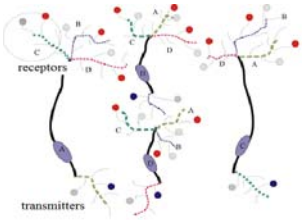
Session: GS1
Artificial brain research
GS1-1 Revisited: Hebbian postulate under homeostatic plasticity

Subha Fernando, Shuichi Matsuzaki, Yuichi Nakamura, and Ashu Marasinghe
(Nagaoka University of Technology, Japan)

We propose a new learning environment to model Hebbian Postulate under Homeostatic Plasticity with the intension of developing effective learning algorithm than the conventional Hebbian based learning algorithms. Our model perceives the human brain as a network of agents; each agent consists of large number of constituent components that play the role of synapses. Statuses of these components: active and inactive, are manipulated through the signal transmission process which is internally controlled by a combination of a stochastic process and a threshold incremental process. The number of active components at a given time determines the strength of the connectivity between two neurons. Thus making the representation of the connectivity strength of a given two neurons more dynamic than static.



GS1-2 Memory capacity and information capacity of the sparsely encoded associative memory with replacing units

Ryota Miyata, Shinnosuke Muta, and Koji Kurata
(University of the Ryukyus, Japan)

We introduce sparse encoding into the autoassociative memory model(Fig.1) with replacing units, and report that the sparsely encoded associative memory model with a small number of replacing units has a larger memory capacity and information capacity than the non-sparsely encoded one.We search the optimal number of replacing units to maximize the memory capacity and the information capacity of the model by computer simulation.We show that the optimal number of replacing units to maximize the memory capacity and the information capacity decreases as the firing ratio decreases, and that the difference of the memory capacity between sparse encoding and non-sparse encoding becomes small as the number of replacing units increases.

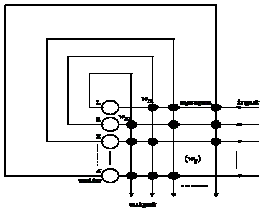
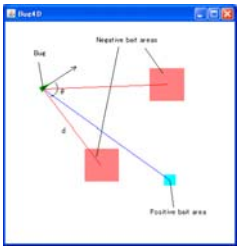


Fig. 1 The network of autoassociative memory model.

GS1-3 A study on Q-learning considering negative rewards

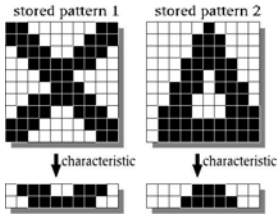
T. Fuchida, Kathy T. A, and A. Sakuragi
(Kagoshima University, Japan)

In Q-learning, a state which is the goal for the agent gives the reward 1 to the agent, and other states will give the reward 0 to the agent. When we want to show that a state which is bad for the agent, we would want to give the reward -1 to the agent. But in the normal Q-learning, only the maximum q-value in the next state must be selected even if a negative q-value would exist. In this paper, we propose a new learning method in which the negative q-value can be propagated, and show the effectiveness of this method.



GS1-4 Intelligent agent construction using the attentive characteristic patterns of chaotic neural networks

M. Obayashi, T. Kuremoto, and K. Kobayashi
(Yamaguchi University, Japan)



In the proposed intelligent agent construction, reinforcement Q-learning method is used for learning. Auto-associative chaotic neural network is also used as mutual associative memory system. However agent cannot retrieve some stored patterns exactly, in the case of too many stored patterns and strong correlation among them. To solve this problem, we propose to use kinds of attentive parameters and attentive characteristic patterns. The attentive characteristic pattern is a part of the stored patterns. When robots concentrate their attention on the specific part of the stored pattern, i.e., the attentive characteristic pattern, whole stored patterns are retrieved completely.

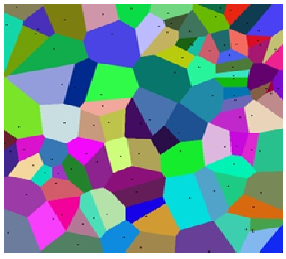
GS1-5 An effective image transmission method in ZigBee system for intruder detection systems

Seon-Ki Hwang and Sang-Gu Lee
(Hannam University, Korea)

The characteristics of ZigBee System are highly reliable, highly secure, able to use very lower power, cost effective, and an open global standard. While most wireless applications are getting to go faster, ZigBee aims for low data rate and low power. In this paper, we will propose an intruder detection system using image transmission based on ZigBee Protocol. In the proposed system, we can monitor a situation of environment using camera module on the limited situations. Image data that are divided by 4 blocks are transferred in RF communication between nodes, therefore RF communication overhead that are divided by 4 blocks are transferred in RF communication between nodes, therefore RF communication overhead are reduced. The Proposed system is composed of ATmega128 based ZigBee motes, many sensors together with RFID reader to detect an intruder and to catch hold of indoor environment, and camera modules. This system provides user convenience and effectiveness.

Session: GS2
Artificial intelligence
GS2-1 Reinforcement learning using Voronoi space division

Kathy Thi Aung and Takayasu Fuchida
(Kagoshima University, Japan)

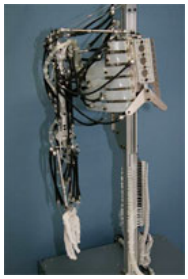


This research is concerned with the study method of the robot and program. It deals with the reinforcement learning. This characterizes normal Q-learning of discrete space as Q-table but the size of Q-table was increased rapidly by Curse of Dimensionality and it is not realistic. So, when using the Voronoi diagram for space division of reinforcement learning method creates Voronoi regions where Voronoi Q-value Elements (VQE) are to be located in the continuous state space and it has been proposed for solving the waste of space. VQE that divides Voronoi of the state space and finds the shortest distance of the input point. This paper applies Voronoi diagram for space division and indicate some results in four-dimensional spaces.

GS2-2 Machine learning approach to 9-dof robotic arm control

S. Nishioka[1], S. Maeda[1], Y. Nakamura[2], T. Ueno[1], H. Ishiguro[2], and S. Ishii[1]
([1]Kyoto University, Japan)
([2]Osaka University, Japan)

We propose a new control strategy for the robotic arm that has 9-dof those actuated by McKibben artificial muscles. To resolve ill-posedness in planning and control, we introduce a notion of imitation learning, that is, 1) A human teacher taught the robot several patterns of target trajectories by moving the robotic arm directly, and the appropriate trajectory that is similar to the teaching trajectories are generated in real-time. Then, 2) the generated target trajectory is pursued by a controller, which has learned the relationship between the control input and the corresponding consecutive arm states before and after the control input is applied by a preliminary experiment.



GS2-3 Consideration on gesture recognition based on multilayer neural network by using input device of home gaming console

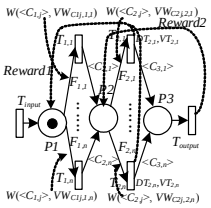
I. Iimura[1], T. Fujiki[1], H. Tsurusawa[2], and S. Nakayama[3]
([1]Prefectural University of Kumamoto, Japan)
([2]Oita National College of Technology, Japan)
([3]Kagoshima University, Japan)

We consider that the human intention and feelings conspicuously appear at the force added to a body rather than the positions of hands in the gesture. In this paper, we have tried gesture recognition based on multilayer neural network by using acceleration sensor because the force to act during motion can be detected by acceleration. From the experimental result, we have proven that our gesture recognition method can recognize the gesture patterns such as numerical characters and graphic symbols. As an input device, we used the Wii remote attached to the home gaming console Wii instead of a special device. Furthermore, we have obtained high recognition rate in the case of not only specific performers but also unspecified performers by using the permutation of the simple normalized acceleration for input values of multilayer neural network.

GS2-4 A learning Petri net model based on reinforcement learning

Liang-Bing Feng, Masanao Obayashi, Takashi Kuremoto, and Kunikazu Kobayashi
(Yamaguchi University, Japan)

A hybrid intelligent control system – Learning Petri Net (LPN) that combines the Petri net and reinforcement learning is presented. LPN is expanded High-level Time Petri nets, in which some transition's input arc weight function and transition delay time have a value item which records the reward from environment. Based on interaction with environment, LPN can adjust the arc weight function and transition delay time when it's modeling system is running. The arc weight function and transition delay time learning algorithm is based on Q-learning – a kind of Reinforcement Learning. Finally, for the purpose of certification of the effectiveness of our proposed Learning Petri net, it is used to model a discrete event dynamic control system – Sony AIBO learning control system as an example. The result of the experiment shows this method is correct and effective.



GS2-5 On detecting a human and its body direction from a video

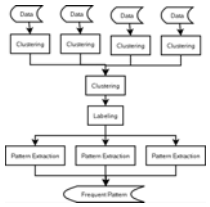
Yuuki Nakashima, Joo Kooi Tan, Seiji Ishikawa, and Takashi Morie
(Kyushu Institute of Technology, Japan)

This paper describes a novel technique for detecting a human and its body direction using HOG feature. The HOG feature is a well-known feature for the judgment of a human. But normally it contains the background feature, which may give negative influence on the judgment. This paper proposes the employment of the HOG feature based on a human model. The feature is also employed for detecting human body direction. Experimental results show effectiveness of the proposed technique compared to the conventional one.

GS2-6 Parallel computing method of extraction of frequent occurrence pattern of sea surface temperature from satellite data

Ayahiko Niimi, Takehiro Yamaguchi, and Osamu Konishi
(Future University-Hakodate, Japan)

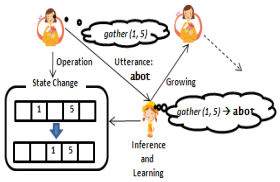
In this paper, we propose the method for finding the frequent occurrence patterns and the frequent occurrence time-series change patterns from the observational data of the weather-monitoring satellite. The observational data of the weather-monitoring satellite is temporal and spatial large-scale data. Various use like the forecast of marine resources is thought by analyzing the satellite data. However, there is a problem of the calculation cost to analyze a large amount of data. Then, we propose to use the parallel computation when the frequent occurrence pattern and the frequent occurrence time series change pattern are extracted in this paper.



GS2-7 Cultural evolution of compositional language under multiple cognition of meanings

Ryuichi Matoba, Shouki Sakamoto, and Takashi Hashimoto
(Japan Advanced Institute of Science and Technology, Japan)

In the actual world, we often happen to meet a state which contains several meanings. Under this environment, the language needs to distinguish ``A do B'' from ``B is done by A'' to represent speaker's intension, even a state change which is pointed these two sentences are the same state change. Thinking of the influence of this phenomenon to grammar acquisition, we employed Iterated Learning Model, and built state change and multiple cognition into this model. Simulating with our model, we speculated an influence of multiple cognition on evolution of compositional language.



Session: GS3
Artificial life & Brain science
GS3-1 Why we talk?: Altruism and multilevel selection in the origin of language

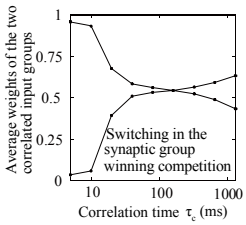
Kana Sugiura and Takaya Arita
(Nagoya University, Japan)

This paper focuses on the altruism in communication and aims to demonstrate evolutionary scenarios based on multilevel selection. We constructed a computational model to examine these scenarios. The evolutionary experiments showed that in case of an unstructured population a stable linguistic system didn't emerge due to the dynamics between interpretable utterance that imposes a penalty and correct interpretation that yields a reward, which is similar to the prey-predator dynamics. However, in case of a multi-group population a linguistic system emerged owing to the multilevel selection among the groups. In addition, the probability of success in conversation was higher in a group with a severer environmental condition. This result supports the Bickerton's hypothesis based on the ecological gap between human ancestors and other ape species.

GS3-2 A variety of competitive properties arises from STDP incorporating metaplastic regulation

S. Kubota[1], J. Rubin[2], T. Kitajima[1], and T. Nakamura[1]
([1]Yamagata University, Japan)
([2]University of Pittsburgh, USA),

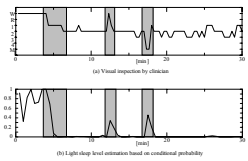
We examine the competitive functions of spike-timing-dependent plasticity (STDP) incorporating a metaplastic activity-dependent feedback (ADFB) mechanism when a conductance-based neuron receives two groups of correlated inputs. We show that there are four distinct types of competitive properties depending on the relative activation frequency of the input groups and the correlation time among the inputs within each group: (1) competition with a bistable synaptic pattern (for identical frequency and brief correlation), (2) no competition (for identical frequency and prolonged correlation), (3) competition preferring strong input activity (for different frequencies and brief correlation), and (4) competition preferring weak input activity (for different frequencies and prolonged correlation).



GS3-3 Automatic estimation of light sleep level during short nap

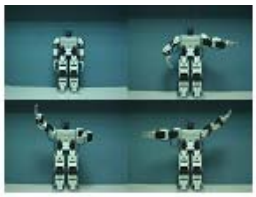
Bei Wang[1], Takenao Sugi[2], Xingyu Wang[1], Shuichiro Shirakawa[3], and Masatoshi Nakamura[4]
([1]East China University of Science and Technology, China)
([2]Saga University, Japan)
([3]National Centre of Neurology and Psychiatry, Japan)
([4]Research Institute of Systems Control, Japan)

Daytime short nap is an effective relaxation way which can avoid the decline of working efficiency and attention level. The short nap sleep has positive effects on performance level. In this study, an automatic estimation technique for light sleep level during short nap was developed. The ultimate purpose is to control the sleep time for an effective short nap. Light sleep level was estimated according to the conditional probability of stage awake by using the expert knowledge-based multi-valued decision making method. The developed technique can be usable for comfortable sleep circumstance control especially to ensure an effective short nap.



