hassan Tanveer, D. Hazry, S. Faiz Ahmed, M. Kamran Joyo, Faizan. A. Warsi  
(Universiti Malaysia Perlis (UniMAP) Malaysia)

This article evaluates the proposed control technique for altitude controlling of Quad-rotor type unmanned Aerial Vehicles under different uncertainty conditions. Smooth takeoff and landing i.e. altitude controlling of Quad-rotor UAV under perturbed conditions such as high wind burst and system or sensor noises has been a challenging research domain for the researchers. In this paper a Hybrid controller is purposed for batter controlling of quad-rotor's altitude through MPC and PID controller. This hybrid controller works in such a way that quad-rotor's sensor and system noises problem are handled by MPC controller and in the occurrence of external disturbances, auto-tuned PID controller is activated and well manage the situation. Simulations are done on MATLAB and results shows the effectiveness of the proposed hybrid method and suggest it as a promising way for real time implementation in altitude stabilization for quad-rotor UAV



Proposed Hybrid Controller:

### GS6-5 Parameters of Gas-Liquid Flow Distribution Uniformity in Upward Multi-Pass Channels

Zuradzman M. Razlan<sup>1</sup>, R. Heng<sup>1</sup>, D. Hazry<sup>1</sup>, A.B. Shahrman<sup>1</sup>, Khairunizam WAN<sup>1</sup>, S. Faiz Ahmed<sup>1</sup>,  
Nazrul H. ADNAN<sup>1</sup>, M. Hirota<sup>2</sup>, N. Maruyama<sup>2</sup>, A. Nishimura<sup>2</sup>, H. Hisyam<sup>3</sup>.  
(<sup>1</sup> Universiti Malaysia Perlis, Malaysia)  
(<sup>2</sup> Mie University, Japan)  
(<sup>3</sup>Lean Applied Pte. Ltd., Malaysia)

The gas-liquid flow distributions in multi-pass upward parallel channels that simulate the evaporator for an electric vehicle air-conditioner system were examined experimentally. In this paper, the attentions are to discover the most influenced parameter to the flow distribution uniformity by using design of experiment method. Experiments were conducted in an isothermal air-water flow system. In the mist-flow inlet, the water distribution was insensitive to the backpressure conditions and its uniformity was improved in comparison with that in the stratified-flow inlet. The flow distribution uniformity for gas phase is influenced mostly by superficial air velocity, and the flow distribution uniformity of liquid phase is mostly influence by 2-way interaction of parameters which are flow pattern and superficial air velocity.

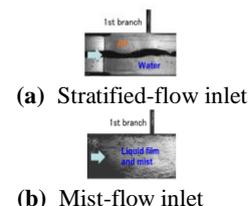


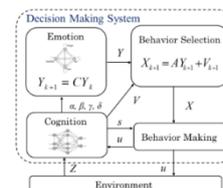
Fig. 1 Flow-inlet conditions

## GS7 Robotics II

### GS7-1 Decision Making System of Robots Introducing a Re-construction of Emotions Based on Their Own Experiences

Shogo Watada, Masanao<sup>1</sup> Obayashi<sup>1</sup>, Takashi Kuremoto<sup>1</sup>, Shingo Mabu<sup>1</sup>, Kunikazu Kobayashi<sup>2</sup>  
(<sup>1</sup>Yamaguchi University, Japan)  
(<sup>2</sup>Aichi Prefectural University, Japan)

We already proposed a decision making system for autonomous robots, which is based on a Markovian emotional model proposed by Banik. In our proposed system, decision making of the robot is designed automatically by two processes. The first is a construction of emotions based on learning of the input stimuli. The second is optimization of behavior selection policy for emotions by optimization of system parameters which define behavior selection probability of each emotion. In our above previous studies, a construction of emotions based on learning of the input stimuli was processed using learning samples of input stimuli on offline in advance. In this study, we introduce an experiences-based reconstruction of emotions to our decision making system as an approach to an automatic construction of decision making online learning.



### GS7-2 Visual Servoing and Sound Localization in a Surveillance Robot

So-Yeon Park, Yeoun-Jae Kim and Ju-Jang Lee  
(KAIST, Korea)

The purpose of this paper is to explain the control and implementation details of the visual servoing and sound localization in a tank shaped surveillance robot. With an eye in hand camera configuration, the key point of the visual servoing is to measure the depth to the target object. In this paper, we suggested the depth estimation technology by moving the camera in a lateral plane. In sound localization, the hardware and software details are fully explained to implement the sound localization technology. Especially the electronic filter design is implemented by utilizing the genetic algorithm.



### GS7-3 Study on the improvement of flexibility for an industrial robot based on machine vision

Jiwu Wang<sup>1</sup>, Xianwen Zhang<sup>1</sup>, Weining Zhang<sup>1</sup>, Sugisaka Masanori<sup>2</sup>  
(<sup>1</sup> Beijing Jiaotong University, China)  
(<sup>2</sup> Nippon Bunri University,)

In order to improve the applications for an industrial robot, it is necessary to increase its flexibility and control accuracy. Many algorithms and control strategies are developed, in which machine vision gets more and more attention. This is because the CCD camera can provide more information than other sensors, which makes the whole control process simple. But it requires that the target position should be extracted accurately and robustly. Moreover, the frequency of image processing should be satisfied with the control requirements. Here an industrial robot arm is designed and set up for experiment simulation with machine vision. The target extraction method with fusion of color space and moment invariants is developed. The experiments results showed that the developed image processing algorithms are robust, and the flexibility of an industrial robot can be improved by machine vision.

