List of Dissertation Abstract　(Department of Information Environment)			
Name	Supervisor	Title	Abstract
Chen Jiayun	Okajima Katsunori	Study on visual texture of food with image processing	To determine what visual information influences the visual texture perception of food, the effects of presentation time, color attributes, and spatial frequency were tested based on psychophysical experiments. The results showed that material perception characteristics associated with presentation time, the three color attributes of brightness, saturation, and hue, and spatial frequency influenced texture perception. It was also found that there were large individual differences in texture evaluation values among the experimental participants, which were attributed to differences in individual interpretations of food images and images of food.

WANG JIA	Katsunari Yoshioka	Detecting and Analyzing Malicious Ethereum Accounts Using Multiple Data Sources	Misconfigured Ethereum clients with application programming interface (API) enabled, JSON-RPC in particular, are targeted by cyberattacks. In this study, we propose a new framework to detect malicious Ethereum accounts using 3 different data sources (honeypot, Internet-wide scanner and blockchain explorer). Through the observation of 6 weeks, we observed 538 hosts trying to call JSON-RPC of our honeypots with 41 types of methods, including 2 types of attacks unreported in the wild. We detected 16 malicious accounts from the honeypot and 64 suspicious accounts from Shodan. To an end, this study provides a brighter view of malicious activities on Ethereum.
Arai Kazuhiro	Junji Shikata	A Study on Construction of Public Key Encryption with Keyword Search	Recently, the need of cloud service increases opportunity for users to encrypt and keep various data in database. However, this situation causes a problem of difficulty of searching and operating such encrypted data without decryption. Public key encryption with keyword search (PEKS) was proposed to solve this problem. In this thesis, two kinds of constructions for PEKS are newly proposed. The first one is constructed from inner product encryption, and the second one is constructed from homomorphic encryption. In addition, this thesis analyze and evaluate security and efficiency of those constructions.

Aramaki Kodai	Tomohiro Fujii	Eliciting focus-sensitive why-questions in Japanese	It has been argued in the literature that reason WH-adverbials such as 'why' can be focus-sensitive while other WH-phrases cannot be and that in Japanese focus-sensitive 'why'-questions, reason-WH-phrases like 'naze' must precede their focus associate. The present study provided experimental support for this word order restriction. Two elicitation experiments were conducted and revealed that the word order restriction in question indeed exits. We successfully tested the relevant theoretical prediction without appealing to the standard acceptability judgement methodology, where context and prosody, two factors that play a crucial role in the construction under investigation, might be hard to control for.
Iida Junko	Tomii Takashi	Design and Implementation of a Load Leveling Simulation Framework Capable of Evaluating Disadvantages of Vehicle-Grid Integration	In this study, we propose a framework that can simulate power load leveling in a smart grid that consists of renewable energy and EVs. The framework consists of three components: a database schema, a load-leveling simulation algorithm, and a method for quantifying the advantages and disadvantages of load-leveling. This framework has made it possible to study the feasibility of load leveling in the smart grid.

iida seiya	okajima katunori	Effects of ipRGCs and rods on color perception in dichromats	In consideration of the individual differences in the spectral sensitivities of the three types of cones, ipRGC and rod among observers, I experimentally investigated the effects of ipRGC and rod on color perception in dichromats. In Experiment 1, individual spectral sensitivities were measured using a flicker method. In Experiment 2, color discrimination experiment was performed where only stimulus response of ipRGCs or rods was modulated while keeping the responses of L,M,S cones which were calculated using individual spectral sensitivities. The results of Experiment 2 showed that ipRGCs and rods contribute to color perception in dichromats.
Ichinose Ryuuya	Tsutomu Matsumoto	A Study on Instrumentation Security for Automated Driving Systems	In recent years, the development of fully automated vehicles that do not require human control has been promoted throughout the automotive industry. In order to guarantee the safety of vehicles equipped with automated driving systems, it is important to analyze the risk of attacks that threaten the Instrumentation Security of on-board sensors and to take necessary countermeasures. In this study, we construct two types of simulators that can be used as evaluation tools for the Instrumentation Security of automated driving systems, and evaluate the attacks as practical examples.