GS3-4 Evolving behavior sequences for a humanoid entertainment robot

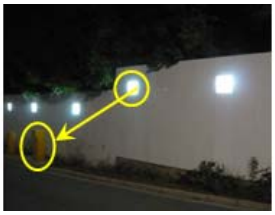
Wei-Po Lee, Jih-Shiou Jong, and Tsung-Hsien Yang
(National Sun Yat-sen University, Taiwan)



One of the most important issues in developing entertainment robot is human-robot interaction, in which the robot is expected to learn new behaviors specified by the user. In this paper we present an evolution-based approach to realize the imitation-based learning. In our work, the robot is shown how to perform the desired behavior first, and during the period of human demonstration, the behavior sequences are recorded and analyzed. Then the Genetic Algorithm is employed to evolve the behavior sequences: to determine how to rotate different motors on the robot's body parts to produce the same behaviors. To evaluate our approach, we use it to evolve different behaviors for a humanoid robot. The preliminary results and analyses show that our approach can successfully and effectively evolve behavior sequences for the robot.

Session: GS4
Chaos & Cognitive science
GS4-1 Visual attention model involving feature-based inhibition of return

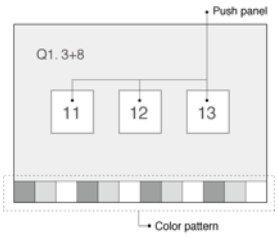
Shinji Hotta, Shigeyuki Oba, and Shin Ishii
(Kyoto University, Japan)



Inhibition of return (IOR) is the phenomenon that directions of visual attention tend to avoid locations where past visual attention has once focused, and it is known as one of important dynamic properties of visual attention. Recently, several studies have reported that IOR occurs not only on locations but also on visual features. In this study, we propose a visual attention model that involves the feature-based IOR by extending a recent model of `Saliency Map'. Our model is evaluated by a computer simulation.

GS4-2 Relation between impression of touch panels' coloration and operation

Makiba Sakamoto, Hidetsugu Suto, and Masahiro Sawai
(Muroran Institute of Technology, Japan)

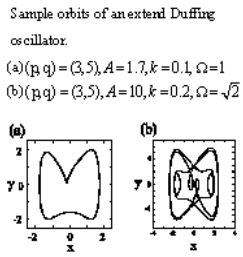


The relationships between the color used in designs of a touch panel and operations on electronic devices are discussed. Experiments that investigate the effect of color in designs of touch panel interfaces on the operation and on impressions of users have been conducted. As a result, the average numbers of correct answers was higher when using "cool-casual" than when using the other coloration. Furthermore, there was a positive correlation between the number of correct answers and preference for the displays' coloration.

GS4-3 An extension of a duffing oscillator and nonlinear energy harvesting

Tokuzo Shimada, Takanobu Moriya, and Hisakazu Uchiyama
(Meiji University, Japan)

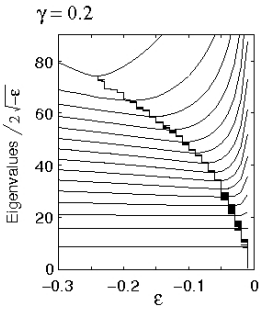
Forced nonlinear oscillators with dissipation term offer us nice testing grounds for the process where macroscopic energy is converted into random energy by random orbits. We study here an extended Duffing oscillator $\ddot{x} = -kx + x^p - x^q + A\cos\Omega t$. Recently it has been shown that a nonlinear oscillator may be used as a tool for energy harvesting. We investigate the application of our model to the energy harvesting. We couple our model to the external random noise and estimate the efficiency. We also investigate whether a collective effect maybe expected by the use of globally coupled flows in the energy harvesting problem.



GS4-4 Matrix diagonalization in the quantum anisotropic Kepler problem

Kazuhiro Kubo and Tokuzo Shimada
(Meiji University, Japan)

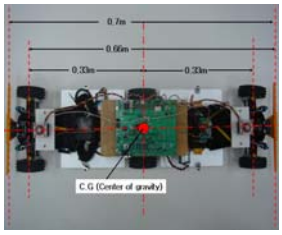
In quantum chaos study, statistical analysis of energy levels is used. For this analysis we have to work out thousands of the energy levels. For the anisotropic Kepler problem a concrete, non-perturbative method was devised by Wintgen et al. In this method the energy levels are deduced from the eigenvalues of a large size matrix at an (in principle) arbitrary choice of a scale parameterε. However, in practice, the finite size effect caused by the truncation of the bases makes the eigenvalues rather dependent on the value of ε. We propose a technical method which determines the most suitable choice of εfor a given matrix size. We also report how the level statistics vary when we change the mass anisotropy parameterγ.



Session: GS5
Control & Techniques I
GS5-1 Lateral control of an UCT (Unmanned Container Transporter) using ultrasonic satellite system and system identification

Hyung Gyu Park, Seong Man Yoon, Kil Soo Lee, Su Yong Kim, and Man Hyung Lee
(Pusan National University, Korea)

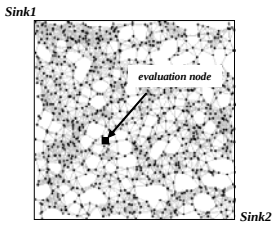
In this paper, which is one of the part of the development for the automation system in the port distribution process, covers the UCT(Unmanned Container Transporter). Local detection system and lateral control are proposed on this paper as two practical ways for the UCT management. Local detection system based on pseudo-satellite was used to be able to detect the space coordinates and the absolute location with four ultrasonic transmitters and two receivers. Using this system we get the lateral dynamic model of an UCT by using system identification methods and design a lateral controller. The system input is the steering wheel angle of the vehicle with constant speed and the output is the yaw of the vehicle. With system identification for a basis, to achieve a control objective, we design a PID controller using the model equation.



GS5-2 Autonomous load-balancing data transmission scheme to multiple sinks for long-term operation of wireless sensor networks

Kakeru Matsumoto, Akihide Utani, and Hisao Yamamoto
(Tokyo City University, Japan)

In wireless sensor networks, hundreds or thousands of micro-sensor nodes with such resource limitation as battery capacity, memory, CPU, and communication capacity are placed in an observation area and used to gather sensor information of environments. Therefore, a data transmission scheme saving and balancing energy consumption of each node is needed to prolong the lifetime of wireless sensor networks. This paper proposes a new data transmission scheme for the long-term operation of wireless sensor networks. By the proposed scheme, autonomous load-balancing data transmissions to multiple sinks are actualized. We evaluate the proposed scheme using computer simulations and discuss its development potential. In simulation experiments, the performance of the proposed scheme is compared with those of the existing ones.



GS5-3 Robust ride comfort control of vehicles without measurements of tire deflection

Katsuhiro Okumura
(Department of Fukuoka Industrial Technology Center, Japan),
Masahiro Oya
(Kyushu Institute of Technology, Japan), and
Hideki Wada
(Shin-Nippon Nondestructive Inspection Co., Japan)

In this paper, a robust ride comfort control scheme for vehicles is proposed in which the measurements of the tire deflections are not required. The controller has good property that we can specify a location where the ride comfort becomes best. To achieve this end, an estimator for the tire deflections and the road disturbances is proposed. Next, a combined ideal vehicle is designed. In the ideal vehicle, the location where ride comfort becomes best can be moved by setting only one design parameter. Finally, to force the real vehicle track the motion of the combined ideal vehicle, a robust tracking controller is designed.

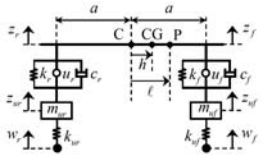
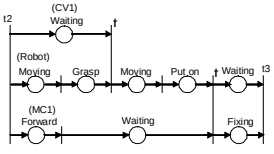


Fig. Two wheels model

GS5-4 Specification and real-time control of robotic manufacturing systems based on concurrent process modeling

Gen'ichi Yasuda
(Nagasaki Institute of Applied Science, Japan)

The paper deals with a systematic method of specification and real-time control for robotic manufacturing systems based on concurrent process modeling. The task specification of discrete event manufacturing processes is represented using a Petri net. Then it is decomposed and distributed into the machine controllers, which are coordinated through communication between the coordinator and machine controllers. Implementation of hierarchical and distributed control is described for an example robotic manufacturing system. The demonstrations show that the proposed system can be used as an effective tool for consistent modeling and control of manufacturing systems.



Petri net representation of loading operation

Session: GS6
Control Techniques Ⅱ

GS6-1 A method using same light sensor for detecting multiple events on window in home intruding crime

Akira Yamawaki, Takayuki Katakami, Yuhuki Kitazono, and Seiichi Serikawa
(Kyushu Institute of Technology, Japan)

Combining robots with many sensor nodes on the sensor network is important to improve the home security. From view of the cost of such system, it is desired that each sensor node is very cheap. The three events to the window and the key occurring when a thief attempts to intrude into the house are detected by the different sensors conventionally. This paper proposes a method detecting the three events by using the simple light-sensor consisting of an infrared LED and a photodiode. In the experiments, the light sensor shows the characteristic tendencies that can detect each event. This fact indicates that our proposal can realize a sensor node more efficiently instead of using different sensors.

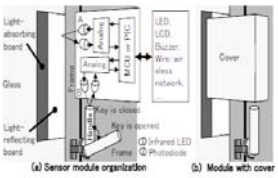
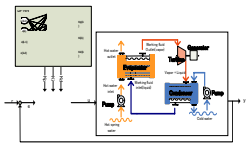


Fig. 1. Image of the sensor module.

GS6-2 A learning control of unused energy power generation

Satomi Shikasho, Ji-Sun Shin, ChengYou Cui, and Hee-Hyol Lee
(Waseda University, Japan)

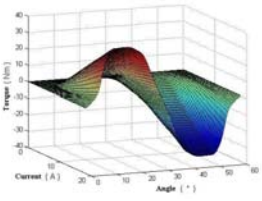
In recent years, the new clean energy without dependence on the fossil fuel is required. The control system of the unused energy power generation is designed to keep the speed of the steam turbine in real environment. This system includes nonlinearity and the characteristics of the system change in real environment with the aged deterioration. The evaporator, the condenser, and the systems are modeled, and the PID control with the ability of learning based on BP neural network is designed.



GS6-3 Design optimization of switched reluctance motor torque controller in electric vehicles

Yueying Zhu[1], Dafang Wang[1], Guifan Zhao[1], Dongyu Yang[1], Ming Xin[1], and Takao Ito[2]
([1]Harbin Institute of Technology, China)
([2]Ube National College of Technology, Japan)

The drive performance of Switched Reluctance Motor (SRM) used for electric vehicles is one of the important issues for improving the stability and comfortable operation of the vehicle. This paper introduces a study of design optimization of the SRM torque controller. The purposes of the SRM nonlinear dynamic model using the MATLAB/Simulink are to reduce the torque ripple and increase the average torque. The torque ripple and average torque, as functions of turn-off angles and rotor speed, are developed by simulation in this paper. The optimized torque controller is designed based on the changeable turn-off angles. The simulation results show that the proposed optimization of the torque controller has strong impact on the improvement of the torque ripple and the average torque.



Lookup table of torque versus current and rotor angle.

Session: GS7
Evolutionary computations
GS7-1 Mixed constrained image filter design using particle swarm optimization

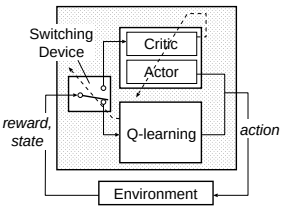
Zhiguo Bao and Takahiro Watanabe
(Waseda University, Japan)

This paper describes evolutionary image filter design for noise reduction using particle swarm optimization (PSO), where mixed constraints on the circuit complexity, power and signal delay are optimized. First, the evaluating values about correctness, complexity, power and signal delay are introduced to the fitness function. Then PSO autonomously synthesizes a filter. To verify the validity of our method, an image filter for noise reduction is synthesized. The performance of resultant filter by PSO is similar to that of Genetic Algorithm (GA), but the running time of PSO is 10% shorter than that of GA.

GS7-2 A reinforcement learning with switching controllers for continuous action space

Masato Nagayoshi[1]
([1]Niigata College of Nursing, Japan)
Hajime Murao[2], and Hisashi Tamaki[2]
([2]Kobe University, Japan)

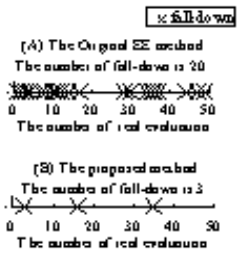
In order to design a suitable action space adaptively, in this paper, we propose a Reinforcement Learning model with switching controllers based on Q-learning and Actor-Critic to mimic a process of an infant's motor development in which gross motor skills develop before fine motor skills. Here, the controller based on Q-learning acquires gross motor skills, and the other controller based on Actor-Critic acquires fine motor skills. Then, a method for switching controllers is constructed by introducing and referring to the "entropy" which is defined on action selection probability distributions in a state. Further, through computational experiments by using a so-called "path planning problem" with continuous action space, the potential and the effectiveness of the proposed method have been confirmed.



