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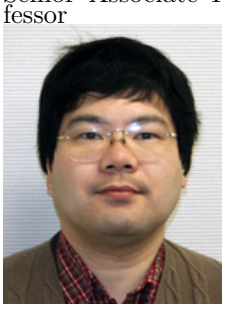

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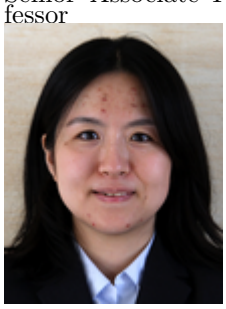
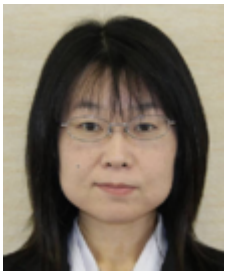


Kyoko Okudaira
Associate Professor



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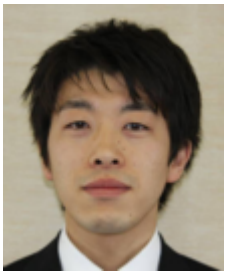

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Keita Nakamura
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CAIST was taking advantage of the leading-edge ICT platforms in the University of Aizu, and striving to establish an R and D hub, in parallel with promoting R and D activities to meet diverse social needs and proactively collaborating with external organizations, including universities, companies and research institutes.

CAIST had taken on a series of commitments and undertaken missions assigned below.

(1) R and D on leading-edge information science and technology

(2) Inter-disciplinary R and D in multiple fields

(3) Creation and utilization of intellectual properties based on research results

(4) Heightening the recognition of the University of Aizu through activities in academic societies and hosting domestic/international conferences

(5) Development and formulation of new knowledge and understanding

There are three types of clusters in CAIST. The first is the strategically planed cluster which is strategically planned based on the management and governance of UoA strategy. The second is the strategic research project-evolved cluster which is established based on evaluation of a strategic research when it is mature enough as a new CAIST cluster. The third is the on-campus open competition-based cluster which is open to all faculty for competitive proposal.

Five clusters are active in AY2017. Three clusters, ARC-Space, ARC-BME and ARC-Robot are the first type. Two clusters, ARC-HPC and ARC-Cloud, are the second type. There is no cluster belonging to the third type currently.

Activities and achievements of each cluster are summarized below.

ARC-BME The research of ARC-BME is focused on the following fields. (1) ICT-based healthcare domain for a long-term strategy for daily healthcare. These studies developed an Internet-based infrastructure, including a series of instrumentation for seamless monitoring of vital signs without disturbing subjects in daily life activities, and a variety of algorithms for in-depth data mining and big data analytics in biomedical application. Several cooperative studies with external institutions and companies were implemented for field trial and exploring possibility of commercialization. - A cooperative study with four nursing homes aimed to collect elderly data and to assess the system performance through field trial. - A cooperative study with Bange Welfare General Hospital collected clinical data from patients suffered from kidney disorder, and evaluated the therapeutic effect during dialysis. - A cooperative study with Simplex Quantum Inc. developed API libraries for healthcare application and relevant commercialized products. (2) Biomedical signal processing, image processing, and cardiac modeling and simulation. The collaboration research supported by JSPS with Fukuoka University is to develop an organic model for the study on the mechanism of atrial fibrillation.

Currently, we are also studying the computer-aided diagnosis of colorectal polyps from colonoscopy videos/images using deep learning with Aizu Medical Center, Fukushima Medical University.

ARC-Cloud This cluster promotes three core activities; research, contribution to society, and education. As research, we conduct multidisciplinary research on security and related fields. For contribution to the society, we satisfy the social needs by industry-academia-government collaboration. As education, we will develop human resources, particularly security talent. ARC-Cloud puts emphasis on information security technology and conducted research on data protection on cloud and safe web-browsing. Also, we aimed to apply our security technology to the fields of IoT by developing network simulation technology to test IoT devices against network and hosts failures and cyber attacks. Through the collaborative research and projects, we contributed to industrial development and competitiveness of technology-based companies. In addition, we conducted security seminars and drill to contribute to develop outstanding human resource in the field.

ARC-HPC (1) Co-development of MOST in software and hardware Method Of Splitting Tsunami (MOST) is an algorithm to solve the shallow water equation for the evolution of Tsunami. This algorithm is a fundamental tool to predict wave height after an earthquake event in the Pacific Ocean. In AY2017, we have ported MOST algorithm on FPGA systems using the OpenCL-based high-level synthesis tool Intel FPGA SDK for OpenCL. We have successfully implemented the MOST by using OpenCL kernels with various optimization techniques. Our latest implementation shows roughly compatible performance to the dedicated FPGA implementations we did in last year. (2) Development of a high-performance linear equation solver The gyrokinetic toroidal five-dimensional Eulerian code (GT5D) is a nuclear fusion simulation code developed by researchers at Japan Atomic Energy Agency. A compute intensive part of GT5D is to solve linear systems of equations. In the linear equation solver, the data communication time is a performance bottleneck. We have been developing an implementation of communication avoided (CA) generalized minimal residual method (CA-GMRES) on GPUs. The CA-GMRES has two major computations: a matrix powers kernel (MPK) and a tall-skinny QR decomposition (TSQR). In this project, we first have developed high-performance MPK and TSQR routines for GPUs. Based on the improved routines, we have evaluated our CA-GMRES implementation on GPU clusters. Results of the evaluation is currently in preparation for publication.

ARC-Robot The objective of this cluster is to develop an information system for multiple and heterogeneous robots with a different OS and CPU. For connecting them and working as a whole system, we have introduced OpenRTM, which is a

robot middleware of defining a common data transmission method in a different OS. This year of 2017, we have developed and demonstrated a robot tele-operation system of a ground vehicle, a ground camera, and an aerial one. It is operated with two kinds of interface system, a camera viewer displaying scenes of the real world, and a virtual robot viewer showing a pose of the whole robot, which cannot be seen from a physical camera. We have expected, and it has been shown that the virtual viewer can improve a robot operationality. The key technology and main contribution of our group is to establish a robot system integration methodology for the multiple and heterogeneous robots. 1 In addition, because the robotics is an integrated field involving mechanical, electrical, control, and computational engineering, we need education programs for robot developers from a beginner or student to an intermediate level or industrial engineer. We have carried out a series of seminars for a local industrial society and contributed to our society.