Iwakami Tomoya	Nagao Tomoharu	Analysis of Marine Biofouling in Underwater Ship Bottom Video Images	Ships need to be brought ashore for cleaning when marine biofouling increases. In order to determine the necessity of such cleaning, experts analyze the video images taken underwater, but manual analysis takes a long time. Therefore, there is a need for a method to automatically analyze the marine biofouling. In this paper, we propose a method that uses deep learning to create pseudo-supervised data from a small amount of supervised data, and segment the underwater ship bottom video images with respect to marine biofouling.
UEDA SHINSEI	MATSUMOTO TSUTOMU	A Study on Instrumentation Security of On-Board Sensors	Automatic driving technology is supported by information on the surrounding environment obtained from onboard sensors. Therefore, any inadequacy in the measurement results may lead to a serious accident. Therefore, there is a need to improve the instrumentation security of in-vehicle sensors. In this paper, (1) we constructed a simulator for ultrasonic sensors to simulate an attack experiment. (2) We proposed an attack method for the on-board camera and evaluated it through experiments. (3) We constructed an automatic driving simulator for evaluation of instrumentation security and evaluated the effect of attacks on the on-board camera on automatic emergency braking.

Uchida Hiroto	Mori Tatsunori	Elaboration of Curation Map based on topic extraction	The document collection, obtained by a general search engine, is not ranked as a score for content comprehensiveness of the document. Thus, if the documents are referred to in order from the top, it may take a great deal of effort for the user to reach the necessary information. To address this problem, research has been done to automate the detection of documents with multiple contents at the top of the ranking and the presentation of "Curation Map" about those documents. "Curation Map" is the graph, which is obtained by dividing a document by its contents and generating links based on the content relevance to other documents with more detailed content. In this research, we attempted to improve its accuracy.
UMEKI Hiroshi	Shinichi SHIRAKAWA	Bézier Simplex Adaptation for Black-Box Multi-Objective Optimization	A Pareto set analysis method using the Bézier simplex fitting has been proposed based on the observation that the Pareto set of real-world continuous multi-objective optimization problems is often homeomorphic to simplex. This method requires running a multi-objective optimization algorithm in advance, and the analysis results heavily depend on the optimization algorithm. This study proposes a black-box multi-objective optimization method to efficiently obtain the Bézier simplex describing the Pareto set through the optimization process by leveraging the Bézier simplex fitting for solution generation. The numerical experiment on benchmark problems whose Pareto set is homeomorphic to simplex shows the efficiency of the proposed method.

Umemoto Haruki	Shirakawa Shinichi	Transfer Learning Method for Regression Problems and Its Application to Industrial Data	When modeling industrial processes and simulators using machine learning, existing models cannot predict output well if their input-output responses change between training and test stages. We propose a transfer learning method that introduces two regularizations to the loss function for regression tasks with little training data after the change. The first is regularization for the parameters of the model and the second is regularization for the intermediate representation of the model. We use two datasets for validation: power plant and wing performance prediction. We show that the proposed method improves the prediction accuracy of the output after the change on the wing performance prediction dataset.
otsuka fuga	Kenta Ozeki	(p,q)-Knight's tours and the total number of knight's tours on a rectangular chessboard	A knight's tour on a chessboard with m rows and n columns is a knight's route such that the knight visits every square exactly once and returns to the first square. We show a new lower bound of the total number of knight's tours on a chessboard in the case of m=n. (p,q)-Knight, also known as (p,q)-leaper, is an expanded knight that can move from (x,y) square to (x ± p,y ± q) or (x ± q,y ± p) square. We show new conditions of p, q, m and n such that a (p,q)-knight's tour exists on a m × n chessboard.