GS7-3 A framework for embodied evolution with pre-evaluation applied to a biped robot

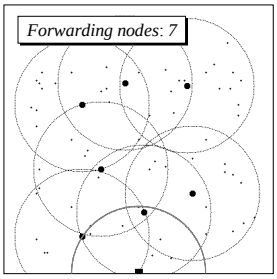
Junichi Nakai and Takaya Arita
(Nagoya University, Japan)

"Embodied Evolution (EE)" is a methodology in evolutionary robotics, in which, without simulations on a host computer, real robots evolve on the basis of the interactions with actual environment. However, we had to accept robot behavior with low fitness especially in the early generations when adopting EE. We introduced pre-evaluation into the EE framework for a biped robot in order to restrain robot behavior of which fitness is estimated to be low, especially, falling. We provide a comparative discussion on the conventional simulate-and-transfer method, the original EE method and the proposed one in terms of calculation time, risk of fitness evaluation and cost of simulation or modeling based on the evaluation experiments. We believe that the EE framework with pre-evaluation is applicable to a wide variety of optimization tasks in which the cost or risk of fitness evaluation is negligible.



GS7-4 Efficient flooding method for wireless sensor networks based on discrete particle swarm optimization computing multiple forwarding nodes sets

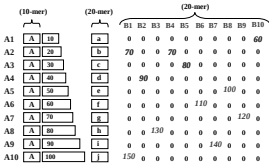
Junya Nagashima, Akihide Utani, and Hisao Yamamoto
(Tokyo City University, Japan)



In wireless sensor networks, flooding is required for the dissemination of queries and event announcements. The original flooding causes the overlap problems. In the original flooding, each sensor node receiving a broadcast message forwards it to its neighbors, resulting in a lot of collisions and duplicate messages. For dense wireless sensor networks, the impact caused by the original flooding may be overwhelming. The original flooding may result in the reduced network lifetime. Therefore, the selecting method of forwarding nodes for the dissemination of queries and event announcements is needed to prolong the lifetime of wireless sensor networks. This paper proposes a new efficient flooding method for wireless sensor networks based on discrete particle swarm optimization computing multiple forwarding nodes sets.

GS7-5 Fixed column primer for Boolean Matrix multiplication with DNA computing

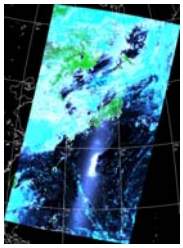
N.Rajaee, H.Aoyagi, and O.Ono
(Meiji University, Japan)



Exponentially increasing material consumption and experimental labor involved in physical implementation of DNA computing are two factors which hinder its feasibility for solving real-world problems. In Boolean matrix multiplication, the problem is encoded by generating DNA sequences to represent the matrix elements. We propose to reduce the experimental labor for the computation by introducing fixed column primer which uses a common starting DNA sequence to represent the whole set of row indicators for the matrix.

GS7-6 Applying soft computing for remote sensing data composite algorithms

Kenneth J. Mackin[1], Takashi Yamaguchi[1], Jong Geol Park[1], Eiji Nunohiro[1],
Kotaro Matsushita[1], Yukio Yanagisawa[2], and Masao Igarashi[2]
([1]Tokyo University of Information Sciences, Japan)
([2]Nihon University, Japan)



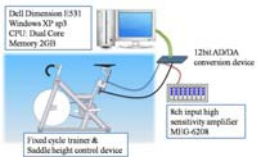
When using satellite sensor data, clouds in the atmosphere can interfere with the remote sensing. Multiple day composite data uses several consecutive days' remote sensing data, and picks the most accurate data within the temporal dataset for the same land point. In this paper, we propose applying soft computing, namely fuzzy logic, in order to select the clearest data in the temporal interval for the composite data. Moderate resolution remote sensing data of areas in Japan were used for evaluation, and results were compared with previous composite methods.

Session: GS8
Intelligent control & Modeling

GS8-1 Evaluation of cycling posture considering the difference of saddle height with principal component analysis based on leg electromyography

Shimpei Matsumoto[1], Tatsushi Tokuyasu[1], Koji Hirakoba[2] and Keichi Ohba[1]
([1]Oita National College of Technology, Japan)
([2]Kyushu Institute of Technology, Japan)

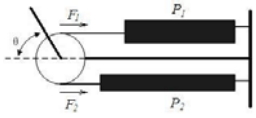
Many types of bicycles have various size of frame for user's physical size based on positions. However there is lack of concern about the importance of bicycle position. This paper quantitatively evaluates the muscular activities during bicycle exercise. The raw electromyographic data is converted to power spectrum data by Fast Fourier Translation, and then it is analyzed by using on-line usage of principal component analysis. For our fundamental study, we have restricted the freedom degrees about bicycle's position to one, the saddle height and have employed binding shoes in order to fix the pedals of bicycle and the bottoms of rider's feet. As the result of our experiments, the scheme of predict for necessary operation to make saddle height get up the best saddle height of the subject could be derived.



GS8-2 A control system based on the fuzzy neural network for a robot joint

Huailin Zhao[1], Masanori Sugisaka[2]
([1]Shanghai Institute of Technology, China)
([2]Nippon Bunri University(NBU), Japan)

To the robot joint actuated by two McKibben muscles, a new model is supposed, and a control algorithm based on fuzzy CMAC is designed. The new model of the robot joint supposes that there are two independent inputs so that the stiffness control of the robot joint becomes possible. The control algorithm based on both fuzzy logic and CMAC is designed. The fuzzy logic fuzzifys the relationships among the blocks of CMAC so that the performance of the CMAC is improved. At last the simulation is done.



GS8-3 Proposal of sensors for robot supporting to take medicines on time

Yuhki Kitazono, Xianglan Zheng, Shota Nakashima, Shiyuan Yang, and Seiichi Serikawa
(Kyushu Institute of Technology, Japan)

This paper proposes robot supporting to take medicines on time with new medicine sensor and chewing sensor. The medicine sensor can accurately judge whether medicines are in the medicine sensor or not using electric capacity. The chewing sensor can be accurately judge whether a user is chewing or not using a photodetector and an infrared LED. By using the medicine sensor and the chewing sensor, this robot can bring the user the medicines on time and have following function. If medicines are not taken at time to take medicines, this robot announces to the user. In case of medicines taken before the meal, this robot warns the user to take medicines if the user is chewing before taking medicines.

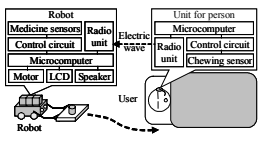
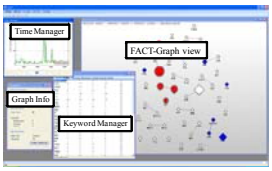


Fig.1. Structure of the robot

GS8-4 Development and case study of trend analysis software based on FACT-Graph

Ryosuke Saga[1], Hiroshi Tsuji[2], Takao Miyamoto[2], and Kuniaki Tabata[1]
([1]Kanagawa Institute of Technology, Japan)
([2]Osaka Prefecture University, Japan)

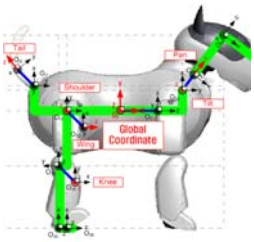
This paper proposes text mining software to analyze FACT-Graph and describes case study by using the software. FACT-Graph is a trend graph which visualizes what kinds of topics exist and shows the change of trend in time-series text data. However, FACT-Graph itself does not have enough environments to analyze trend although it provides the clue for trend. In order to resolve the problem, we develop the software called Loopo. This software provides the functions of adding the consideration of analyst as the keywords and operating FACT-Graph itself such as moving, adding, and clearing nodes. Also, the system allows analysts to refer information source, keyword information, and network information in order to analyze and consider FACT-Graph. In a case study about criminal trend using the title of articles of newspaper between 1987 and 2007, we confirm the usability of this software.



GS8-5 Gait planning for a robot dog

Sooyeong Yi[1] and Daesung Choi[2]
([1]Seoul National University of Technology, Korea)
([2]DASA Corp., Korea)

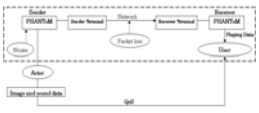
A motion planning algorithm is presented in this paper for a quadruped walking of robot pet, Genibo developed by Dasarobot Co. Stable walking is the basic requirement for a commercial-purpose legged robot. In order to secure the walking stability, body sway to the centroid of support polygon is addressed. By representation of walking motion with respect to the world coordinate system, it is possible to design the several gaits in unified fashion. The initial gait posture is introduced to maximize the stride and to achieve fast walking. The proposed walking motion planning is verified through computer simulation and experiments.



Session: GS9
Human-machine cooperative systems
GS9-1 Real time interpolation of haptic information using case base

Takayuki Toki[1], Hirokazu Taki[1], Hirokazu Miura[1], Noriyuki Matsuda[1], Masato Soga[1], and Norihiro Abe[2]
([1]Wakayama University, Japan)
([2]Kyushu Institute of Technology, Japan)

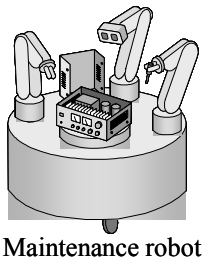
This paper has described a real time interpolation technology for haptic information using case base. To share haptic data in multiple points, we must send complete haptic data. However, in the transmission line, packet loss and noise are occurred sometimes. In this situation, users don't sense correct force. We developed new interpolation method for haptic sense data without conventional mathematical approach. We can interpolate haptic information lag and loss using case-based approach. In our method, the system selects a suitable case and reconfigures it to fit the error.



GS9-2 Recovery technique from classified errors in skill-based manipulation

Akira Nakamura and Yoshihiro Kawai
(National Institute of Advanced Industrial Science and Technology (AIST), Japan)

Manipulator tasks such as assembly and disassembly can generally be divided into several motion primitives. We call such motion primitives "skills" and explain how most manipulator tasks can be composed of sequences of these skills. We are currently planning to construct a maintenance robot for household electrical appliances. We considered hierarchizing the manipulation tasks since the maintenance of such appliances has become more complex than ever before. Additionally, we considered grouping errors into several classes according to their estimated causes. The reliability of the task achievement increases with the classification of errors. This paper contributes to the achievement of these concepts by showing our restoration technique for each class of error. The technique is described with the concrete examples.


Maintenance robot

GS9-3 Development of an inheritance assist system for experienced operation skill by using a haptic function of PHANToM

T. Tokuyasu[1], K. Yufu[1], T. Shuto[1], N. Abe[2], and A. Marui[3]
([1]Oita National College of Technology, Japan)
([2]Kyushu Institute of Technology, [3]Kyoto University, Japan)

This paper presents a surgical training factor that helps to inherit the operation skill of experienced doctors to young doctors. The system is composed of a PC and a haptic device PHANToM. By using PHANToM's basic functions recording function and reproducing function for the operation of end effecter of PHANToM are build. This study conducted experiments under two different conditions. First, a subject manipulates the end effecter to trace the supervised data with only visual information. Second, haptic assist is added to the first condition. The supervised data is a simple operation data like a doctor cuts a body surface of patient. As a result it was cleared that haptic assist worked well to learn the skill of operation.

GS9-4 Automatic detection of pedestrians from stereo camera images

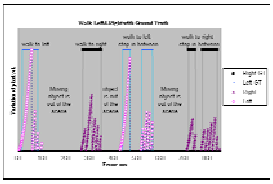
Kazuki Inumaru, Joo Kooi Tan, Seiji Ishikawa, and Takashi Morie
(Kyushu Institute of Technology, Japan)

We propose a technique for detecting pedestrians employing stereo camera images based on probabilistic voting. From a disparity map, each pixel on the image is voted on a depth map employing a 2-D Gaussian distribution. The region having a peak value of the vote is chosen as the foot of an object. The object is specified by a rectangle on the right image, which is referred to as a region of interest (ROI). This ROI is described by HOG features and it is judged by SVM if it contains a person. With the ROI containing a person, Kalman filter is applied to track the person through successive image frames. Performance of the detection of persons was evaluated employing a ground truth data. The rate of detected persons to the ground truth data, called a recall rate, was 80 %. This is a satisfactory result.

GS9-5 Human behavior analysis with optical flow and median-filtered temporal motion segmentation method

Md. Atiqur Rahman Ahad, J.K. Tan, H. Kim, and S. Ishikawa
(Kyushu Institute of Technology, Japan)

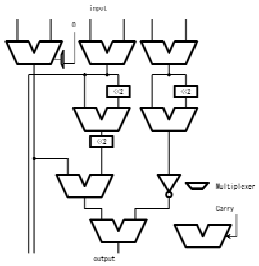
We focus on human activity analysis for an intelligent system that can easily understand important activities. An improved Median-filtered Temporal Motion Segmentation (MfTMS) method is presented that can segment and understand motion temporally from the video sequence. It is based on the computation of optical flow and thereafter split it into four different channels. Later median filtering is applied and we produce four motion-history templates based on the directional motion vectors according to DMHI method. Based on the total pixel volumes on four history templates and their related variations, various directions of the action primitives are segmented temporally. We conduct experimentations both indoor and outdoor environments and achieved sound performance.



Session: GS10
Image processing Ⅰ
GS10-1 A dynamically reconfigurable processor for the H.264/AVC image prediction

Y. Hayakawa and A. Kanasugi
(Tokyo Denki University, Japan)

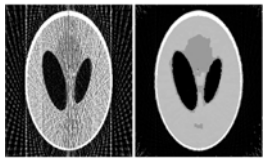
H.264/AVC provides high video quality at substantially low bit rates. It is useful for a save and transfer of video images by robot cameras. However, the computational complexity of H.264/AVC is very high. Therefore an application specific processor is necessary. Dynamic reconfiguration can expand virtually circuit area in limited chip area. Thus, this paper proposes a dynamically reconfigurable processor for the H.264/AVC image prediction. H.264/AVC contains intra and inter prediction process. These processes are not used at the same time by the decoder. The proposed dynamically reconfigurable processor reconfigures these circuits. Proposed processor was designed and synthesized. As a result, LUT (look up tables) were reduced to 93%, flip flops were reduced to 94%, and calculation time was about the same.