ARC-Space ARC-Space has started since April 1st in 2009 on the basis of advanced informatics of UoA and experiences of the researchers in operations and developments of optical instruments in deep space explorations. Main topics are Geo-informatics, GIS, Deep Space Explorations such as Hayabusa2 to the asteroid Ryugu, and supporting tools for the explorations. Goal of the cluster is to be a COE for Archive Science, which is a interdisciplinary one between Space Science and Informatics with archived data sets of lunar planetary explorations. Space exploration projects in AY2017 are Hayabusa2 to the asteroid Ryugu, Tanpopo Program for astrobiology on the International Space Station, SLIM (Smart Lander for Investigating Moon), Akatsuki around Venus, MMX (Martian Moon eXploration for Sample Return), DESTINY+ to the asteroid Phaeton, etc. We have another topic for monitoring volcanic activities in Fukushima as a regional contribution. This cluster members have been assigned for WG of Satellite Data Analysis in Meteorological Agency's Volcanic Eruption Prediction Liaison Council by means of InSAR (Interferometric SAR, Synthetic Aperture Radar), whose target is crustal deformation of cm-class. Visibility of this cluster is significant based on public outreach activities, more than 20 Delivery Lectures and Exhibitions.

Review Committee was established to evaluate achievements and social significance of cluster activities, and to discuss establishment/discontinuation of a cluster and other relevant affairs. The evaluation results were reported to the Deans and Directors Council and the Education and Research Council for official authorization of CAIST activities. Advisory Board, consisting of internal members and external members, was established for providing professional advice to relevant cluster and promoting cluster's activities. Center office was in charge of making and implementing an annual budget plan, daily management of CAIST and

cluster activities, promoting public recognition of CAIST, enhancing cooperative connection among academia-industry-government, organizing annual symposium and advisory board meeting, and etc.

Refereed academic journal

[chonda-403-079-01:2017] M.; Kouyama T.; Tatsumi E.; Kameda S.; Honda R.; Sawada H.; Ogawa N.; Morota T.; Honda C.; Sakatani N.; Hayakawa M.; Yokota Y.; Yamamoto Y.; Sugita S. Suzuki, H.; Yamada. Initial inflight calibration for Hayabusa2 optical navigation camera (ONC) for science observations of asteroid Ryugu. *Icarus*, 2018.

Hayabusa2, the first sample return mission to a C-type asteroid was launched by the Japan Aerospace Exploration Agency (JAXA) on December 3, 2014 and will arrive at the asteroid in the middle of 2018 to collect samples from its surface, which may contain both hydrated minerals and organics. The optical navigation camera (ONC) system on board the Hayabusa2 consists of three individual framing CCD cameras, ONC-T for a telescopic nadir view, ONC-W1 for a wide-angle nadir view, and ONC-W2 for a wide-angle slant view will be used to observe the surface of Ryugu. The cameras will be used to measure the global asteroid shape, local morphologies, and visible spectroscopic properties. Thus, image data obtained by ONC will provide essential information to select landing (sampling) sites on the asteroid. This study reports the results of initial inflight calibration based on observations of Earth, Mars, Moon, and stars to verify and characterize the optical performance of the ONC, such as flat-field sensitivity, spectral sensitivity, point-spread function (PSF), distortion, and stray light of ONC-T, and distortion for ONC-W1 and W2. We found some potential problems that may influence our science observations. This includes changes in sensitivity of flat fields for all bands from those that were measured in the pre-flight calibration and existence of a stray light that arises under certain conditions of spacecraft attitude with respect to the sun. The countermeasures for these problems were evaluated by using data obtained during initial in-flight calibration.

[chonda-403-079-02:2017] H.; Takamatsu T.; Cho Y.; Yasuda T.; Yamada M.; Sawada H.; Honda R.; Morota T.; Honda C.; Sato M.; Okumura Y.; Shibasaki K.; Ikezawa S.; Sugita S. Kameda, S.; Suzuki. Preflight Calibration Test Results for Optical Navigation Camera Telescope (ONC-T) Onboard the Hayabusa2 Spacecraft. *Space Science Reviews*, 2017.

The optical navigation camera telescope (ONC-T) is a telescopic framing camera with seven colors onboard the Hayabusa2 spacecraft launched on December 3, 2014. The main objectives of this instrument are to optically navigate the spacecraft to asteroid Ryugu and to conduct multi-band mapping the asteroid.

We conducted performance tests of the instrument before its installation on the spacecraft. We evaluated the dark current and bias level, obtained data on the dependency of the dark current on the temperature of the charge-coupled device (CCD). The bias level depends strongly on the temperature of the electronics package but only weakly on the CCD temperature. The dark-reference data, which is obtained simultaneously with observation data, can be used for estimation of the dark current and bias level. A long front hood is used for ONC-T to reduce the stray light at the expense of flatness in the peripheral area of the field of view (FOV). The central area in FOV has a flat sensitivity, and the limb darkening has been measured with an integrating sphere. The ONC-T has a wheel with seven bandpass filters and a panchromatic glass window. We measured the spectral sensitivity using an integrating sphere and obtained the sensitivity of all the pixels. We also measured the point-spread function using a star simulator. Measurement results indicate that the full width at half maximum is less than two pixels for all the bandpass filters and in the temperature range expected in the mission phase except for short periods of time during touchdowns.

[chonda-403-079-03:2017] Kohei; Abe Masanao; Ohtake Makiko; Arai Takehiko; Arai Tomoko; Hirata Naru; Hiroi Takahiro; Honda Chikatoshi; Imae Naoya; Komatsu Mutsumi; Matsunaga Tsuneo; Matsuoka Moe; Matsuura Shuji; Nakamura Tomoki; Nakato Aiko; Nakauchi Yusuke; Osawa Takahito; Senshu Hiroki; Takagi Yasuhiko; Tsumura Kohji; Takato Naruhisa; Watanabe Sei-ichiro; Barucci Maria Antonietta; Palomba Ernesto; Ozaki Masanobu Iwata, Takahiro; Kitazato. NIRS3: The Near Infrared Spectrometer on Hayabusa2. *Space Science Reviews*, 2017.