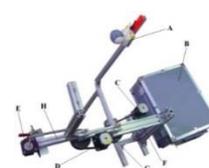
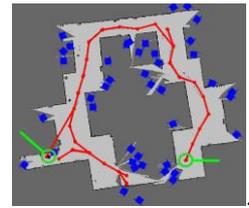


Fig.1. The illustration of the structure of the arm robot

### GS7-4 Improved Map Generation by Addition of Gaussian Noise for Indoor SLAM using ROS

Khairul Salleh Mohamed Sahari, Barry Loh Tze Yuen  
(Universiti Tenaga Nasional, Malaysia)

Rao-Blackwellized Particle Filter (RBPF) is used in this paper to solve the Simultaneous Localization and Mapping (SLAM) problem. RBPF algorithm uses particle filter where each particle carries an individual map of the environment. With the usage of Robot Operating System (ROS), GMapping package was used as a basis for map generation and SLAM. To improve the map generation, Gaussian noise was introduced to the data from laser range finder and also the odometry from the robot Pioneer P3AT's pose. The introduced algorithm was successful in decreasing the uncertainty as well as increased the knowledge of each particle in the estimation of the robot's pose, proven through practical experiment. Exploration experiments were also carried out to test the performance of P3AT based on our proposed method.

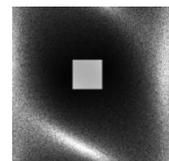


**PS**

### **PS1-1 Relationship input object position and optimal error diffusion coefficients for Kinoform using error diffusion method**

Daisuke Kashima, Ken-ichi Tanaka.  
(Meiji Univ. Japan)

We performed simplify defining optimal error diffusion coefficients for Kinoform. In order to define optimal error diffusion coefficients simply, we performed searching relationship input object position and formulating the relationship to approximation. In order to prove that approximation is true, this paper show simulation result of making reconstructing by error diffusion method.



### **PS1-2 Optimization of dither matrix by hybrid of Genetic Algorithm and Simulated Annealing**

Kohei Kato, Ken-ichi Tanaka  
(Meiji University)

Halftoning is used by ink-jet printer, color copier and so on. Dither method is the method of halftoning. Bayer method that is one of the dither methods is able to obtain a superior evaluation value compare with other dither methods, though it is the decided matrix. Several investigations of Optimization of the dither matrix are reported. However, there is no investigation from point of view of the combinational optimization problems. In this paper, we search the optimum dither matrix by Genetic Algorithm (GA) and Simulated Annealing (SA) and hybrid of GA and SA(GA/SA).We weigh conventional method against these methods.



### **PS1-3 Inverse Halftoning using Multi-Layer Feed-Forward Neural Network**

Hiroki Hamashoji, Ken-ichi Tanaka  
(Meiji University)

In this paper, we proposed novel inverse halftoning technique, which use Multi-Layer Feed-Forward Neural Network (MLFFNN) and Gaussian filtering. This method reconstruct continuous tone image from any halftoning methods. As a result, a high quality image can reconstructed from binary image compared with conventional method. Especially the proposed method image quality is good both visually and Peak Signal-to-Noise Ratio (PSNR) value, compared with reconstructs inverse halftone images by Look-up table (LUT) based inverse halftoning.



### **PS1-4 Embedding of the Confidential Image in a Dithered Color Image**

Keisuke Banba, Kenichi Tanaka  
(Meiji University, Japan)

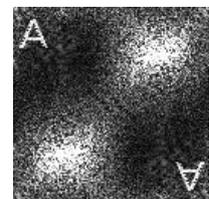
This paper proposed embedding information in dithered color image. We have developed a method of encryption using computer-generated holograms (CGH) embedded in dithered color image. First, confidential information is converted into a CGH. Next, the CGH data undergo two separate dithering processes in parallel: one corresponding to CGH white pixels and one corresponding to CGH black pixels. The results from both processes are used to form a dither matrix for creating the final dithered and encoded image. In this way, confidential information can be embedded into the image. The dither method is algorithm used for digital halftone processing. We evaluated image quality of a dithered color image, and evaluation value of the image is superior to one of conventional method.



### **PS1-5 Three Dimensional Images Reconstruction on Computer Generated Holograms the Multiple Regression Analysis**

Kenta Ayabe, Ken-ichi Tanaka  
(Meiji University, Japan)

In this paper, for a Computer Generated Hologram (CGH) reconstructing a three-Dimensional (3D) object, we present the improvement of the reconstruction image, reducing of the calculation time using error diffusion method and a multiple regression analysis. The multiple regression analysis predicts one response variable with plural explanatory variables. The purposes of this paper are reducing calculation time and improving reconstruction images. Therefore we move 26 pieces of images from A to Z at various positions. We prepare for 650 pieces of images in total and perform GA in each. We expect diffusivity for a multiple regression analysis from the result and regenerate it..



## PS1-6 Embedding used binary number conversion into a Color image

Hiroaki Oguma, Ken-ichi Tanaka  
(Meiji University, Japan)

Digital watermarking is widely used as security of a binary format image. The purpose of this paper is extension to a color image from grayscale image. Then, it thought as important giving many embedding information to a color image. A color image is divided into RGB, the concentration value of a pixel is made into a binary number, and last 3 digits are changed to arbitrary numbers. It embeds by carrying out by repeating this, and secure many information. 10x19660 times of embedding are able to be performed to the picture of 256x256 pixels. Moreover, the signal to noise ratio is about 40 db. Therefore, it seems that there is little influence which it has on a picture.