GS10-2 X-ray computed tomography using material-class modeling by MRF energy minimization

Wataru Fukuda, Shin-ichi Maeda, Atsunori Kanemura, and Shin Ishii
(Kyoto University, Japan)

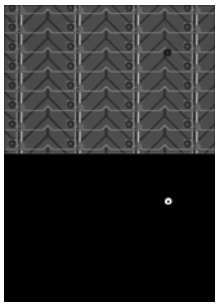
We develop a new statistical reconstruction procedure for X-ray computed tomography. We utilize the knowledge that the human body is composed of a finite number of materials whose CT values are approximately known in advance. The problem is formulated in the framework of maximum a posterior (MAP) estimation and tomographic images and material classes are simultaneously estimated. To minimize the MAP objective function, we use an expansion algorithm, which is a variant of graph cuts. Experiments show that the proposed algorithm performs better than the existing methods in severe situations where samples are limited or metal is inserted into the body.



GS10-3 Implementation of TFT inspection system using the stream processor

Park Bum Yong, Chang Hee Lee, and PooGyeon Park
(Pohang University of Science and Technology, Korea)

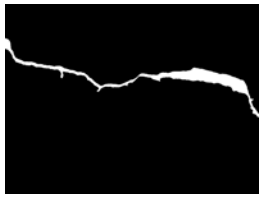
In this paper, we adapt the stream processor of Stream Processor Inc. (SPI) against the previous solutions. The SPI processor design and software development tools can easily exploit parallelism and locality in hardware. We first explain various defects on TFT-LCD and describe the implementation of the inspection system on the stream processor and CPU respectively. The components and behavioral properties of the inspection system are also explained. Then, we compare the performance of the systems equipped with the stream processor and CPU using the inspection algorithm that utilizes the repeated characteristics of the TFT-LCD. It will be shown that this algorithm is easy to implement on the stream processor. Finally, the experiment results show the successful transition from the traditional CPU-based system to the stream processor based system in the TFT-LCD inspection.



GS10-4 Study on the crack detection of bridges based on digital image processing

Jiwu Wang, Guoqi Zhang, and Mingcheng E
(Beijing Jiaotong University, China)

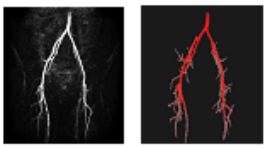
It is necessary to carry on the inspection of the bridge after more and more bridges are built. In view of present inspection techniques, we try to explore to inspect the bridge by machine vision. Considering the practical complex working conditions, such as lighting conditions, interference of the shadows of the trees or cables, it is difficult to realize the reliable crack extraction. In this paper, we try to solve those problems with various algorithms. Some initial good results were obtained. The further research will be carried on soon.



Session: GS11
Image processing Ⅱ
GS11-1 Segmentation of artery areas on none-enhanced fresh blood imaging based on dot enhancement filter and 3-D region growing method

Akiyoshi Yamamoto, Takashi Nishizaki, Hyoungseop Kim, Joo Kooi Tan, and Seiji Ishikawa
(Kyushu Institute of Technology, Japan)

Peripheral arterial disease (PAD) is characterized by lower extremities arterial obstruction due to atherosclerosis and manifests in lower extremities as intermittent claudicating, limb ischemia, or gangrene. The diagnosis of the PAD using magnetic resonance imaging (MRI) equipment without contrast medium is available as a useful visual screening in clinical practice. In this paper, we propose a new method for segmentation of arterial images, which are obtained from non-contrast enhanced magnetic resonance angiography (MRA) based on dot enhancement filter and 3-D region growing methods, and satisfactory experimental results are obtained.

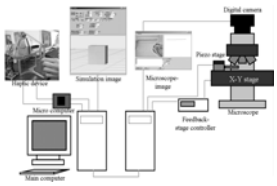


Original image Extraction result

GS11-2 Construction of a sense of force feedback and vision for micro-objects

R.Uehara and E.Hayashi
(Kyushu Institute of Technology, Japan)

This research aims to develop a combined sense system that uses both the force feedback and visual feedback to establish the shape of microscopic features of a microsample. It is thought that the efficiency of minute procedures would be improved if the operator could obtain a sense of force while using a manipulator. We used a cantilever to touch a minute object and obtain a reaction force from the degree of bending. We made a haptic device which gives a sense of that force to the operator, who can feel the force when a user touches a sample with a cantilever. In addition, when the haptic device is used in simulations, the user can feel a force just as if the user had touched a sample.



GS11-3 A real-time face detection and recognition system for mobile robot in the complex background

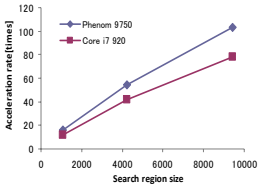
Song Chen, Tao Zhang, Chengpu Zhang, and Yu Cheng
(Tsinghua University, China)

The research presented in the paper focuses on a real-time face detection and recognition system applied to biped robot in the complex background. In the visual system, a multi-information method consisted of Adaboost algorithm and color information for face detection part is proposed and Embedded Hidden Markov Model (EHMM) is employed to recognize the detected faces. The system introduced in the paper improves the processing speed of detecting and recognizing faces in a frame with a suitable accuracy by integrating three rapid algorithms.

Session: GS12
Innovative computations
GS12-1 Fast processing method for PIV using GPGPU

Koji Miyazaki and Kikuhito Kawasue
(University of Miyazaki, Japan)

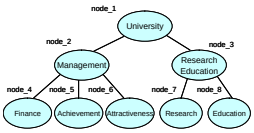
General purpose computation on graphics processing units (GPGPUs) have been investigated, and the application of GPGPUs to various scientific fields has been reported. However, there have been few reports on the application of GPGPUs to particle image velocimetry (PIV). In the present study, the ability to apply GPGPUs to PIV is confirmed, and the processing speed of the PIV is accelerated by GPGPUs. Our code is based on the direct cross-correlation method, where one of the PIV algorithms is rewritten for GPGPU computing using the CUDA tool kit. The results of a performance test indicate that GPU computing for PIV demonstrated an excellent acceleration rate of more than 100 times greater than CPU computing while maintaining acceptable precision.



S12-2 Data envelopment analysis for evaluating Japanese universities

Kazushige Inoue, Ryota Gejima, and Shingo Aoki
(Osaka Prefecture University, Japan)

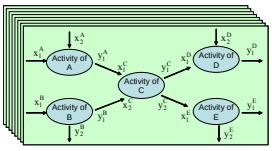
In order to evaluate universities from various aspects, this study proposes method by utilizing DEA (Data Envelopment Analysis). The management of universities is complex and necessary to find out strength and weakness to be better educational institute. In this sense, DEA contributes for evaluation since it can show efficiency of universities based on multiple viewpoints. However, when the number of evaluated universities is increased, result of evaluation among universities is similar. Therefore, it is difficult to understand the specific points each university has. So this study proposes method for developed evaluation by ramifying DMU to some viewpoints.



GS12-3 Data envelopment analysis for supply chain

Akio Naito, Ryota Gejima, Kazushige Inoue, Shingo Aoki, and Hiroshi Tsuji
(Osaka Prefecture University, Japan)

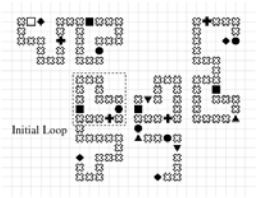
DEA (Data Envelopment Analysis) is a method for evaluating management efficiency of DMU (Decision Making Unit). This paper proposes DEA model for supply chain management. Traditional study focuses on selection of partners and construction of supply chain. Therefore, this study would like to consider how to optimize supply chain itself for maximizing benefit by DEA. The proposed method introduces adjustment variable to calculate optimum operation as a supply chain. The utility and effectiveness of the proposed method are shown by numerical experiments.



GS12-4 On a Brownian cellular automaton implementing self-reproducing loop

Koji Ono[1], Teijiro Isokawa[1], Ferdinand Peper[1,2], Jia Lee[3],
Ayumu Saitoh[1], Naotake Kamiura[1], and Nobuyuki Matsui[1]
([1]University of Hyogo, Japan)
([2]National Institute of Information and Communications Technology, Japan)
([3]ChongQing University, China)

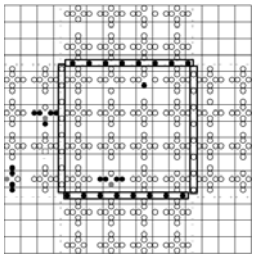
An implementation of Self-Reproducing Loops (SRL) on Brownian Cellular Automata (BCA) is proposed in this paper. BCA are asynchronous cellular automata in which certain local configurations propagate randomly in the cellular space, resembling Brownian motion. In the proposed SRL, the signals in the loops and the loop heads can move backward and forward through the Brownian nature of BCA, thus making it possible to avoid collisions of loop heads.



GS12-5 An application of self-reproducing loops to defect-tolerant computation on self-timed cellular automaton

Tadashi Kunieda[1], Teijiro Isokawa[1], Ferdinand Peper[2,1],
Ayumu Saitoh[1], Naotake Kamiura[1], and Nobuyuki Matsui[1]
([1]University of Hyogo, Japan)
([2]National Institute of Information and Communications Technology, Japan)

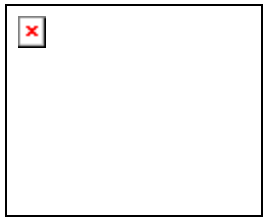
For the realization of nanocomputers it will be important to have built-in defect-tolerance, which is the ability to overcome the unreliability caused by defective components. This paper explores defect-tolerance for nanocomputers based on Self-Reproducing Loops, in which each of the loops in the system acts as a computational element, supporting the propagation of signals along transmission wires and their processing in logic elements. The loop-based design facilitates the adaptation to defects through the expansion of wires such as to prevent them from being blocked by defects. The proposed system is implemented on an asynchronously timed Cellular Automaton.



GS12-6 Management of experience data for rapid adaptation to new policies based on bayesian significance evaluation

Saifuddin Md. Tareeq and Tetsunari Inamura
(National Institute of Informatics, Japan)

This paper shows a rapid learning method of behavior policy for mobile robots teleoperated by an operator. Rapid policy adaptation cannot be achieved when data from every process cycle is used for learning because important and meaningful data are not differentiated with other data. We propose a method to solve the problem by selecting significant data for the learning based on change in degree of confidence of the behavior decision. A small change in the degree of confidence can be regarded as reflecting insignificant data for learning, so that data can be discarded. Accordingly the system can avoid having to store too much experience data and the robot can adapt rapidly to changes in the user's policy. In this paper we discuss the experimental result of an experiment in which user policy changes between 'avoid' and 'approach' on a mobile robot.

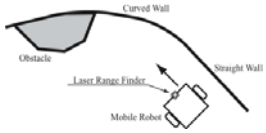


Session: GS13
Mobile vehicles I

GS13-1 Trajectory tracking control of mobile robot moving along curved wall using imaginary wall

Seiji Furuno[1], Kouhei Yanagi[1], Minoru Kobayashi[1], and Go Hirano[2]
([1]Kyushu Institute of Technology, Japan)
([2]Kinki University, Japan)

In this study, a trajectory tracking control method of a mobile robot moving along curved wall is proposed. To move along curved wall, we use imaginary wall that is generated by distance between the mobile robot and the wall The trajectory tracking control method consists of three control methods. The first one is a method that controls the mobile robot to move along a wall maintained constant. The second one is a method that controls the mobile robot to move along a wall in case of the wall direction changes. The third one is obstacle avoidance on a path. We developed a mobile robot which has two-driven wheels and the laser range finder to confirm the proposed method.



GS13-2 Vision-based obstacle avoidance system for autonomous mobile robot in outdoor environment

Ji Eun Jung[1], Kil Soo Lee[1], Hyung Gyu Park[1], Yung Ho Koh[2], and Man Hyung Lee[1]
([1]Pusan National University, Korea)
([2]Futronic Co., Ltd., Korea)

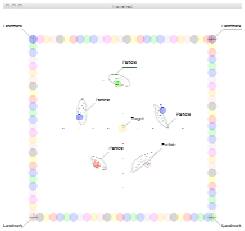
In this paper, we propose the obstacle avoidance system on based vision sensor for an autonomous mobile robot. For real-time turn angle correction, we obtain the state equation of a mobile robot from input-output continuous data. Each individual image pixel is classified as belonging either to an obstacle or non-obstacle based on its color property (HSI color model). HSI color model is less sensitive to illumination changes than RGB color model. Using some conditions and the voting system, we choose the path area, the navigation point, and the turn angle. This method uses a single color camera.

Fig. 1 Our autonomous robot with single color camera.

GS13-3 Cooperative localization by using knowledge of self-organized regularity

Masao Kubo, Takashi Matsubara, Satoshi Shimizu, and Hiroshi Sato
(National Defense Academy, Japan)

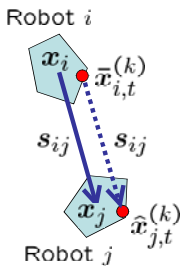
In this paper, a new localization approach for a team of robots which utilize emergent properties of their formation is proposed. At times, some of such a synchronized behavior generates spin-off effects that include geometric patterns on them. Therefore, it seems to be a reasonable question whether it is possible to utilize the pattern. Firstly, the authors discuss Takayama's control strategy which is proposed for target enclosure formation, which is a typical formation for Robocup. Then they propose a simple and useful expansion of Monte Carlo localization to utilize the emergent pattern of this formation. The proposed algorithms are confirmed by a series of computer simulations.