NIRS3: The Near Infrared Spectrometer is installed on the Hayabusa2 spacecraft to observe the target C-type asteroid 162173 Ryugu at near infrared wavelengths of 1.8 to 3.2 um. It aims to obtain reflectance spectra in order to detect absorption bands of hydrated and hydroxide minerals in the 3 um-band. We adopted a linear-image sensor with indium arsenide (InAs) photo diodes and a cooling system with a passive radiator to achieve an optics temperature of 188 K (-85degC), which enables to retaining sufficient sensitivity and noise level in the 3 um wavelength region. We conducted ground performance tests for the NIRS3 flight model (FM) to confirm its baseline specifications. The results imply that the properties such as the signal-to-noise ratio (SNR) conform to scientific requirements to determine the degree of aqueous alteration, such as CM or CI chondrite, and the stage of thermal metamorphism on the

asteroid surface.

[keita-n-403-079-01:2017] T.Matsumoto, Y.Oyama, J.Ogawa, K.Nakamura, and K.Naruse. Mechanism of generating drawbar pull of rod wheel on loose soil. *Journal of Artificial Life and Robotics*, 2017.

In this paper, we propose a model of drawbar pull generated by wheels fitted with a rod and assess it by comparing measured values obtained from an experiment with those from the model. In recent years, many kinds of robots for weeding in paddy fields have been developed. However, almost all of these are large and heavy. We have previously developed a small, lightweight robot for weeding. This robot is equipped with a rod wheel that has roles of weeding and running. However, this wheel was developed by experience from demonstrations and its dynamics for control remain unknown. To solve this problem, we propose a new model for drawbar pull generated by rod wheels and evaluate it by comparing experimental values with those from the model.

[keita-n-403-079-02:2017] W.Chen, Y.Yaguchi, K.Naruse, Y.Watanobe, and K.Nakamura. QoS-aware Robotic Streaming Workflow Allocation in Cloud Robotics Systems. *IEEE Transactions on Services Computing*, 2018.

Current solutions of computation offloading for cloud robotics face challenges: 1) traditional approaches do not consider the characteristics of networked cloud robotics (NCR)(e.g., heterogeneity and robotic cooperation); 2) they fail to capture the characteristics of tasks in a robotic streaming workflow (RSW) (e.g., strict latency requirements and different task semantics); and 3) they do not consider quality-of-service (QoS) issues for cloud robotics. In this paper, we address these issues by proposing a QoS-aware RSW allocation algorithm for NCR with joint optimization of latency, energy efficiency, and cost, while considering the characteristics of RSW and NCR. We first propose a novel framework that combines robot individuals, robot clusters, and a remote cloud for computation offloading. We then formulate the joint QoS optimization problem for RSW allocation in NCR while considering latency, energy consumption, and operating cost, and show that the problem is NP-hard. Next, we construct a data flow graph based on the characteristics of RSW and NCR, and transform the RSW allocation problem into a mixed-integer linear programming problem. To obtain an optimal solution in reasonable time, we also develop a heuristic-based algorithm. Experiments demonstrate significant performance gains, with improved QoS and reduced execution times.

[keita-n-403-079-03:2017] Kizuku Mineta Keita Nakamura and Keitaro Naruse. Investigation of 3D Reconstruction from Time-series Images by Towing Camera. *IFAC-PapersOnLine*, 2017.

This study shows the investigation of three dimensional (3D) reconstruction using a towing camera system in order to collect the information inside the nuclear plant for reactor decommissioning. The towing camera obtains time-series inside the nuclear plant by moving through a cable. The camera can move by pulling the cable. However, in this case, passive rotation affects the 3D reconstruction. In this study, in order to investigate effect of the passive rotation, the experiments are carried out for 3D reconstruction with actual camera at a mockup. In order to investigate influence of passive rotation, we prepare two types of camera. One is towing passive joint camera which is influenced by passive rotations and the other is towing fix joint camera which is not influenced by them. We compare 3D reconstruction from time-series images by these two cameras. A square log is adopted as a target for 3D reconstruction in mockup. Experimental results show that time-series images by a passive joint camera reconstruct the target more accurate and the floor more flatly in comparison to a fixed joint camera. Additionally, we verify that it is difficult to reconstruct the points with respect to the vertical height when towing camera is set to downward.

[kitazato-403-079-01:2017] T. Okada, T. Fukuhara, S. Tanaka, M. Taguchi, T. Imamura, T. Arai, H. Senshu, Y. Ogawa, H. Demura, K. Kitazato, R. Nakamura, T. Kouyama, T. Sekiguchi, S. Hasegawa, T. Matsunaga, T. Wada, J. Takita, N. Sakatani, Y. Horikawa, K. Endo, J. Helbert, T. G. Mueller, and A. Hagermann. Thermal Infrared Imaging Experiments of C-Type Asteroid 162173 Ryugu on Hayabusa2. *Space Science Reviews*, 208(1-4):255–286, 2017.

[kitazato-403-079-02:2017] T. Iwata, K. Kitazato, M. Abe, M. Ohtake, T. Arai, T. Arai, N. Hirata, T. Hiroi, C. Honda, N. Imae, M. Komatsu, T. Matsunaga, M. Matsuoka, S. Matsuura, T. Nakamura, A. Nakato, Y. Nakauchi, T. Osawa, H. Senshu, Y. Takagi, K. Tsumura, N. Takato, S. Watanabe, M. A. Barucci, E. Palomba, and M. Ozaki. NIRS3: The Near Infrared Spectrometer on Hayabusa2. *Space Science Reviews*, 208(1-4):317–337, 2017.

[kitazato-403-079-03:2017] M. Matsuoka, T. Nakamura, T. Osawa, T. Iwata, K. Kitazato, M. Abe, Y. Nakauchi, T. Arai, M. Komatsu, T. Hiroi,

N. Imae, A. Yamaguchi, and H. Kojima. An evaluation method of reflectance spectra to be obtained by Hayabusa2 Near-Infrared Spectrometer (NIRS3) based on laboratory measurements of carbonaceous chondrites. *Earth, Planets and Space*, 69(1):1–12, 2017.

[nakamura-403-079-01:2017] Kikuchi S., Watanabe S., Kenmotsu T., Yoshino D., Nakamura A., and Hayashi T. Analysis of Impactful Factors on Performance in Combining Architectural Elements of IoT. *Advances in Internet of Things (AIT)*, 7(4):121–138, October 2017.