Ohashi Hironori	Tomii Takashi	Utilization of EV Internal Data for different purposes to produce the EV Energy Map	This study shows how to utilize internal data from electric vehicles (EVs) to create EV-specific energy consumption maps. For mapping purposes, various data including power consumption data flowing on CAN bus (CAN: Controller Area Network) inside the EV are accumulated as a “lifelog” and utilized. The lifelog of the EV on constant speed condition was used as the minimum road-specific energy consumption. The coverage of the map was improved by selecting logs from daily driving logs that were temporarily driven at a constant speed, as opposed to using logs that were driven at a constant speed using Adaptive Cruise Control.
Ogawa Kota	Katsunari Yoshioka	A study on feature extraction of IoT malware by dynamic analysis	In this study, we first investigate the network state changes caused by IoT malware infection by executing malware samples, collected by IoT honeypots, in a virtual machine. As a result, we found that about 33% of the samples change the network state of infected devices and there are many patterns in the changes of the network state. Next, based on the results of the dynamic analysis in the virtual environment, we extracted samples that made unique changes in the network state and conducted the dynamic analysis using bare-metal IoT devices. As a result of the analysis, we found that changes in the network state were also observed in the actual devices, which can be confirmed by external port scanning. The change of the port listening state in the virtual environment did not always match that in the actual device. Finally, we discuss the possibility of remotely detecting infected devices by checking their port listening status.

Ozaki Yu	Nagao Tomoharu	Transformation from Real Images to Illustrations Depending on the Style of a Few Illustration Examples	Recently, image transformation based on Generative Adversarial Networks has been widely used. However, one of the problems in transforming a photograph to a different domain, such as an illustration, is that a large number of examples of the target image are required. In this paper, we propose a method that extracts the features of a style from a few illustration or painting examples to be transformed and reflects the style to a photograph. Experiments show that the proposed method can make a photograph closer to the target illustration or painting.
OTOGAWA Yuma	NAGAO Tomoharu	A Parts-Based Detection Method for Construction Machinery	In the construction industry, image recognition is being used for the automatic operation of construction machinery and for improving work efficiency. In particular, it is necessary to be able to accurately recognize obstacles and people around construction machinery by object detection. It is also important to be able to explain why the recognition was correct or wrong. In this paper, we propose a new method that is more accurate and can explain the basis of recognition by using parts of construction machinery. In experiments, we confirmed how the results changed compared to the conventional method.

Kimura Masahiro	Ozeki Kenta	The relationship between the degree sum of independent vertex set and the minimum leaf number in a $K_{1,p}$-free graph	Since a Hamiltonian path, which is one passing through all vertices of the graph, is a spanning tree with the smallest number of leaves, the minimum leaf number problem(the problem of finding a spanning tree with the smallest number of leaves) can be considered as an extension. In this thesis, we consider the relationship between the degree sum of independent vertex set and the minimum leaf number in a $K_{1,p}$-free graph. This problem was previously shown only when $p \leq 4$ and when $p = 5$ and the minimum leaf number is 4 and 6. In this thesis, by introducing a new method, the condition is obtained for the case of the general minimum leaf number at $p = 5$.
Kono Taro	Nagao Tomoharu	Real Scene Adaptation of Semantic Segmentation Model Using CG-Style Transfer from Real Images	In CG-based real scene adaptation of semantic segmentation, real-style transfer from CG has been used. However, it is difficult to transfer CG into real images in blurry and colorless environments such as civil engineering worksites. In this study, we consider real scene adaptation by transferring real images into CG. The proposed methods are (1) adversarial learning, in which the output distributions of CG-styled real images and of CG images are made close, and (2) spatio-temporal constraints, in which the pixel values on same positions of neighboring frames are made equal. The accuracy of the proposed method is improved by more than 10% on the data of civil engineering worksites.