GS13-4 A collaborative localization tolerant to recognition error by double check particle exchange

Takashi Matsubara, Masao Kubo, and Yusuke Murachi
(National Defense Academy, Japan)

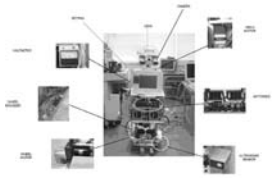
Statistical algorithms for collaborative multi-robot localization have been proposed using particle filter. These algorithms assume correctness of recognition of other robots, and influence of recognition error is not discussed. However, if the recognition of other robots is wrong, a large amount of error in localization may occur. This paper explains this problem. Furthermore, an algorithm for collaborative multi-robots localization is proposed to cope with this problem Simulation results show that mistakes of recognition of other robots does not cause serious problem in the proposed method.



GS13-5 Study on the route extraction based on the image processing

Jiwu Wang[1] and Masanori Sugisaka[2]
([1]Beijing Jiaotong University, China)
([2]Nippon Bunri University(NBU), Japan)

In the application of a mobile robot, we generally pay more attention on the navigation. In this paper, we study the visual based navigation for a mobile robot. We assume that we set the moving trace with some simple marks. Based on the image processing, the robot can extract the moving trace and realize self-location. At the same time, combing with some logic algorithms, the robot can reach the target point. Here, we try to find how to extract the visual signal from the simple continuous landmarks.



Session: GS14
Mobile vehicles Ⅱ
GS14-1 Intelligent OkiKoSenPBX1 security patrol robot via network and map-based route planning

Mbaïtiga Zacharie
(Okinawa National College of Technology, Japan)

This paper introduces an intelligent patrol robot system called OkiKoSenPBX1. The system integrates a variety of sensors to gather environmental information and to detect abnormal events including intruders. To tackle this problem, the route planning procedure is used. This route planning is based on determining a sequence of intermediary goal points or coordinates x and y composing the robot trajectory. A qualitative running experimental evaluation has been performed as a preliminary practical implementation, where a student playing the role of a guard man takes control of the camera pan and tilt functions remotely.

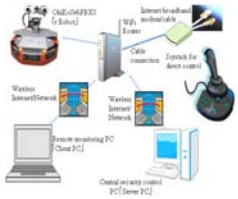


Fig.1: Testing performance setup

GS14-2 Obstacle arrangement detection using multichannel ultrasonic sonar for indoor mobile robots

Kiyoshi Okuda[1], Masamichi Miyake[1], Hiroyuki Takai[1], and Keihachiro Tachibana[2]
([1]Hiroshima City University, Japan)
([2]Osaka Gakuin University, Japan)

In the last several years, mobile robot systems that perform complicated tasks have been studied. To work in complicated environments, the robot has to avoid collisions with obstacles. Therefore the robot needs to detect the arrangement of any surrounding obstacles. We considered a simple distance estimation algorithm using ultrasonic sonar. Since the algorithm was able to estimate distance accurately, we also attempted stereo reception using two ultrasonic microphones. The stereo reception sonar was able to detect direction of obstacles. In order to make precise measurement, we attempted to use the signal coherence of ultrasonic waves. In order to install small system into mobile robots and to detect any surrounding obstacles, we designed a multi-channel sonar signal processing system using a high-performance embedded microcontroller. This paper describes our ideas for the distance estimation algorithm for ultrasonic sonar and a design for signal processing system using a high-performance microcontroller.

GS14-3 A collision avoidance achievement of vehicle warning system in intersection via DSRC

C. W. Hsu, C. N. Liang, L. Y. Ke, H. Y. Huang, and F. Y. Huang
(Automotive Research & Testing Center, Taiwan)

This paper presents a solution to enhance intersection safety for adjacent vehicles driving using vehicular communication and developed algorithm. The developed system integrates dedicated short range communication and GPS with embedded system into a delicate remote warning system. To transmit the vehicular information and broadcast vehicle position, DSRC communication technology is adopt as communication channel. The positioning unit is utilized to provide the position and heading information from commercial GPS module, and furthermore the vehicular data unit is used to receive the break signal, throttle signal, and other signals via controller area network interface connected to each mechanism. From conflict detection algorithm and error bubble consideration, the result shows collision avoidance applicability in intersection.

GS14-4 Autonomous navigation system using geographical feature elements information for navigation mapping system

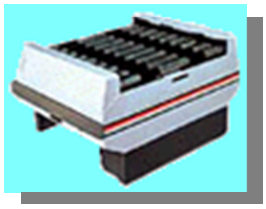
I. Zunaidi[1], M. Rozailan[1], MS Samsi[1], and N. Kato[2]
([1]TATI University College, Malaysia)
([2]Mie University, Japan)

A path-planning algorithm for an autonomous mobile robot using geographical information, under the condition that the robot moves in unknown environment. Image inputted by camera at every sampling time are analyzed and geographical elements are recognized, and the geographical information is embedded in environmental map. Then, the path is updated by integrating the exploited information and the prediction on unexploited environment. We used a sensor fusion method for improving the mobile robot dead reckoning accuracy. The experiment results, confirm the effectiveness of the proposed path-planning algorithm on the robot's reaching the goal successfully using geographical information are presented.

Session: GS15
Multi-agent systems
GS15-1 Robots' action control of autonomous decentralized FMS by remorse mind

Hidehiko Yamamoto, Keisuke Ikebuchi, and Takayoshi Yamada
(Gifu University, Japan)

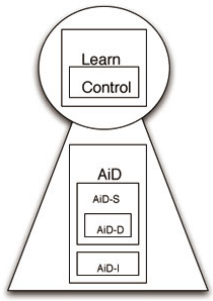
This paper describes the control of moving robots in an autonomous decentralized flexible manufacturing system (FMS) by "changes in the mind" of the moving robots. In an autonomous decentralized FMS, many moving robots are operating, and path interference problems occurred. It is very difficult to grasp the innumerable path interference situations that really occur. Therefore, to avoid these unexpected situations flexibly, we used mind model. In this way, we could solve path interference problems. However, the previous mind model we proposed had problems while taking evasive action. Robots having the previous proposed mind model are inefficient in solving path interference problems. Therefore, we propose a new mind model that can allow robots to avoid path interference efficiently.



GS15-2 Improvement of a software estimate efficiency centered PSP practice support system using multiagent techniques

Daisuke Yamaguchi[1], Ayahiko Niimi[2], and Muneo Takahashi[1]
([1]Toin University of Yokohama, Japan)
([2]Future University-Hakodate, Japan)

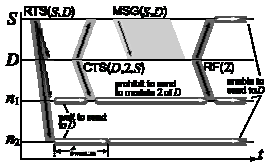
In this paper, we propose the PSP Practice Support System necessary to efficiently of estimative capabilities of software. This system can transmit programming to specific human among many software processes using a Multiagent technology. The system is also synthesized to do parallel and cooperative proposing internally. Applying the proposed method to a personal process-removing task, a flexible programming for quality of software. Software developments depend on information, which is possible to collection of personal process. Agent planning has get use working data on user action and other communication. Therefore collection of all user data is necessary for agent learning. Agent studies the best transmission programming, planning and quality according to the makes planning in the personal process.



GS15-3 A communication protocol based on IR-Space division transceivers for mobile robots

Tetsuo Abe[1], Hiroyuki Takai[1], and Keihachiro Tachibana[2]
([1]Hiroshima City University, Japan)
([2]Osaka Gakuin University, Japan)

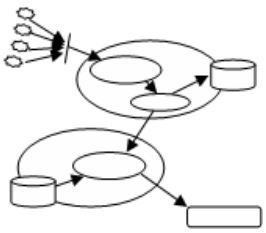
In this paper, we propose MAC protocols based on our designed Infrared-Space Division Transceiver (IR-SDT) for mobile robots. The IR-SDT has 8 communication modules, so it can communicate with maximally 8 other nodes simultaneously. The number of parallel multiple accesses will be improved by using this transceiver and the protocol specialized for it. In addition, we consider situations in which a packet collision occurs, and propose a protocol that resolves communication-conflictions using signal collision-detection function of IR-SDT. Finally we consider the performance of these protocols, and discuss the influence of signal collision-detection accuracy.



GS15-4 Intelligent network surveillance system based on ontology

Soomi Yang
(The University of Suwon, Korea)

For the surveillance of the area consisting in an integrated framework of networked RFID sensors, CCTVs and smart cameras, we made wide area surveillance systems which provide collaborations between distributed agents having heterogeneous data from various sources. In our intelligent network surveillance system, each of agents has autonomy and collaborates and does reasoning based on distributed knowledge bases.



GS15-5 A multi-agent-based approach for furniture arrangement

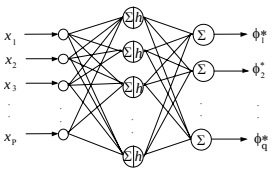
Satoshi Ono, Takayuki Oshige, and Shigeru Nakayama
(Kagoshima University, Japan)

This paper proposes a furniture arrangement method based on a multi-agent approach for interior coordination. In the proposed model, each furniture item acts as an agent, interacts with an environment and other agents, and moves to where it wants to go. Consequently, all furniture items reach well-coordinated placement. Agent movement of the proposed method is inspired by particle movement in particle swarm optimization algorithms, that is, agent's velocity is calculated from linear summation of vectors to avoid constraint violation, to harmonize with other agents, and so on. A simple example shows that the proposed method can make well-coordinated furniture arrangement from randomized positions.

Session: GS16
Neural networks
GS16-1 Learning algorithm of the revised RBF network and its application to the media art system

Chihiro Kondo[1] and Tadashi Kondo[2]
([1]Keio University, Japan)
([2]Tokushima University, Japan)

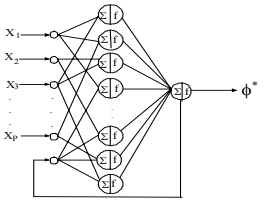
In this study, a revised radial basis function (RBF) network and its learning algorithm are proposed and applied to the identification problems of the nonlinear system and the media art system. In the revised RBF network, the structural parameters such as means and variances of the radial basis functions in the neurons are determined automatically using the regression analysis of the training data and so the revised RBF network can be easily applied to the identification problems of the nonlinear complex systems. The revised RBF network is applied to the media art system and generates the artificial sensibility in the media art system. Graphics and sounds are generated using the identified artificial sensibility.



GS16-2 Feedback GMDH-type neural network algorithm and its application to medical image analysis of cancer of the liver

Chihiro Kondo[1] and Tadashi Kondo[2]
([1]Keio University, Japan)
([2]Tokushima University, Japan)

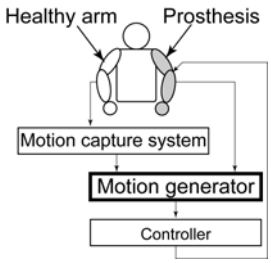
In this study, medical image analysis of cancer of the liver by a feedback Group Method of Data Handling (GMDH)-type neural network self-selecting optimum neural network architecture is developed. The feedback GMDH-type neural network algorithm has a feedback loop and can identify the characteristics of the medical images accurately using feedback loop calculations. The neural network architecture that fits the complexity of the medical images is automatically organized by the feedback GMDH-type neural network algorithm so as to minimize the prediction error criterion defined as PSS.



GS16-3 Improvement of a neural network based motion generator with bimanual coordination for upper limb prosthesis

E. Inohira and H. Yokoi
(Kyushu Institute of Technology, Japan)

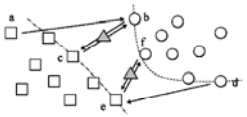
We propose to redesign a neural network used as a motion generator with bimanual coordination for upper limb prosthesis in order to improve its learning capability. In our previous work, we have proposed a prosthesis control system using a neural network that learns bimanual coordination in advance in order to smoothly implement motion with both hands. We propose to use both a healthy arm's posture and prosthesis' posture as neural network input in order to improve its learning capability. We showed that a single neural network whose input is current posture of both arms can learn relation of coordinated motions of holding a box with different size and the newly proposed system can generate desired motions of the prosthesis for such coordinated motions through computer simulation.



GS16-4 Midpoint-validation algorithm for support vector machine classification

Hiroki Tamura, Shingo Yamashita, and Koichi Tanno
(University of Miyazaki, Japan)

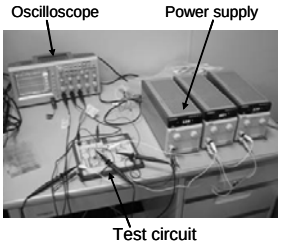
In this paper, we propose midpoint-validation algorithm for SVM, which improves the generalization of SVM so that midpoint-validation error is minimized. This idea applies midpoint-validation method (Adjustment technique: Tamura & Tanno, Jul. 2008) to learning algorithm and learning stop technique of SVM. We compare performance of midpoint-validation algorithm with those of the original SVM, *soft margin* SVM, Multilayer Perceptron, Radial Basis Function Neural Network and tested our proposed method on fifth benchmark problems. The simulation results carried out shows the effectiveness of the midpoint-validation method.