We implemented a generalized infrastructure for Internet of Things (IoT infrastructure) to be applicable in various areas such as Smart Grid. That IoT infrastructure has two methods to store sensor data. They commonly have the features of double overlay structure, virtualization of sensors, composite services as federation using publisher/subscriber. And they are implemented as synthesizing the elemental architectures. The two methods majorly have the common architectural elements, however there are differences in how to compose and utilize them. But we observed the non-negligible differences in their achieved performance by the actual implementations due to operational items beyond these architectural elements. In this paper, we present the results of our analysis about the factors of the revealed differences based on the measured performance. In particular, it is clarified that a negative side effect due to combining independent elemental micro solutions naively could be amplified, if maximizing the level of loose coupling is applied as the most prioritized design and operational policy. Primarily, these combinations should be evaluated and verified during the basic design phase. However, the variation of how to synthesize them tends to be a blind spot when adopting the multiple independent architectural elements commonly. As a practical suggestion from this case, the emphasized importance in carrying out a new synthetization with multiple architectures is to make a balance naturally among architectural elements, or solutions based on them, and there is a certain demand to establish a methodology for architectural synthetization, including verification.

[naru-403-079-01:2017] Ryuhei Yamada, Hiroki Senshu, Noriyuki Namiki, Takahide Mizuno, Shinsuke Abe, Fumi Yoshida, Hirotomo Noda, Naru Hirata, Shoko Oshigami, Hiroshi Araki, Yoshiaki Ishihara, and Koji Matsumoto. Albedo Observation by Hayabusa2 LIDAR: Instrument Performance and Error Evaluation. *Space Science Reviews*, 208(1):49–64, 2017.

The Japanese asteroid explorer Hayabusa2 was launched at the end of 2014.

Hayabusa2 is supposed to observe the near-Earth C-type asteroid 162173 Ryugu (1999 JU3) and bring surface material samples back to Earth in 2020. It is equipped with Light Detection and Ranging (LIDAR) instrument for laser ranging which can be used to measure the intensities of transmitted and received pulses. The intensity data can be used to estimate the normal albedo of Ryugu at a laser wavelength of 1.064 um. To perform this estimation, we determined the transfer functions of the laser module and receiver to convert the intensity data into pulse energies, along with the utilization ratio of the returned pulse energy, through verification tests of the LIDAR flight model. Then, we evaluated the error of the normal albedo. This error is affected not only by the performance of the LIDAR but also by the slope and roughness of the asteroid's surface. In this paper, we focus on the error in the normal albedo due only to the instrument error, which will be 18.0 % in an observation at a nominal altitude of 20 km.

[naru-403-079-02:2017] S. Yamamoto, T. Matsunaga, T. Nakamura, Y. Sekine, N. Hirata, and Y. Yamaguchi. An Automated Method for Crater Counting Using Rotational Pixel Swapping Method. *IEEE Transactions on Geoscience and Remote Sensing*, 55(8):4384–4397, 2017.

We develop a fully automated algorithm for determining the geological ages by crater counting from the digital terrain model (DTM) and the digital elevation model (DEM) taken by remote-sensing observations. The algorithm is based on the rotational pixel swapping method, which uses a multiplication operation between the original DTM/DEM data and the rotated data to detect impact craters. Our method does not need binarization and/or noise reduction, because noise components are automatically erased. We show that our method can detect not only simple craters but also complex circular structures such as imperfect, degraded, or overlapping craters. We demonstrate that this method succeeds in the automatic detection of hundreds to thousands of impact craters, and the estimated ages are consistent with those by manual counting in previous works. In addition, it is shown that the calculation time by this method is more than several hundred times faster than by previous methods.

[naru-403-079-03:2017] T. Mizuno, T. Kase, T. Shiina, M. Mita, N. Namiki, H. Senshu, R. Yamada, H. Noda, H. Kunimori, N. Hirata, F. Terui, and Y. Mimasu. Development of the Laser Altimeter (LIDAR) for Hayabusa2. *Space Science Reviews*, 208(1):33–47, 2017.

Hayabusa2 was launched on 3 December 2014 on an H-IIA launch vehicle from

the Tanegashima Space Center, and is, at the time of writing, cruising toward asteroid 162137 Ryugu (1999 JU 3). After reaching the asteroid, it will stay for about 1.5 years to observe the asteroid and collect surface material samples.

[naru-403-079-04:2017] Wataru Ueno, Hirohide Demura, and Naru Hirata. HARMONICS: A Visualization Tool for Hayabusa and Hayabusa 2 Missions. *TRANSACTIONS OF THE JAPAN SOCIETY FOR AERONAUTICAL AND SPACE SCIENCES*, 60(3):132–136, 2017.

We developed a tool for visualizing the spatial geometry of objects and field-of-view (FOV) of scientific instruments for mission plans and data analysis of Hayabusa and Hayabusa 2, and named "HARMONICS (Hayabusa Remote MONItoring and Commanding System)." We also implemented a graphical user interface to simulate a changing FOV. Displaying arbitrary viewpoints over a time sequence helps determine the geometry observed and supports later data analysis. HARMONICS loads ancillary data with the SPICE kernel format: position and attitude of the spacecraft, properties of scientific instruments and target's shape model, etc. Here, we report on the system details and enhanced functions of HARMONICS compared to the original version in 2005.

[naru-403-079-05:2017] T. Imamura, H. Ando, S. Tellmann, M. Peatzold, B. Heausler, A. Yamazaki, T.M. Sato, K. Noguchi, Y. Futaana, J. Oschlisniok, S. Limaye, R.K. Choudhary, Y. Murata, H. Takeuchi, C. Hirose, T. Ichikawa, T. Toda, A. Tomiki, T. Abe, Z. Yamamoto, H. Noda, T. Iwata, S. Murakami, T. Satoh, T. Fukuhara, K. Ogohara, K. Sugiyama, H. Kashimura, S. Ohtsuki, S. Takagi, Y. Yamamoto, N. Hirata, G. L. Hashimoto, M. Yamada, M. Suzuki, N. Ishii, T. Hayashiyama, Y. J. Lee, and M. Nakamura. Initial performance of the radio occultation experiment in the Venus orbiter mission Akatsuki. *Earth, Planets, and Space*, 69:137, 2017.

After the arrival of Akatsuki spacecraft of Japan Aerospace Exploration Agency at Venus in December 2015, the radio occultation experiment, termed RS (Radio Science), obtained 19 vertical profiles of the Venusian atmosphere by April 2017. An onboard ultra-stable oscillator is used to generate stable X-band downlink signals needed for the experiment. The quantities to be retrieved are the atmospheric pressure, the temperature, the sulfuric acid vapor mixing ratio, and the electron density. Temperature profiles were successfully obtained down to 38 km altitude and show distinct atmospheric structures

depending on the altitude. The overall structure is close to the previous observations, suggesting a remarkable stability of the thermal structure. Local time-dependent features are seen within and above the clouds, which is located around 48-70 km altitude. The H2SO4 vapor density roughly follows the saturation curve at cloud heights, suggesting equilibrium with cloud particles. The ionospheric electron density profiles are also successfully retrieved, showing distinct local time dependence. Akatsuki RS mainly probes the low and middle latitude regions thanks to the near-equatorial orbit in contrast to the previous radio occultation experiments using polar orbiters. Studies based on combined analyses of RS and optical imaging data are ongoing.