KOSAKAI MASATO	OZEKI KENTA	Relation between girth and minimum leaf number of cubic graphs	Minimum number of leaves in any spanning tree is called the minimum leaf number of the graph. It is known that a connected, n-vertex, cubic graph has a minimum leave number less than n/6+1/3, and it is also known that this is the best. In this study, I predict that a cubic graph on n-vertices with girth greater than or equal to 4 and connected has a minimum leaf number less than or equal to n/8+1/4, and we show a partial solution that the minimum number of leaves is less than or equal to n/7 if the girth is greater than or equal to 6.
Kobayashi Hirokazu	Shikata Junji	Optimal Construction of Anonymous Broadcast Encryption and Authentication	Broadcast Encryption (BE) is a cryptosystem that allows a sender to specify recipients so that only the specified recipients can perform decryption. Anonymity, which is one of additional but important security requirements of BE, guarantees that no information of the designated recipients is leaked from ciphertexts, and several BE schemes with anonymity (ANO-BE) have been proposed so far. In this thesis, in ANO-BE, the tight lower bound on the ciphertext-size is derived and an optimal construction is proposed. Similarly, in anonymous broadcast authentication, the lower bound on the authenticator-size is derived and an optimal construction is provided.

Shimizu Ryota	Yamada Takahiro	VERIFICATION OF AN IDENTIFICATION METHOD FOR AHYPERELASTIC BODY BASED ON STRESS ANALYSIS	Usually, when identifying hyperelastic, the main focus is on obtaining comprehensive parameters. However, in the case of mechanical products, it is more useful to obtain parameters that are sufficiently accurate under the design conditions of the product. Therefore, a property identification method focusing on the frequency of occurrence of deformation states of structures has been proposed. In this study, the best property parameters for the structure were calculated in an inverse manner, and sample points that are important for property identification were extracted. This verifies the assumptions made by the method and demonstrates its usefulness.
Suzuki Mana	Okajima Katsunori	Multisensory Feedback Interface and Multiperson Empathy System Using Mixed-Reality Devices	I constructed an experimental environment of virtual keyboard using Hololens2 and verified the effects of various types of feedback on operation performance. As a result, I showed that the tactile feedback generated by the user's touch to his/her own skin during input has a positive influence on the impression evaluation. In addition, a mixed reality system that augmented the rhythm of others was constructed and tested. As a result, it was shown that the visualized rhythm synchronized with the audience's nasal movements contributes to the formation of a sense of togetherness.

Suzuki Ryotaro	Professor Tatsunori Mori	Similar document search from a set of past defect/inquiry documents by text analysis	There is a great demand for searching past defect cases for inquiries that occur in manufacturing sites. However, it is difficult to apply existing machine learning methods to such case because of their small amount of data and lack of labeling. In this study, we attempted to create a document vector generation model suitable for accident and failure case documents by combining predicate term structure analysis and passages segmentation by window width, based on SWEM, a simple document vector generation method that takes the average value of vectors. In the search experiments, we were able to obtain an accuracy that exceeded that of BERT, a machine learning method.
SONG ZIHAO	Tsutomu Matsumoto	A Study on Pairing Based Cryptography and Aggregate Signature	High-performance cryptography is a new type of cryptography that can provide not only encryption and decryption but also more convenient functions, and is expected to be implemented in society with higher speed and security proofs. In this study, three new parameters of the core technology of high-performance cryptography, which have not yet been implemented and evaluated, are implemented and evaluated, and their superiority, inferiority, and characteristics are clarified for the first time. We also proposed the first cloud-based large-scale cryptographic simulator and evaluation platform, which is indispensable for the social implementation of high-performance cryptography, and implemented a prototype of the platform.

Takasu Megumi	Tatsunori Mori	Study on the Explainability in Question-Answering System for World History Essay Type Questions	In recent years, deep learning techniques have made remarkable progress, improving the accuracy of prediction and estimation. On the other hand, systems are becoming more and more black-boxed, and explainability, which adds transparency and interpretability to the results of AI decisions, is attracting researchers' attention. Although some methods to explain the result of Factoid-type question answering systems are proposed, it is still difficult to apply them to Non-Factoid-type question answering systems (Non-Factoid QA systems). In this study, we discuss the explainability in Non-Factoid QA systems. We first consider how to make Non-Factoid QA systems explainable, and proposed a method to give explanations from external knowledge sources to sentence using proper nouns as keys. As a result, the method achieved 34.4% in recall.
Takeuchi Yuta	Nakamoto Atsuhiro	The generating theorem of non-q-colorable signed graphs.	It is known as the Hajós theorem that all non-q-colorable graphs are obtained from a certain graph by three operations. It is also known that all non-q-colorable signed graphs are obtained by five operations, where signed graphs are ones with each edge assigned a signature ＋ or －. In this thesis, under a certain condition when q is even, we improve this theorem by decreasing the number of the operations into four.