GS16-5 An analog-digital circuit for sound localization based on the biological auditory system

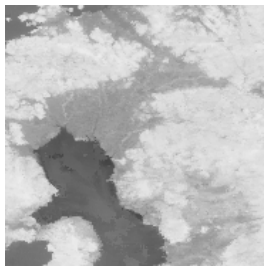
Takanori Tomibe and Kimihiro Nishio
(Tsuyama National College of Technology, Japan)

We proposed and designed the analog-digital circuit for sound localization based on the biological auditory system. The proposed unit circuit was constructed with 9 metal oxide semiconductor (MOS) transistors and 1 capacitor. The proposed circuit is characterized by the simple structure, high speed processing and the low power consumption. The measured results of the test circuit fabricated on the breadboard showed that the proposed unit circuits can operate normally. The results with the simulation program with integrated circuit emphasis (SPICE) showed that the circuit can generate the signal for detecting the sound localization of the object.



GS16-6 Artificial neural networks paddy field classifier using spatiotemporal remote sensing data

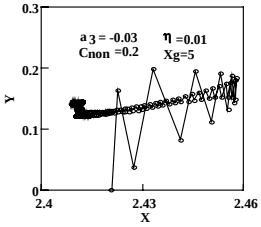
Takashi Yamaguchi, Kazuya Kishida, Eiji Nunohiro, Jong Geol Park, Kenneth J. Mackin, Keitaro Hara, Kotaro Matsushita, and Ippei Harada
(Tokyo University of Information Sciences, Japan)



Monitoring changes in paddy field area is important since rice is staple food, and paddy agriculture is a major cropping system in Asia. For monitoring change in land surface, a lot of satellites were launched and its applications were researched in the field of remote sensing. However monitoring paddy field area with remote sensing is difficult due to the temporal change in land surface, and difference of spatiotemporal characteristics in countries and regions. In this paper, we applied artificial neural network to classify paddy field areas using moderate resolution sensor data that includes spatiotemporal information. Our aim is to automatically generate a paddy field classifier in order to create localized classifiers for each country and region.

GS16-7 Transformation of neural network weight trajectories on 2D plane for learning type neural network direct controller

Takayuki Yamada
(Ibaraki University, Japan)



Through the simulation of tracking method of neural network weight change on 2D plane, we noticed that it was hard for untrained users to observe the neural network weight performance on 2D plane in some cases. To overcome this problem, this paper applied a transformation of the neural network weight trajectories on 2D plane to the learning type neural network direct controller. The simulation results confirmed that although the trajectory of the neural network weight change on 2D plane had the complex structure, the proposed transformation of the neural network weight trajectories to one dimensional values was useful to determine whether the neural network learning was terminated or not.

Session: GS17
Robotics I
GS17-1 Development of variable stiffness joint drive module and experimental results of joint angle control

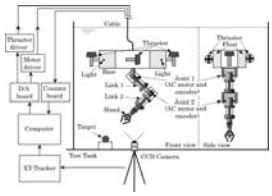
Jun Kobayashi[1], Katsuhiro Okumura[2], Yasuhiro Watanabe[2], and Noriyoshi Suzuki[3]
([1]Kyushu Institute of Technology, Japan)
([2]Fukuoka Industrial Technology Center, Japan)
([3]Mitsuwa Co., Ltd., Japan)

Two prototypes of variable stiffness joint drive module imitating a human joint structure are presented in this paper. A human joint is driven by a pair of flexor and extensor muscles that work antagonistically. The stiffness of the joint is adjusted by their co-contraction. Such a structure was given to the joint drive module so that it could achieve a variable stiffness property. The joint is driven by two wires with nonlinear springs. Thanks to the nonlinearity of the springs, the stiffness of the joint can be adjustable by quasi-co-contraction of the wires. With the first prototype, the stiffness adjustability of the joint was empirically confirmed. Regarding joint angle control, a three-layered PID control algorithm was implemented in the second prototype, and it was verified that the control algorithm worked properly.

GS17-2 Digital RAC with disturbance observer for underwater vehicle-manipulator systems

Shinichi Sagara, Takashi Yatoh, and Tomoaki Shimozawa
(Kyushu Institute of Technology, Japan)

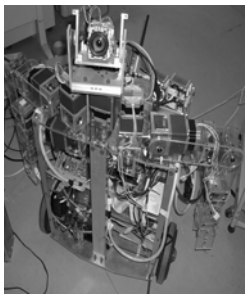
Most of control methods of Underwater Vehicle-Manipulator Systems (UVMS) are based on the computed torque method that is used for underwater robotic vehicles. We have proposed a Resolved Acceleration Control (RAC) method for UVMS. In this paper, we propose a disturbance compensation control method for both vehicle and manipulator based on the RAC method. Experimental results using an underwater robot with vertical planar 2-link manipulator show that the proposed control method has good control performance.



GS17-3 Development of an autonomous-drive personal robot "An object recognition system using image processing and an LRS"

Yasushi Kibe and Eiji Hayashi
(Kyushu Institute of Technology, Japan)

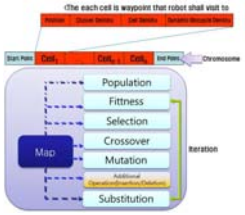
In this report, we describe an object recognition system for an autonomous robot. This object recognition system is composed of both an object recognition processing part and a location information acquisition processing part, both of which are based on a sensor using a CCD camera and an LRS. At first, the object recognition processing part searches for the object that the user specified according to the shape and color of the object, based on the image information from the CCD camera. Next, the location information of the searched object is acquired by the location information acquisition processing part. LRS is used to acquire the location information. An object-recognition system acquires the location information of an object using both of these recognition systems.



GS17-4 Path planning algorithm using the values clustered by k-means

Won-Seok Kang, Seung-Hyun Lee, Berdakh Abibullaev, Jin-Wook Kim, and Jinun An
(Daegu Gyeongbuk Institute of Science and Technology, Korea)

We suggest a path planning algorithm that makes the movement of an autonomous robot easier in a dynamic environment. We focus on finding optimal movements for mobile robot to keep going on a stable situation but not on finding shortest paths or smallest movements. The proposed algorithm is based on GA and uses k-means of cluster analysis to recognize the much more information of obstacles distribution in real-life space.



GS17-5 Homing navigation with image matching approach

Jiwon Lee and DaeEun Kim
(Yonsei University, Korea)

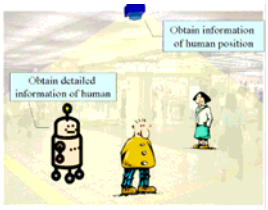
Many studies have tried to develop more accurate and highly sophisticate vision-based navigation algorithm. Simple and efficient navigation has been considered to save computation time and spatial memory. Bio-inspired navigation methods follow the navigation model of insects or animals, and it is believed that their mechanism use the image matching between the home snapshot image and the current snapshot image to determine the homing direction without any other information. This kind of simple navigation approach can be applied to robotic navigation. In this paper, we show the potential of the image matching approach for homing navigation.

Session: GS18
Robotics Ⅱ

GS18-1 Human tracking with variable prediction steps based on Kullback-Leibler divergence

N. Takemura[1], Y. Nakamura[1], Y. Matsumoto[2], and H. Ishiguro[1]
([1]Osaka University, Japan)
([2]National Institute of Advanced Industrial Science and Technology, Japan)

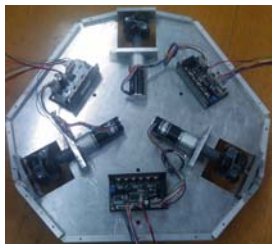
This paper deals with a path planning problem for tracking humans in order to obtain detailed information about human behavior and characteristics. In our method, path planning is performed based on Kullback-Leibler divergence between the predicted distribution of all human position and the intensity of field of view of agents. The number of prediction steps is determined according to the consistency of the prediction. Experimental results show that when prediction of human movement is accurate, the long-term prediction is useful for the path planning. On the other hand, when prediction is inaccurate, long-term prediction might not be useful. Our path planning method works well even under changing circumstances by changing the number of the prediction length.



GS18-2 Optimal path planning with holonomic mobile robot using localization vision sensor

Dong Seok Lee[1], Chang Sup Kim[1], Soo Yong Kim[1], Kil Soo Lee[1],
Hyung Gyu Park[1], Yung Ho Koh[2], Man Hyung Lee[1]
([1] Pusan National University, Korea)
([2]Futronic Co., Ltd., Korea)

Most of the present drive systems of the home service robots and the industrial robots are non-holonomic systems that function only when the robots are moving. For instance, the average vehicle can be steered only when driving so instant movement in all directions is not possible. And that is why the holonomic drive system is attracting attention. In this paper, we propose a holonomic system using three omni-direction wheels to enable instant movement in all directions. Also, IR-projector and vision sensor are proposed for autodrive robots to detect the robot's positioning. This system uses an infrared ray projector which processes the image reflected from the infrared reflector installed on the ceiling to detect the absolute position and direction angle of the robot in real time. Robot autodrive using vision sensors is also proposed.



GS18-3 Efficient robotic memory controller for long-term planning

Hassab Elgawi Osman
(Tokyo Institute of Technology, Japan)

This paper contributes on designing robotic self-optimizing memory controller for non-Markovian reinforcement tasks. Instead of holistic search for the whole memory contents, the controller adopts associated feature analysis to produce the most likely relevant action from previous experiences. Actor-Critic (AC) learning is used to adaptively tuning the control parameters, while on-line variant of Random Forest (RF) learner is used as memory-capable to approximate the policy of Actor and the value function of Critic. Learning capability is experimentally examined through non-Markovian cart-pole balancing task. The result shows that the proposed controller acquired complex behaviors such as balancing two poles simultaneously and displays long-term planning.

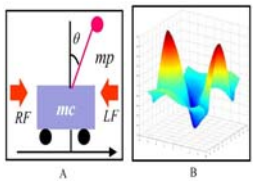


Fig. A. Non-Markovian Cart-Pole setting. B. Optimal Value function.

GS18-4 Construction of the robot control system with use of pointing action and voice

Yuki Takenaka[1], Norihiro Abe[1], Yoshihiro Tabuchi[1], Hirokazu Taki[2], and Shoujie He[3]
([1]Kyushu Institute of Technology, Japan),
([2]Wakayama University, Japan),
([3]VuCOMP, USA)

This research is aiming at making the robot that can go to take an object designated by a user. We produce the robot control system that uses pointing action and voice. This system is composed of two systems. One system is the object instruction system that uses pointing action, another one is the object instruction system that uses voice. An approximate position of a designated object is recognized by the object instruction system that uses pointing, details of information on a designated object and an instruction operation correction are conveyed by the object instruction system that uses voice. A robot is able to be moved to a designated object by using this system.

S18-5 The water-tank test of novel underwater positioning system based on sensor networks

Bin Fu[1], Lian Lian[1], Zhang Feifei[2], Ito Masanori[2], and Li Wen tao[1]
([1]Shanghai Jiao Tong University, China)
([2]Tokyo University of Marine Science and Technology, Japan)

To provide highly precise position information for AUV's autonomous navigation in large-scale area, we are developing one new underwater positioning system based on sensors networks. In this system, we set many standard stations on the surface of the sea and use GPS-sound positioning. Therefore, in this research we try to propose a novel underwater distance-measuring method which is low cost-consuming and more simple. This novel method is based on energy loss in the course of sound's propagation and it does not need highly precise atomic clock, carrier wave unit or recover unit .We verify the linear relationship between Sound Propagate Loss and propagation distance. However, the major problem of this method comes from influences of background noise and reflected waves.

GS18-6 Countering asymmetric situations with distributed artificial life and robotics approach

Peter Sapaty[1] and Masanori Sugisaka[2]
([1]National Academy of Sciences, Ukraine)
([2]Nippon Bunri University(NBU), Japan)

A novel control model and technology, creating distributed virtual systems with artificial life features, is discussed. They become capable of runtime reshaping, adapting to unknown environments, exhibiting consciousness and will, and pursuing global goals. The approach is based on known holistic and gestalt principles, where the whole is first and parts are treated in the context of the whole. Distributed Scenario Language, DSL, the core of the approach, and its spatial interpretation in networked systems, will be revealed. Mission scenarios in DSL, covering, integrating, tasking, and controlling distributed resources (robotic swarms including), can effectively fight world disasters and crises.

Session: GS19
Robotics & Bipedal robot
GS19-1 Design of robotic arm's action to imitate the mechanism of an animal's consciousness

Takahiro Yamasaki and Eiji Hayashi
(Kyushu Institute of Technology, Japan)

We are attempting to develop that user be able to let robots perform an intellectual action that has a healing and friendly feeling. So we copied the consciousness of an animal, and we were modeled paying attention to the dopamine which is a substance within a brain which manages action of an animal. Robotic arm's finger is outfitted with a small Web camera, allowing the arm to recognize external information so that the robot can select various actions released in compliance with the outside environment. Furthermore, the robot can build the system corresponding to internal states, such as the degree of rotation angle, and temperature, by using the actuator of a robot arm. In the present study, a motivation model which considers the outside environment and the internal state has been used, and the behavior of the robotic arm has been verified.