[naru-403-079-06:2017] Takahiro Iwata, Kohei Kitazato, Masanao Abe, Makiko Ohtake, Takehiko Arai, Tomoko Arai, Naru Hirata, Takahiro Hiroi, Chikatoshi Honda, Naoya Imae, Mutsumi Komatsu, Tsuneo Matsunaga, Moe Matsuoka, Shuji Matsuura, Tomoki Nakamura, Aiko Nakato, Yusuke Nakauchi, Takahito Osawa, Hiroki Senshu, Yasuhiko Takagi, Kohji Tsumura, Naruhisa Takato, Sei-ichiro Watanabe, Maria Antonietta Barucci, Ernesto Palomba, and Masanobu Ozaki. NIRS3: The Near Infrared Spectrometer on Hayabusa2. *Space Science Reviews*, 208(1):317–337, 2017.

NIRS3: The Near Infrared Spectrometer is installed on the Hayabusa2 spacecraft to observe the target C-type asteroid 162173 Ryugu at near infrared wavelengths of 1.8 to 3.2 um. It aims to obtain reflectance spectra in order to detect absorption bands of hydrated and hydroxide minerals in the 3 um-band. We adopted a linear-image sensor with indium arsenide (InAs) photo diodes and a cooling system with a passive radiator to achieve an optics temperature of 188 K, which enables to retaining sufficient sensitivity and noise level in the 3 um wavelength region. We conducted ground performance tests for the NIRS3 flight model (FM) to confirm its baseline specifications. The results imply that the properties such as the signal-to-noise ratio (SNR) conform to scientific requirements to determine the degree of aqueous alteration, such as CM or CI chondrite, and the stage of thermal metamorphism on the asteroid surface.

[naru-403-079-07:2017] M. Arakawa, K. Wada, T. Saiki, T. Kadono, Y. Takagi, K. Shirai, C. Okamoto, H. Yano, M. Hayakawa, S. Nakazawa, N. Hirata, M. Kobayashi, P. Michel, M. Jutzi, H. Imamura, K. Ogawa, N. Sakatani, Y. Iijima, R. Honda, K. Ishibashi, H. Hayakawa, and H. Sawada. Scientific Objectives of Small Carry-on Impactor (SCI) and Deployable

Camera 3 Digital (DCAM3-D): Observation of an Ejecta Curtain and a Crater Formed on the Surface of Ryugu by an Artificial High-Velocity Impact. *Space Science Reviews*, 208(1):187–212, 2017.

The Small Carry-on Impactor (SCI) equipped on Hayabusa2 was developed to produce an artificial impact crater on the primitive Near-Earth Asteroid (NEA) 162173 Ryugu (Ryugu) in order to explore the asteroid subsurface material unaffected by space weathering and thermal alteration by solar radiation. An exposed fresh surface by the impactor and/or the ejecta deposit excavated from the crater will be observed by remote sensing instruments, and a subsurface fresh sample of the asteroid will be collected there. The SCI impact experiment will be observed by a Deployable CAMera 3-D (DCAM3-D) at a distance of, 1 km from the impact point, and the time evolution of the ejecta curtain will be observed by this camera to confirm the impact point on the asteroid surface. As a result of the observation of the ejecta curtain by DCAM3-D and the crater morphology by onboard cameras, the subsurface structure and the physical properties of the constituting materials will be derived from crater scaling laws. Moreover, the SCI experiment on Ryugu gives us a precious opportunity to clarify effects of microgravity on the cratering process and to validate numerical simulations and models of the cratering process.

[naru-403-079-08:2017] Kazunori Ogohara, Masahiro Takagi, Shin-ya Murakami, Takeshi Horinouchi, Manabu Yamada, Toru Kouyama, George L. Hashimoto, Takeshi Imamura, Yukio Yamamoto, Hiroki Kashimura, Naru Hirata, Naoki Sato, Atsushi Yamazaki, Takehiko Satoh, Naomoto Iwagami, Makoto Taguchi, Shigeto Watanabe, Takao M. Sato, Shoko Ohtsuki, Tetsuya Fukuhara, Masahiko Futaguchi, Takeshi Sakanoi, Shingo Kameda, Ko-ichiro Sugiyama, Hiroki Ando, Yeon Joo Lee, Masato Nakamura, Makoto Suzuki, Chikako Hirose, Nobuaki Ishii, and Takumi Abe. Overview of Akatsuki data products: definition of data levels, method and accuracy of geometric correction. *Earth, Planets and Space*, 69(1):167, 2017.

We provide an overview of data products from observations by the Japanese Venus Climate Orbiter, Akatsuki, and describe the definition and content of each data-processing level. Levels 1 and 2 consist of non-calibrated and calibrated radiance (or brightness temperature), respectively, as well as geometry information (e.g., illumination angles). Level 3 data are global-grid data in the regular longitude, latitude coordinate system, produced from the contents of Level 2. Non-negligible errors in navigational data and instrumental align-

ment can result in serious errors in the geometry calculations. Such errors cause mismapping of the data and lead to inconsistencies between radiances and illumination angles, along with errors in cloud-motion vectors. Thus, we carefully correct the boresight pointing of each camera by fitting an ellipse to the observed Venusian limb to provide improved longitude, latitude maps for Level 3 products, if possible. The accuracy of the pointing correction is also estimated statistically by simulating observed limb distributions. The results show that our algorithm successfully corrects instrumental pointing and will enable a variety of studies on the Venusian atmosphere using Akatsuki data.

[naru-403-079-09:2017] Takehiko Satoh, Takao M. Sato, Masato Nakamura, Yasumasa Kasaba, Munetaka Ueno, Makoto Suzuki, George L. Hashimoto, Takeshi Horinouchi, Takeshi Imamura, Atsushi Yamazaki, Takayuki Enomoto, Yuri Sakurai, Kosuke Takami, Kenta Sawai, Takashi Nakakushi, Takumi Abe, Nobuaki Ishii, Chikako Hirose, Naru Hirata, Manabu Yamada, Shin-ya Murakami, Yukio Yamamoto, Tetsuya Fukuhara, Kazunori Ogohara, Hiroki Ando, Ko-ichiro Sugiyama, Hiroki Kashimura, and Shoko Ohtsuki. Performance of Akatsuki/IR2 in Venus orbit: the first year. *Earth, Planets and Space*, 69(1):154, 2017.