Natsumeda Chikako	Matsui Kazumi	Sintering Simulation for Ceramics in Large Deformation	In this paper, the simple simulation strategy for sintering ceramics in the large deformation framework is proposed. The total deformation gradient is multiplicatively decomposed into thermal and mechanical components, and they are also decomposed into reversible and irreversible components. For the thermal irreversible component (sintering deformation), Master Sintering Curve is employed, and Peric's viscoplasticity model is used for the mechanical irreversible component to represent the creep deformation in sintering ceramics under stress. The model is introduced into ANSYS, thermal-structural analysis with User Programmable Feature (UPF). The simulation is validated by comparing with sintering experiment under external axial compression loads.
Noda Yuhei	Shinichi Shirakawa	Dynamic Neural Architecture Search for Convolutional Neural Network with Categorical Distribution and Structure Regularization	Neural Architecture Search (NAS) is a field of automatically designing deep neural network architectures. In this study, we focus on NAS that takes into account the architecture complexity and propose a method that obtains multiple architectures with different complexity in a single search by using importance sampling. We experimentally show that the proposed method can obtain multiple architectures with the same or better performance with less search cost than the comparison method.

hayashi shungo	Prof. Tsutomu Matsumoto	A Study on Evaluation and Countermeasures of Laser Induced Instruction Manipulation	Fault injection attacks cause faults in operating embedded systems, resulting in the leakage of confidential information. In particular, instruction manipulation attacks cause faults in instructions executed by a processor and change the instruction to another one. This study shows that existing countermeasure is vulnerable to instruction manipulation attacks using laser irradiation, and proposes a coding method to improve resistance to such attacks. This study also proposes a method to analyze and evaluates the effects of instruction manipulation attacks on programs.
Hirose Masaya	Mori Tatsunori	Detection of facial emojis that affect the estimation of utterance intention	The growth of SNS makes sentiment analysis more crucial. In recent years, the method of using emoji for sentiment analysis has become a hot topic. Since emojis are widely used in text communication and their usage is diverse, emojis with rhetorical usage such as sarcasm and self-mockery 😊, for example, are expected to affect the results of sentiment estimation using existing methods. In this paper, we proposed a method to detect such emojis using emoji classifiers and showed its effectiveness.

Hirobe Akira	Kenta Ozeki	Characterization of graphs representing rectangular dissections of the cylinder	A rectangle divided into rectangles is called a rectangular dissection of the rectangle. Felsner gave a necessary and sufficient condition for plane graphs to represent rectangular dissections of a rectangle. We can similarly define a rectangular dissection of the cylinder. However, we need more discussion that do not occur for the rectangle case, due to a property of the cylinder. In this thesis we first give another proof of the Felsner's result and then give a necessary and sufficient condition for cylindrical graphs to represent rectangular dissections of a cylinder.
Fujita Tomoko	Nagao Tomoharu	Construction of Pedestrian Behavior Model Using ADG; Automatically Defined Groups	In recent years, simulating and analyzing pedestrian flow has attracted much attention to improve safety and revitalize areas where people gather, such as train stations and urban areas. However, it is difficult to analyze the pedestrian flow in public spaces under normal conditions using a single pedestrian behavior model, because individuals act for various purposes. In this paper, we propose a method to construct a pedestrian behavioral model by using ADG. The results of the experiments show that by using our method, behavioral models with multiple objectives are acquired.