GS19-2 Development of an autonomous-drive personal robot (Self-position correcting by door recognition)

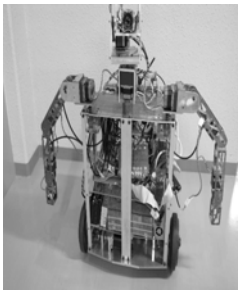
Seiki Matsuura and Eiji Hayashi
(Kyusyu Institute of Technology, Japan)

We are attempting to develop an autonomous personal robot that has the ability to perform practical tasks in a human living environment by using information derived from sensors and a knowledge database. In this system, the robot presumes the position of a door from the image offered by an ocellus CCD camera. Next, it moves to the presumed position and a door is checked. If a door is discovered, the robot calculates the distance between a door and a robot. And a calculation result is compared with a map and a self-position is recognized. As mentioned above, a robot operates safely and correctly.

GS19-3 A user recognition system using a stemma camera

Seiichi Tanaka and Eiji Hayashi
(Kyusyu Institute of Technology, Japan)

In this report, we describe the recognition of multiple people system for an autonomous robot. This system detects a moving object from an image provided by the stemma of a CCD camera and estimates a search domain. It judges whether a human being exists in a camera image using color and form information. In addition, it obtains a detailed image of a face using the zoom function of the camera, detecting the position of the eyes and nose using an obtained detailed image. It also detects features around the detected portion of an image. Finally, it identifies a user by comparing the features with information in a database.



GS19-4 Design of robotic behavior that imitates animal consciousness- Development of method for pursuing or escaping from an object -

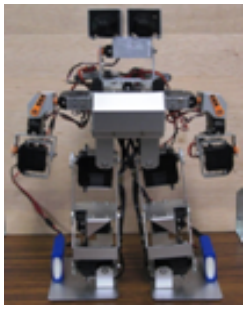
Koichiro Kurogi and Eiji Hayashi
(Kyusyu Institute of Technology, Japan)

In this report, we describe the system of the robot imitating the consciousness mechanism of the animal. In our research, we have made an attempt to give the robot "considerations" such as people and animals have. It is believed that some motives are sure to exist in the actions of people and animals, and we have constructed a motivation model to give a motive of action for the robotic arm. This motivation model is a system that models an animal's dopamine generation mechanism, and it determines the motivation of the robot based on changes in the amount of dopamine generated.

GS19-5 Recognition and movement in artificial environment with bipedal robot

Naohiro Ohtsu, Norihiro Abe, Kazuaki Tanaka, and Yoshihiro Tabuchi
(Kyusyu Institute of Technology, Japan)

However well we control a bipedal robot in walking, images gotten by the cameras are tilted by rolling and small bumps. This complicates recognition of environment with cameras in walking, and the robot can't move smoothly. Introducing a bipedal robot is to make it possible for both a human and the robot which have the same embodiment to make collaboration by making both take the same behavior as far as possible which is difficult to attain with other types of robots such as a wheel driven robot. Under the artificial environment mainly consisting of vertical and horizontal lines, images must be corrected by detecting the tilt angle of them using Hough Transformation, which detects nearly-vertical lines form the environment. As a result, a robot successfully recognizes the environment with a stereo vision using images obtained by correcting tilted ones.



GS19-6 Estimation of other's sensor patterns based on motion imitation and communication-- Identification of symbolization strategy for sensor by comparative evaluation questions --

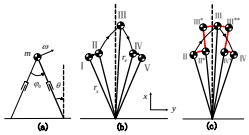
Keisuke Okuno[1] and Tetsunari Inamura[1,2]
([1]Sokendai, Japan)
([2]National Institute of Informatics, Japan)

Estimation of user's sensorimotor patterns by motion observation enables robots to achieve user friendly supporting tasks. In previous works, we proposed a method to estimate arbitrary other's sensorimotor patterns by a projection function between other's and self's sensorimotor experiences. Estimation errors derived from differences in body conditions were corrected by queries for sensory information. However, symbolization strategies for sensor were not discussed. Thus, in this paper, we propose comparative evaluation queries for motions for this matter. With the method, the estimation for the other's torque patterns converged after a few queries with successful identifications. Applications of the proposed method are not restricted for the identification, but can estimate continuous sensory patterns that can't be expressed by symbol representations.

GS19-7 A walking gait generation using stance-leg actuation

Xiaoyue Zhang and Mingguo Zhao
(Tsinghua University, China)

We study a simple two-link model based on Passive Dynamic Walking which can walk on the level ground. It is powered by extending and shortening the telescopic stance-leg. Through the up-and-down motion of the hip mass, the mechanical energy is increased in one walking cycle before the heel-strike. If the incremental energy is equal to the lost energy at collision, the model can have cyclic gait. Through the simulation of an easy equivalent instantaneous model, we can obtain the analytical expression of the fixed point and study the stability of the fixed point. From the mechanical energy's point of view, we find the model has energy feedback which can also illustrate the asymptotical stability of the fixed point. As a conclusion, the stance-leg actuation is a walking gait generation for robots walking on level ground.

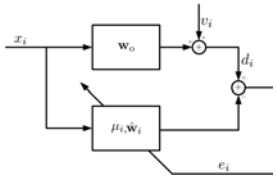


Model and key instants in one walking step

Session: GS20
Robotics & Application
GS20-1 Variable step-size affine projection algorithm based on excess mean square error

Chang Hee Lee and PooGyeon Park
(Pohang University of Science and Technology, Korea)

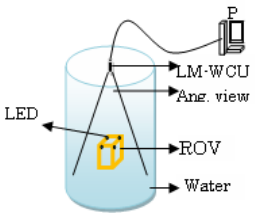
In this paper, we modify the variable step-size APA (VSSAPA) suggested by Shin et al by reducing the number of computation. In Shin's VSS-APA, as the system order increase, the projection of the estimation error into the input regression space requires a large amount of computation and the resulting projection vector also has a large dimension (n by 1) that is used in the step-size adjustment. To moderate it, this paper suggests an algorithm that utilizes the estimated excess mean square error (EMSE) by time averaging instead of the projection vector. Consequently, it eliminates the projection operation and reduces the resulting vector dimension from n by 1 to M by 1, where M denotes the projection order. Finally, the required computation gets remarkably reduced. The simulation results verify the performance of the proposed algorithm for various input signals and several orders.



GS20-2 Basic research on new underwater positioning technology based on machine vision

Bin Fu, WenTao Li,Tong Ge, Lian Lian, and Han Zhang
(Shanghai Jiao Tong University, China)

We have developed a hovering AUV for observation and operation. In response to some problems of AUV positioning within small-scale work environment, this paper proposes a new method to determine position and posture of AUV based on machine vision. The system consists of three parts: plural LED light source, a camera and a data-processing computer. This paper will initially explore difficulties and solutions of the visual image processing used in underwater environment, discuss the arrangement of LED array and the algorithm of relative position and analyze the results of performance tests on this method. Due to limited propagation distance in water, We also discuss the scope of application of the method and give reasonable applications.



GS20-3 Basic research on underwater laser ranging and speed-measuring

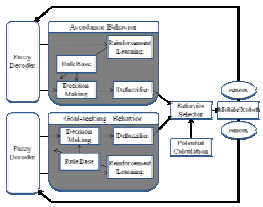
Bin Fu, Han Zhang, Tong Ge, Lian Lian, and Wentao Li
(Shanghai Jiao Tong University, China)

This paper proposes one new method of calculating (1) the speed of AUV according to the distance measured by one laser range finder and (2) the angle between AUV head and the surface of underwater structure according to the different distances measured by two laser range finders. Besides discussing the selection of the laser type, this study tests computing speed, accuracy, range and other performance of underwater laser ranging method through a large number of experiments of simulating the process that the AUV gets close to and goes far away from the object in different postures. The results show that the accuracy for laser ranging has no major changes in the water medium. And the range of this method is affected by water quality, reflector materials, angle of reflection, etc.

GS20-4 Ultrasonic sensor based navigation for a mobile robot using fuzzy logic

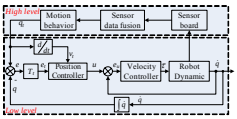
Nguyen Huu Cong and Sung-Hyun Han
(Kyungnam University, Korea)

This paper proposes ultrasonic sensor-based navigation method which utilizes fuzzy logic and reinforcement learning for navigation of mobile robot in an unknown environment. It based on the combination of elementary behaviors has been developed. Most of these behaviors are achieved by means of fuzzy inference systems. The proposed navigator combines two types of obstacle avoidance behaviors, one for the convex obstacles and one for the concave ones. The use of fuzzy inference systems to generate the elementary behaviors is quite simple and natural. However, one can always fear that the rules deduced from a simple human expertise are more or less sub-optimal. This is why we have tried to obtain these rules automatically. A new navigation method using fuzzy logic and reinforcement learning is proposed in this paper.



GS20-5 Robust real-time control of autonomous mobile robot by using ultrasonic and infrared sensors

Van-Quyet Nguyen, Shim-Byoung Kyun, and Sung-Hyun Han
(Kyungnam University, Korea)



This paper presents a new approach to obstacle avoidance for mobile robot in unknown or partially unknown environments. The method combines two navigation subsystems: low level and high level. The low level subsystem takes part in the control of linear, angular velocities using a multivariable PI controller, and the nonlinear position control. The high level subsystem uses ultrasonic and IR sensors to detect the unknown obstacle include static and dynamic obstacle. This approach provides both obstacle avoidance and target-following behaviors and uses only the local information for decision making for the next action. Also, we propose a new algorithm for the identification and solution of the local minima situation during the robot's traversal using the set of fuzzy rules. The system has been successfully demonstrated by simulations and experiments.

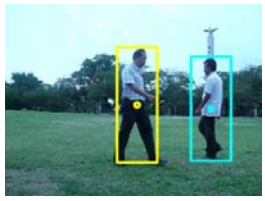
GS20-6 Artificial life intelligent contour following industrial robot

MS Samsi, I Zunaidi, N Nagarajan, Y Sazali, and M Rozailan
(TATI University College, Malaysia)

Contour following is very important topic to be studied since the outcome of robot to follow contour automatically can simplify robot teaching process. Normal teaching to make robot capable of following contour is quite tedious and time consuming. It requires three points in order to model an arc. If the curve is quite complex it requires curve fitting of several points not to mentions teaching iterations in order to get correct overall curve path and speed. This research will empower industrial robot life artificially and can behave like intelligent entity whereby the industrial robot capable of self learning the curve and has the power to judge and discriminate the number of sampling points between simple curve and complex curve.

Session: GS21
Pattern recognition
GS21-1 A color-based particle filter for multiple objects tracking in outdoor environment

B. Sugandi, H. Kim, J.K. Tan, and S. Ishikawa
(Kyushu Institute of Technology, Japan)

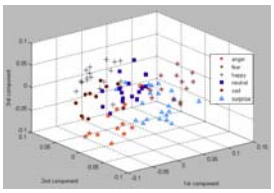


We present an approach to handle multiple objects tracking in the presence of occlusions, background clutter and appearance change. The occlusion is handled considering the predicted trajectories of the objects based on a dynamic model and likelihood measures. We propose also a target-model update conditions, ensuring the proper tracking multiple objects. The proposed method is implemented in the color-based particle filter framework. The color histogram is used for calculating the likelihood of the particles that is measured based on Bhattacharya coefficient. The experimental results confirm the effectiveness of our method to track multiple objects.

GS21-2 A Study of dimension reduction of Gabor features from different facial expressions

Rosdiyana Samad and Hideyuki Sawada
(Kagawa University, Japan)

Facial expressions are an important channel of nonverbal communication. Currently, many facial expression analysis or recognition systems have been proposed. In this paper, a study of dimension reduction of Gabor features from different facial expressions is presented. Principle Component Analysis (PCA) is used as dimension reduction method. There are six facial expressions; anger, fear, happy, neutral, sadness and surprise are used in this study. Experimental results demonstrated the reduced dimensions of Gabor features could be effectively used in the next processing for recognizing facial expressions.



GS21-3 Interactive musical editing system to support human errors and offer personal preferences for an automatic piano -A method for searching for similar phrases using DP matching and for inferring performance expression with the best alignment of DP matching-

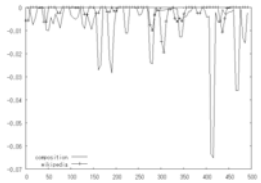
Kenichi Koga and Eiji Hayashi
(Kyusyu Institute of Technology, Japan)

A highly skilled pianist is able to play an unfamiliar piece of music by sight, even if the performance is not completely in accord with an intended specific musical interpretation. Current computing systems cannot perform a new piece of music by sight, and thus they cannot simulate a human pianist's musical expressions. We developed a system that searches for similar phrases throughout a musical score and infers the style of the performance. The method for searching for similar phrases using DP matching and for inferring performance expression with the best alignment of DP matching. In this paper, we describe the results of searching and inferring for similar phrases using DP matching, and we provide an evaluation of these results.

GS21-4 A Corpora-based detection of stylistic inconsistencies of text in the targeted subgenre

Kiyota Hashimoto[1], Kazuhiro Takeuchi[2], and Hideaki Ando[2]
([1]Osaka Prefecture University, Japan)
([2]Osaka Electro-Communication University, Japan)

The authors are currently on the way to develop a couple of educational applications for learners to improve their utterance/writing skills with a particular reference to stylistic coherence: a visual aid for teachers and learners to detect style inconsistencies with advice on improvements, an evaluation aid for teachers to grade learners' writings. In this paper, as a foundational data accumulation and analyses for them, we propose a method using multi-corpora comparison to correctly extract expressions not suited to a particular subgenre intended.