The first year (December 2015 to November 2016) of IR2 after Akatsuki's successful insertion to an elongated elliptical orbit around Venus is reported with performance evaluation and results of data acquisition. The single-stage Stirling-cycle cryo-cooler of IR2 has been operated with various driving voltages to achieve the best possible cooling under the given thermal environment. A total of 3091 images of Venus (1420 dayside images at 2.02 um and 1671 night-side images at 1.735, 2.26, and 2.32 um) were acquired in this period. Additionally, 159 images, including images of stars for calibration and dark images for the evaluation of noise levels, were captured. Low-frequency flat images (not available in pre-launch calibration data) have been constructed using the images of Venus acquired from near the pericenter to establish the procedure to correct for the IR2 flat-field response. It was noticed that multiple reflections of infrared light in the PtSi detector caused a weak but extended tail of the point-spread function (PSF), contaminating the night-side disk of Venus with light from the much brighter dayside crescent. This necessitated the construction of an empirical PSF to remove this contamination and also to improve the dayside data by deconvolution, and this work is also discussed. Detailed astrometry is performed on star-field images in the H-band (1.65 um), hereby confirming that the geometrical distortion of IR2 images is negligible.

[yaguchi-403-079-01:2017] W. Chen, Y. Yaguchi, K. Naruse, Y. Watanobe, and K. Nakamura. QoS-aware Robotic Streaming Workflow Allocation in Cloud Robotics Systems. *IEEE Transactions on Services Computing*, PP(99):1–1, 2017.

Current solutions of computation offloading for cloud robotics face challenges: 1) traditional approaches do not consider the characteristics of networked cloud robotics (NCR)(e.g., heterogeneity and robotic cooperation); 2) they fail to capture the characteristics of tasks in a robotic streaming workflow (RSW) (e.g., strict latency requirements and different task semantics); and 3) they do not consider quality-of-service (QoS) issues for cloud robotics. In this paper, we address these issues by proposing a QoS-aware RSW allocation algorithm for NCR with joint optimization of latency, energy efficiency, and cost, while considering the characteristics of RSW and NCR. We first propose a novel framework that combines robot individuals, robot clusters, and a remote cloud for computation offloading. We then formulate the joint QoS optimization problem for RSW allocation in NCR while considering latency, energy consumption, and operating cost, and show that the problem is NP-hard. Next, we construct a data flow graph based on the characteristics of RSW and NCR, and transform the RSW allocation problem into a mixed-integer linear programming problem. To obtain an optimal solution in reasonable time, we also develop a heuristic-based algorithm. Experiments demonstrate significant performance gains, with improved QoS and reduced execution times.

[yoshiko-403-079-01:2017] T. Nakamura S. Tanaka H. Demura Y. Ogawa N. Sakatani Y. Horikawa H. Senshu T. Fukuhara T. Okada Arai, T. Thermal Imaging Performance of TIR Onboard the Hayabusa2 Spacecraft. *Space Science Reviews*, 208:239–254, July 2017.

The thermal infrared imager (TIR) is a thermal infrared camera onboard the Hayabusa2 spacecraft. TIR will perform thermography of a C-type asteroid, 162173 Ryugu (1999 JU3), and estimate its surface physical properties, through remote in-situ observations in 2018 and 2019.

[yoshiko-403-079-02:2017] T. Fukuhara S. Tanaka M. Taguchi T. Imamura T. Arai H. Senshu Y. Ogawa H. Demura K. Kitazato R. Nakamura T. Kouyama T. Sekiguchi S. Hasegawa T. Matsunaga T. Wada J. Takita N. Sakatani Y. Horikawa K. Endo J. Helbert T. G. Muller A. Hagermann Okada, T. Thermal Infrared Imaging Experiments of C-Type Asteroid 162173 Ryugu on Hayabusa2. *Space Science Reviews*, 208:255–286, July 2017.

The thermal infrared imager TIR onboard Hayabusa2 has been developed to investigate thermo-physical properties of C-type, near-Earth asteroid 162173 Ryugu. TIR is one of the remote science instruments on Hayabusa2 designed to understand the nature of a volatile-rich solar system small body, but it also has significant mission objectives to provide information on surface physical properties and conditions for sampling site selection as well as the assessment of safe landing operations.

[yutaka-403-079-01:2017] W. Chen, Y. Yaguchi, K. Naruse, Y. Watanobe, and K. Nakamura. QoS-aware Robotic Streaming Workflow Allocation in Cloud Robotics Systems. *IEEE Transactions on Services Computing*, PP(99):1–1, 2017.

Current solutions of computation offloading for cloud robotics face challenges: 1) traditional approaches do not consider the characteristics of networked cloud robotics (NCR)(e.g., heterogeneity and robotic cooperation); 2) they fail to capture the characteristics of tasks in a robotic streaming workflow (RSW) (e.g., strict latency requirements and different task semantics); and 3) they do not consider quality-of-service (QoS) issues for cloud robotics. In this paper, we address these issues by proposing a QoS-aware RSW allocation algorithm for NCR with joint optimization of latency, energy efficiency, and cost, while considering the characteristics of RSW and NCR. We first propose a novel framework that combines robot individuals, robot clusters, and a remote cloud for computation offloading. We then formulate the joint QoS optimization problem for RSW allocation in NCR while considering latency, energy consumption, and operating cost, and show that the problem is NP-hard. Next, we construct a data flow graph based on the characteristics of RSW and NCR, and transform the RSW allocation problem into a mixed-integer linear programming problem. To obtain an optimal solution in reasonable time, we also develop a heuristic-based algorithm. Experiments demonstrate significant performance gains, with improved QoS and reduced execution times.

Refereed proceedings of an academic conference

[chonda-403-079-04:2017] T. Kouyama S. Kameda Y. Yokota S. Sakatani H. Suzuki M. Yamada H. Sawada R. Honda C. Honda T. Morota K. Ogawa M. Hayakawa K. Yoshioka N. Ogawa N. Tanabe H. Kamiyoshihara Y. Iijima ONC Team S. Sugita, E. Tatsumi. Pre-Arrival Scientific Cali-

bration of the Hayabusa2 Multi-Band Visible Camera. In *49th Lunar and Planetary Science Conference*, 2018.