Funawatashi Takashi	Ushikoshi Erika	Mathematical analysis of crack growth in the elastic body by bending	This study analyzes a mathematical model of crack growth by bending a one-dimensional elastic body whose shape is a very thin rod. Specifically, we derive a mathematical model of crack growth due to bending based on the method of Takaishi-Kimura(2009), who considered the case for mode III. Furthermore, we analyze the relationship between the parameters of the stationary problem and a sketch of the graph of the solution using numerical analysis. In addition, the results of numerical calculations are discussed from a mathematical view point.
Furihata Suguru	Shirakawa Shinichi	Construction of Focus Determination Model for Bhas42 Cell Transformation Assay by Multiple Instance Learning	Bhas42 cell transformation assay (Bhas42 CTA) is a method for testing the carcinogenicity of chemical substances. In Bhas42 CTA, the experimenter needs to manually determine whether the abnormal growth of the cell group exposed to the chemical substance is due to the cancerous cells. Therefore, the automatic judgment system is required to reduce the burden on the experimenter. In this study, we use Multiple Instance Learning to construct a determination model that captures both global and local information in cell group images. The effectiveness of the proposed model is demonstrated by comparing existing methods.

Matsuda Takuya	Shinichi Shirakawa	End-to-End Learning of Tabular-to-Image Converter and Convolutional Neural Network	Methods for converting tabular data into images and applying convolutional neural networks (CNN) that show excellent performance on image recognition have been developed. However, previous studies do not transform tabular data into images by directly considering the CNN error. In this study, we propose a novel method that simultaneously trains a tabular-to-image converter and CNN, resulting in obtaining the tabular-to-image converter minimizing the CNN loss. Further, we introduce an additional loss function to create human-interpretable images by the tabular-to-image converter. We confirmed that the proposed method achieves high accuracy and produces human-interpretable images on several benchmark datasets.
Matsuyama Atsushi	Nakamoto Atsuhiro	K6-minors in 4-representative graphs on the torus	In graph theory, characterizations of graphs which contains the complete graph of specified number of vertices as a minor are considered important and studied by many researchers, in relation to a conjecture on the graph coloring problem. However, no characterization is known for the cases where the order of the complete graph is at least 6. As a restriction of this problem, we show that every graph which has a 4-representative embedding on the torus has the complete graph of 6 vertices as a minor, confirming the result obtained by a computer-aided experiment.

Murakami Taichiro	Tomii Takashi	Design and Evaluation of Load Leveling Algorithm Utilize Renewable Energy and EV Batteries	This study simulate power load leveling utilize renewable energy and EV batteries. To achieve this load leveling, we formulated and designed an algorithm. Utilizing a database that combines open data and lifelogs for load leveling, when load leveling was performed, the simulation was conducted under various conditions to quantify and visualize the results under various evaluation indexes.
murakami hayato	Katsunari Yoshioka	Measuring the effectiveness of notification to the users of insecure IoT devices via dedicated apps	The importance of notification activities for users of vulnerable devices is increasing, and as a method, we focused on a model that alerts through a dedicated app installed on the user terminal. In this research, we conducted a notification experiment using an actual app for 60 people who have opened vulnerable ports. As a result, the port opening status was improved more than three times compared to when no notification was given. In addition, in the questionnaire in the notification, information of the user's network environment and whether or not there was an intention to open the port was obtained.

Yamaguchi Teppei	Shinichi Shirakawa	Improvement of CMA-ES for Optimizing High-Dimensional Functions with Low Effective Dimensionality	High-dimensional black-box optimization problems often have a property where only a small part of design variables affects the objective function value but the others do not. This property is called Low Effective Dimensionality (LED). In this study, we introduce a mechanism that estimates and leverages the low effective design variable into a widely used continuous black-box optimization algorithm, Covariance Matrix Adaptation Evolution Strategy (CMA-ES), and realize efficient optimization on objective functions with LED.
Wakabayashi Kentaro	Shinichi Shirakawa	Improving Machine Learning Model by Pre-Training Scheme toward Support of Construction Equipment Operations	A support system to improve the operator's skill during the construction work is needed for the smooth progress of construction work. In this study, we train machine learning models using sensor data of wheel loaders and discuss the operation supporting method using the trained model. In order to improve the accuracy of the operation supporting method, we propose a pre-training method for efficiently exploiting our datasets including different conditions of data in terms of the construction site and operator. The experimental result using overseas data and domestic test site data shows that the proposed pre-training method can improve the operator classification and operation prediction performances. We also discuss the potential of the operator support using the trained model.