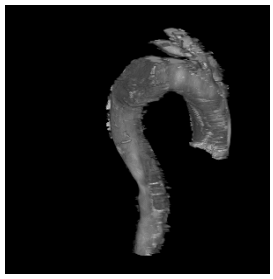


Session: GS22
Virtual reality

GS22-1 Detection of volume data of aortic tissues based on three dimensional domain growing

T. Tokuyasu[1], T. Shuto[1], K. Yufu[1], N. Abe[2], S. Kanao[3], A. Marui[3], and M. Komeda[4]
([1]Oita National College of Technology, Japan) ([2]Kyushu Institute of Technology, Japan)
([3]Kyoto University, Japan) ([4]Nagoya Heart Center, Japan)

This study aims to develop a diagnosis assist system that clearly shows the region of aneurysm of a patient based on image processing for the patient's computer tomography data. Because the border between region of aneurysm and other around organ drawn on the CT image are not clear, so the purpose of this study is to accurately extract the region of aneurysm. Then we applied region growing method to extract the region of aneurysm and blood vessel and succeeded to extract cross section of blood vessel. In order to obtain the volume data of patient's aneurysm, we gave it a twist and made it possible to obtain most of volume data in respect to aortic tissue.



GS22-2 Autonomous walking with use of quadruped virtual robot

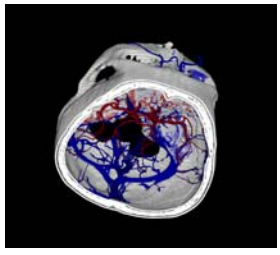
Kouki Miyoshi[1], Norihiro Abe[1], Yoshihiro Tabuchi[1], Hirokazu Taki[2], and Shoujie He[3]
([1]Kyusyu Institute of Technology, Japan)
([2] Wakayama University, Japan)
([3]VuCOMP, USA)

In the development of a robot, it needs much cost and time to verify a robot's motion with use of real machinery. Especially it is difficult to validate a robot's behavior at the unsafe place. Then developers have paid attention to virtual debugging system. It makes verification of a machine's behavior makes more efficient and easy by using a program validated in VR space. In this research, we have a virtual robot walk on a road autonomously with the images which are captured by cameras on the virtual robot.

GS22-3 Construction of the head model for the operation simulation system targets the brain aneurysm

Toshihide Miyagi[1], Norihiro Abe[1], Yoshimasa Kinoshita[2],Tatsushi Tokuyasu[3],Hirokazu Taki[4], and Shoujie He[5]
([1]Kyushu Institute of Technology, Japan)
([2]Munakata Suikokai General hospital, Japan)
([3]Oita National College of Technology, Japan)
([4]Wakayama University, Japan) ([5]VuCOMP, USA)

In traditional clinical training, the doctor has acquired medical skills through experiences of medical operation. But, these training contain some problems that are security and burden to a patient. And so, as a new approach for the medical training, researches of the operation simulation system using Virtual Reality are considered promising.. As a back ground, points that human body is possible to rebuild from high resolution image obtained by CT or MRI, and advancement of computer's processing speed, are adduced. Especially, the purpose of this research is development of the simulation system which targets brain aneurysm that is occurred at inside of blood vessel of the head. The purposes of this research are the detection of the operation target, and modeling the head including the operation target.



GS22-4 The construction of remote communication system between haptic-devices

Yasutaka Uchida[1], Norihiro Abe[1], Yoshimasa Kinoshita[2],
Hirokazu Taki[3], Tatsushi Tokuyasu[4], and Shoujie He[5]
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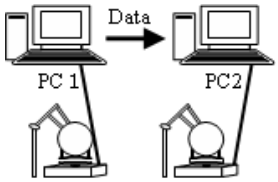
Recent years, advances in medical technology are remarkable. With the development, many lives being difficult to save are saved. As there are a few cases which need the latest medical technologies, it is difficult for to acquire experience to cope with such cases. So, this research purpose is construction of the operation simulation system which allows learners to experience the medical specialist's manipulation of a knife and a scissor in operation and makes it possible to reproduce the real operation.



GS22-5 Construction of virtual dense elastic object from medical image data and deformation with haptic device

Hiroshi Takada[1], Norihiro Abe[1], Yoshimasa Kinoshita[2],
Hirokazu Taki[3], Tatsushi Tokuyasu[4], and Shoujie He[5]
([1]Kyushu Institute of Technology, Japan)
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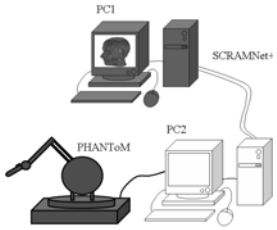
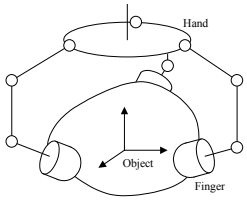
Our objective in this research is to construct the training system of medical operations which gives the haptic sense of operation, and an inexperienced surgeon can try operation again and again to improve his skill by using the system. We construct a virtual dense elastic object which considers inner tissue from medical image data such as computed tomography (CT) or magnetic resonance imaging (MRI), and we use a spring-mass model to represent the movement of elastic deformation. Haptic sense which is generated from a deformation of the object is given to an operator with haptic device in this system. In this paper, we study a real time rendering and real time deformation which is needed in surgical simulation.



GS22-6 Stability analysis of 3D grasps by considering curvatures and torsions of contact geometry

Takayoshi Yamada[1], Toshiya Taki[2], Manabu Yamada[2], Yasuyuki Funahashi[3], and Hidehiko Yamamoto[1]
([1]Gifu University, Japan)
([2]Nagoya Institute of Technology)
([3]Chukyo University, Japan),

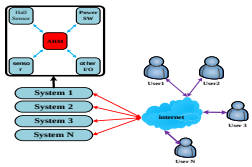
This paper analyzes 3-dimensional static grasp stability taking into account of contact geometry (metric tensor, curvature, and torsion). Grasp stiffness matrices are derived by replacing each finger with a 3-dimensional spring model. The stability is evaluated by eigenvalues and eigenvectors of the matrices. Any friction condition is considered at each contact point. That is, rolling contact occurs at friction contact point, and sliding contact occurs at frictionless contact point. Effectiveness of our proposed method is demonstrated though numerical examples.



Session: PS1
Poster Session
PS1-1 A study of embedded community network system in home automation

Chun-Liang Chen and Pi-Yu Chen
(Nan Kai University of Technology, Taiwan)

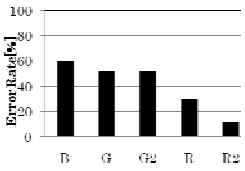
This paper presents home automation in community network with embedded system. The system includes home security monitor and home energy monitor. Home security monitor uses sensors and micro switches to monitor home status; home energy monitor adopts Hall sensor to oversee household energy consumption and control the power consumption of home appliances, Furthermore, use embedded database to record, energy consumption. Besides, the system use Shortest Paths and Topological Sort of power dispatch module. Data is transmitted to computers, mobile phones, or other devices connected to Internet. The system integrates every node subsystem and is constructed on net framework by using Common Gateway Interface (CGI) and Cell Spitting.



PS1-2 A novel coding method for genetic algorithms based on redundant binary number

A. Murayama and A. Kanasugi
(Tokyo Denki University, Japan)

This paper proposes a novel GA which switches the expression of solution from redundant binary number to usual binary number. Furthermore, a GA which switches the expression from Gray code to usual binary number is compared. Gray code is a binary numeral system where two successive values differ in only one bit. In this paper, comparison of performance among five GA (in these figures, 'B' means binary number, 'G' means Gray code, "G2" means switching from Gray code to binary number, 'R' means redundant binary number, and "R2" means switching from redundant binary number to binary number.) were illustrated. The performances were evaluated by solving some equations. It is confirmed that the proposed GA was effective for improvement of error rate.



PS1-3 The optimal combination of dither matrix by using genetic algorithm

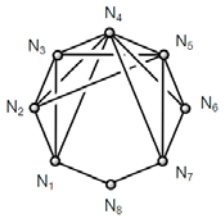
Tsuneyasu Kato, Ken-ichi Tanaka
(Meiji University, Japan)

In this study, optimal combination of dither matrix is searched on a viewpoint of image quality with Genetic Algorithm(GA). At first, the combination of matrix is selected at random. The method of Crossover is interchanging positions of two individuals from element no.0 to element no. X. No. X is selected at random. And the type of selecting individuals is the tournament. The criterion of comparing data is cost E that is the evaluation value of gray level. And it is addition of cost Em and cost Ec. Individuals that have small cost E are prior carried over. The cost E of Bayer dither is 102.846. The cost E of GA is 102.826. It is clear that the result of GA is more super than Bayer dither on a viewpoint of image quality.

PS1-4 Improved algorithm for solving the Maximal Clique Problem with DNA computing

H. Aoyagi, N. Rajaee and O. Ono
(Meiji University, Japan)

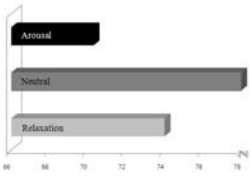
Solving a Maximal Clique Problem with DNA computing was introduced by Q.Ouyang in 1997. However, while we can determine the size of the largest clique from the lengths of the DNA strands in Ouyang's proposal, the determination of the vertices for a clique was not able to be derived directly from the read-out of the computation results. In our work, we improved Ouyang's algorithm and show that individual vertices involved in a particular clique can be sorted and analyzed directly from the gel electrophoresis process.



Session: PS2
Poster Session
PS2-1 Difference of 3-back task performance due to three levels of arousal

M. H. Choi[1], J. S. Choi[1], B. C. Min[2], G. R. Tack[1], and S. C. Chung[1]
([1]Konkuk University, Korea)
([2]Hanbat National University, Korea)

The purpose of this study was to investigate how three levels of arousal affect performance of a 3-back task. Ten university male (25.7±1.5 years) and ten female (24.5±1.8 years) students participated in this experiment. Using pictures selected from a group test, three levels of arousal (arousal, neutral, and relaxed emotions) were induced. Each subject was run through the procedure three times, once for each arousal level. The procedure consisted of six phases for each arousal condition; Rest 1 (2 min), Picture 1 (2 min), 3-back Task 1 (2 min), Picture 2 (2 min), 3-back Task 2 (2 min), and Rest 2 (2 min). Skin conductance level (SCL) of electrothermal activity was also measured during all phases of the experiment. The accuracy rate of 3-back task performance was the highest at a neutral emotional state. Based on the results, it could be inferred that arousal emotion, induced by stimuli unrelated to cognitive tasks, decreases the ability to perform cognitive tasks.

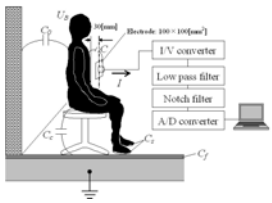


The accuracy rate by 3 types of emotion

PS2-2 Detection of human respiration based on measurement system of current generated by electrostatic induction

Koichi Kurita
(Kochi National College of Technology, Japan)

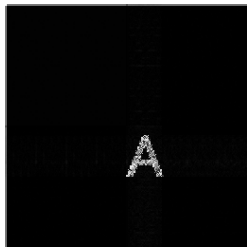
In this study, we developed an effective technique for measuring human respiration using a noncontact and nonattached electrode. The technique requires measurement of the current generated due to the difference in capacitance between a given electrode and the human body. The subpicoampere electrostatic induction current flowing through the electrode when placed a few centimeters from the subject is detected. We propose an occurrence model for the electrostatic induction current generated by the change in the capacitance caused by the movement of the body surface while taking a breath. This model effectively describes the behavior of the current flowing through the measurement electrode.



PS2-3 Authentication of the reconstructed image from computer-generated hologram: synthesized by Complex Hadamard Transform

Fumiya Inaba, Norihiro Fujii, Ken-ichi Tanaka
(Meiji University, Japan)

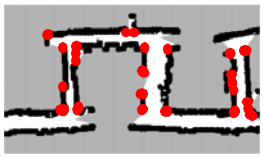
This study is about a type of steganography or digital watermarking. The reconstructed image of Computer Generated Hologram (CGH) includes noise caused by quantization error when synthesis a hologram. Therefore, authentication of the reconstructed image by using computer is difficult. This study proposes a method using Complex Hadamard Transform (CHT). CHT is a function of the basis for the conversion functions required by the Hadamard Matrix, using only addition and subtraction. In this study, CHT is compared with Fourier Transform (FT) at the points of the detection accuracy. The possibility of adaptation to authentication of the reconstructed image calculated by CGH, in the case of this proposal using for calculation method, are examined.



PS2-4 Feature extraction method using laser range finder for SLAM

Taerim Kim, Sungyoung Jung, Jungmin Kim and Sungshin Kim
(Pusan National University, Korea)

In this paper, we propose the feature extraction from laser range data using angle histogram algorithm. Most people commonly know that laser sensor has relatively accurate performance. But noises were existed in experimental result that a few points appeared empty space. We proposed noise reduction method using angle histogram algorithm that accumulated repeatedly counted points in each angle. Laser range data with reduced noise is used for the feature extraction method. We find feature point using that one line lies cross at right angles to another line. And we tested simulation of SLAM using the feature extraction.



PS2-5 A case study of discussion classes in mathematics education (Research for the improvement of mathematics education)

Hyang Joo Rhee
(Duksung Womens University, Korea)

Modern society is looking for a leader who not only knows how to approach knowledge but creates new ones by integrating and utilizing existing knowledge, along with devoted character free to share one's ideas with others and embrace criticisms from them. In steps with such social need, increasing number of universities are expanding small group discussion-based classes in order to develop students' communication skills. This study will introduce a case that shows how a form of teaching methodology was applied to a mathematics class which often requires demonstrative thinking process to reach logical solutions.