Introduction: JAXAs Hayabusa2 is planned to bring back samples to Earth from one of the C-type asteroids, which are widely believed to contain water and organics, important ingredients for life. When the spacecraft arrives at the target asteroid Ryugu, it will start detailed observations on its surface for both understanding its geologic history and selecting sampling sites.

[chonda-403-079-05:2017] C. Honda M. Ohtake M. Hareyama, Y. Ishihara. Preliminary Unsupervised Classification of the Mercurys Surface Using Multiband Reflectance Data Obtained by MESSENGER/MDIS. In *49th Lunar and Planetary Science Conference*, 2018.

Introduction: The final goal of our study is to create a global geologic map of Mercury to approach Mercurian crustal evolution. For that purpose, we decide geological unit of Mercury's surface by using automatic classification methods for different physical quantities such as reflectance spectrum, element concentration, and elevation acquired by US Mercury Explorer MESSENGER.

[keita-n-403-079-04:2017] K.Hamatani, J.Ogawa, K.Nakamura, and K.Naruse. Distributed Localization by Camera Robots with Consensus Filter. In *Proceedings of SWARM2017: THE SECOND INTERNATIONAL SYMPOSIUM ON SWARM BEHAVIOR AND BIO-INSPIRED ROBOTICS*, 2017.

This paper proposes a new self-localization method based on Extended Kalman Consensus Filter (EKCF) using only angular informations observed by many standing robots each other that are not controlled and that are dispersed in an environment as a localization method using only local information around robots. In a localization method by Extended Kalman Filter (EKF), to localize more dozen robots is difficult because matrix calculation are difficult for a regular computer. Therefore, to solve this problem a consensus is introduced to the EKF. Each EKF localize some robots in each EKF group and take consensus with each other to localize as a whole. To verify this method the numerical experiments were carried out and the effectiveness is confirmed.

[keita-n-403-079-05:2017] H.Nakazawa, J.Ogawa, K.Nakamura, and Keitaro Naruse. Robot Sweep Path Planning with Weak Field Constrains under Large Motion Disturbance. In *Proceedings of SWARM2017: THE*

SECOND INTERNATIONAL SYMPOSIUM ON SWARM BEHAVIOR AND BIO-INSPIRED ROBOTICS, 2017.

Our research group has developed robot for a rice field ("Aigamo robot"). The problem of Aigamo robot are motion is uncertainty by disturbance and robot damages to rice plants. Sweep path for Aigamo robot generates by separating sweeping field into square cells. The sweep path planning at traditional type that sweep all cells in sequence is difficult and taking too much time for Aigamo robot because robot motion is uncertainty. Aigamo robot cannot enter into the target cell, and robot sweep many times at same point when robot introduces it. Aigamo robot actually sweep every day. Aigamo robot can sweep upward another day when robot cannot sweep completely. Therefore, it is assumed that sweep rate of 80[%] is enough. We propse to reducing the number of visiting cells. The proposed method is realized that sweep rate is 80[%] or more and the damage to rice plants is smaller.

[keita-n-403-079-06:2017] F.Abe, K.Nakamura, Jun Ogawa, and Keitaro Naruse. Stable Pulling Out Strategy for Small Disaster Response Robot with Dual-arm. In *Proceedings of The Twenty-Third International Symposium on Artificial Life and Robotics 2018*, 2018.

Abstract: Many disaster response robots have been studied and developed to reduce the risk of secondary disaster. These robots are expected to improve efficiency and security. However, it is difficult for these robots to enter narrow spaces due to their size. Therefore, small disaster response robots are expected to remove debris. In this paper, we consider the task that a small disaster response robot pulls a bar whose length and mass are unknown stably out of a wall as debris removal. Pulling out motion involves a big problem that rotation center of the bar changes instantly and largely when it is left from a wall. Therefore, we propose stable pulling out motion to suppress rotation and translation. Experimental results show our proposal motion can stably pull out.

[keita-n-403-079-07:2017] I.Otani, Y.Yaguchi, K.Nakamura, and Keitaro Naruse. Quantitative Evaluation of Streaming Image Quality for The Robot Teleoperation. In *Proceedings of The Twenty-Third International Symposium on Artificial Life and Robotics 2018*, 2018.

Abstract: In this paper, we define a novel measure of streaming video quality for remotely operated robots. Controlling robots remotely is crucial for disaster response, and many attempts have been made to create such systems.

Wireless communication, which is used in remote-control systems for unmanned vehicles, change dynamically and the streaming quality also changes to the quality of the network; however, wireless conditions are not typically measured in conventional robot systems. We are developing a quality measure for remote control using video proprieties such as delay and degrading of image quality as Quality of Control (QoC). In this paper, we introduce this QoC measure using delay and degrading of image quality curves in simulation environments, and we discuss the implications for robot system design.

[keita-n-403-079-08:2017] K.Nakamura, D.Kai, K.Mineta, Jun Ogawa, and Keitaro Naruse. Improvement for 3D Reconstruction Considering Passive Rotation by Towing Camera. In *Proceedings of The 1st International Conference on Digital Practice for Science, Technology, Education, and Management*, 2018.

Abstract: This study shows the improvement for three dimensional (3D) reconstruction using a towing camera system. This camera system collects the information inside the nuclear plant for reactor decommissioning. The camera obtains timeseries inside the nuclear plant by moving through a cable. It can move by pulling the cable. However, in this case, passive rotation affects the 3D reconstruction. In this study, in order to investigate effect of the passive rotation, the experiments are carried out for 3D reconstruction with actual camera at a mockup. In order to investigate influence of passive rotation, we consider three major factors for 3D reconstruction. These factors are motion of camera, angle of view and environmental background. We compare 3D reconstruction from time-series images in order to investigate how each factor affects 3D reconstruction. Experimental evaluation is the number of reconstructed points from time-series data. A square log is adopted as a target for 3D reconstruction in mockup. Experimental results show that there are few feature points in background when swinging camera. Additionally, we clarify that it is important that removing the image when swinging camera from the time-series data in order to improve 3D reconstructed result.

[keita-n-403-079-09:2017] J.Ogawa, M.Taira, K.Nakamura, and K.Naruse. Cellular Automaton Approach for Motion Pattern Analysis of Soft-bodied Agent. In *Proceedings of The 1st International Conference on Digital Practice for Science, Technology, Education, and Management*, 2018.