HE SONGWEI	Katsunari Yoshioka	A New Web Service to Inspect End Users' IoT Devices for Malware Infection and Vulnerabilities	In recent years, it becomes important to notify the owners of IoT devices infected with malware in Japan. The traditional method is that the notification to the end user who did suspicious communication by ISP. In this research, we propose a new notification method to provide check results for the users who want to know the security status of their IoT devices in their homes by the web service.
Guo Binnan	YOSHIOKA Katsunari	A research on analysis of vulnerability attacks observed in honeypots	With the increase in IOT devices, cyber attacks targeting their vulnerabilities are becoming more sophisticated. Honeypots, which are decoy systems, are widely researched, developed, and operated to take security measures. Insufficient registration of vulnerabilities in the database and an increase in research scans by researchers and operators make it difficult to observe attacks. In this research, we analyze the attacks observed in the honeypot, which is a decoy system, identify the equipment / system to be attacked, the vulnerabilities being exploited, and investigate the characteristics of the attack activity.

Kou Buntou Kou	Katsunori OKAJIMA	Study on communication robot returning appropriate gestures according to the emotions of users	I developed a communication robot with specific character-equipped motion sets that can read the emotions of a face-to-face person with a facial expression recognition system and return an appropriate gesture. I conducted three evaluation experiments. The results of Expt.1 showed that humans can estimate emotions from body movements, and the results of Expt.2 showed that the natural feeling and willingness to use virtual robots are significantly improved by appropriately selecting characters. Finally, the results of Expt.3 showed that communication robots have a positive effect on human emotions when humans are watching videos.
ZHOU LUMING	NAGAO TOMOHARU	Facial Expression Recognition of Sketch Using Facial Landmark	In recent years, facial expression recognition of humans has been actively carried out, but there are few studies related to facial expression recognition of sketch such as manga characters. Since the style of sketch depends on the author, it is more difficult than the facial expression recognition task of a person. In this paper, we propose a facial expression recognition model using landmarks for different styles of sketch. By inputting landmark into the facial expression recognition model in addition to the facial image, important parts of the face are emphasized. The accuracy of the model is improved compared to the conventional research in which only the facial image is input.

SHEN XINNAN	Mori Tatsunori	Automatic summarization of minutes of the meeting	Unlike the ordinary document summary, the minutes summary is required a special summary format that consists of the "question of the members" and the corresponding "answer of the governor". However, there are difficulties that one statement in the minutes is very long, the question and the answer wide apart, and maybe there are multiple answers to one question. To solve these problems, this study summarizes by considering the structure of the discussion. We constructed detailed rules from some minutes' characteristics and determine the position of questions and answers. Experimental result shows that the proposed method improves the ROUGE value of the minutes summary.
Chen Kai	Katsunori Okajima	Adaptation and delay compensation effects of incoherent visual information in hand movements	In this study, we investigated an adaptation effect and a compensation effect for motion delay by modulating the gain = (speed of hand movement in virtual environment) / (speed of real hand movement) in VR spaces. The experimental results showed that participants adapted to such inconsistent environments where the gain is not 1 in a short time, and that motion delay can be partially compensated by setting the gain more than 1. In addition, it was shown that working efficiency in three-dimensional spaces with a motion delay can be improved by modulating the position gain appropriately.

YANG LIU	Okajima katsunori	Image processing method and the visual perception mechanism of rain strength	In this study, I developed a method to control raindrops in moving images using image processing technology and clarified the visual mechanism on perception of rain intensity. I conducted experiments to evaluate the perception of rain intensity by modulating the number and size distribution of raindrops and brightness contrast in moving images Using the proposed method. The results showed that the number, size distribution, and brightness contrast of raindrops affect the perception of rain intensity. Finally, a prediction equation for the perception was derived by analyzing the experimental data.