Soft-bodied agent (SBA) with ambiguous boundary between driving part and body such as gel robot is expected to give action that can not be realized by conventional robot composed of metal parts in the field of soft robotics.

There is a high degree of freedom in the arrangement of the drive system embedded in the soft body, however, there is no study to verify what kind of motion the agent is generated and how motional feature the agent is classified through these soft body. This paper discusses a motion pattern of soft-bodied agent by using one-dimensional cellular automaton through an elastic robot simulation by using voxel model. A one-dimensional cellular automaton (CA) is an approach that can classify temporal evolution of a state into four classes such as an ordered state and a chaotic state by using a discrete calculation model by a simple rule. We design an agent chemically bonded vibration motor and hard gel-like body in an virtual space and give an he volumetric vibration pattern of sine wave determined by CA into voxels as actuator in the body. As the result, we found that an ordered class gives the periodic and constant change of motion unless an external noise works the agent, and we discussed that chaos class is expressed as the improvement factor of motional robustness for SBA.

[nakamura-403-079-02:2017] Watanabe S. and Nakamura A. Integrated Data Access to Heterogeneous Data Stores for IoT Cloud. In Sieminski A. et al., editor, *Modern Approaches for Intelligent Information and Database Systems, Studies in Computational Intelligence Vol.769*. Springer, 2018.

Recently, Internet of Things (IoT) attract attention. The authors are developing a cloud platform for IoT applications. The IoT cloud needs to deal with various types of data and large data sets depending on applications and purpose of use. That is, the IoT cloud necessarily includes heterogeneous data stores in a mixed manner. For example, relational databases and NoSQL databases have different connection methods and query languages. This configuration complicates the system design and increases the development cost. This paper presents a configuration method of data access component (DAC) that absorbs the connection method and the query language differences among data stores. This allows us to develop IoT applications without worrying about data store differences and later replacements. In the implementation, we used specific DACs optimized for specific data stores and a multi-purpose DAC Apache MetaModel. With a large scale data set of more than one million records under most configurations, the response time for various kinds of queries are less than 1 second.

[yaguchi-403-079-02:2017] Y. Yaguchi, M. Omura, and T. Okumura. Geometrical mapping of diseases with calculated similarity measure. In *2017*

IEEE International Conference on Bioinformatics and Biomedicine, Workshop on BHI, pages 1131–1134, November 2017.

Disease similarity is a useful measure that has potential application to various aspects of medicine. One such application is the mapping of diseases in a two-dimensional plane, which can be the foundation of a useful diagnostic reminder method called the "pivot and cluster strategy." However, the mapping of diseases using a similarity measure has yet to be explored. This article investigates such a mapping, and quantifies its basic characteristics. We first collected mutual similarity data for 1,550 diseases using a machine learning approach. The calculated similarity data were then used to map the diseases using a "multidimensional scaling" algorithm. Quantitative analysis indicated that it is difficult to express all the diseases on the map and yet still show the similarity information between the items. Then, by restricting the input, the algorithm performed well in practice. To our knowledge, this is the first study to investigate the automated mapping of diseases on a plane for use in clinical practice.

[yaguchi-403-079-03:2017] Y. Yaguchi, K. Moriuchi, and K. Amma. Comparison of camera configuration for real-time drone route planning in 3D building maze. In *2017 IEEE 8th International Conference on Awareness Science and Technology (iCAST)*, pages 244–249, November 2017.

In this research, we investigate what camera settings are effective for an indoor automatic search system. We recommend installing RGB cameras with depth sensors like the Kinect and show how they should be installed to facilitate searches in indoor environments such as buildings with multiple floors. To validate camera configurations, the RTA* algorithm is used for automatic searching and we also measured how fast a drone could move to goal points in a simulation of a 3D-building model. We also studied various patterns of restart points because a drone has limited battery life, which restricts the available flight time. In the experiment, we allowed six batteries and each flight could last 600 seconds. This experiment showed that we should use three cameras positioned on the forward, upward, and backward of a drone to conduct a 3D building floor search because drones can easily rotate in the yaw direction, but cannot rotate in the pitch direction. We also showed that once the drone had returned to its start position for a battery replacement, it should restart from that point for effective searching.

[yaguchi-403-079-04:2017] Y. Yaguchi, Y. Nitta, S. Ishizaka, T. Tannai, T. Mamiya, K. Naruse, and S. Nakano. Formation control for different

maker drones from a game pad. In *2017 26th IEEE International Symposium on Robot and Human Interactive Communication (RO-MAN)*, pages 1373–1378, September 2017.

This paper describes a generalized software interface for formation flying by drones from different manufacturers. Conventional research into formation flight assumes that the drones all have the same power and functionality. However, consider a disaster response, where we might assemble a platoon of drones to sense the environment and to search for survivors by combining the different functions of drones provided by different manufacturers. The difficulties of controlling formation flight by such a variety of drones include both different mechanical specifications and different interfaces from the manufacturers for activating the same command. In this research, we construct a generalized interface for drones from each manufacturer using OpenRTM-aist. We can then assemble these drones and establish formation flight by using a virtual leader-follower system. The leader and the follower positions are calculated by using speed and rotation data from feedback information such as the GPS, velocity and rotation data from each individual machine. We also investigate good features of flight commands that can express the attributes of the representative motion of the drones. From our experiments, we show that we can establish formation flight using drones of different power and from multiple manufacturers.

[yaguchi-403-079-05:2017] I. Otani, Y. Yaguchi, K. Nakamura, and K. Naruse. Quantitative Evaluation of Streaming Image Quality for The Robot Teleoperation. In *2018 23rd International Symposium on Artificial Life and Robotics*, pages 230–235, January 2018.

In this paper, we define a novel measure of streaming video quality for remotely operated robots. Controlling robots remotely is crucial for disaster response, and many attempts have been made to create such systems. Wireless communication, which is used in remote-control systems for unmanned vehicles, change dynamically and the streaming quality also changes to the quality of the network; however, wireless conditions are not typically measured in conventional robot systems. We are developing a quality measure for remote control using video proprieties such as delay and degrading of image quality as Quality of Control (QoC). In this paper, we introduce this QoC measure using delay and degrading of image quality curves in simulation environments, and we discuss the implications for robot system design.

[yaguchi-403-079-06:2017] R. Yamada, Y. Yaguchi, and M. Yoshida. Performances

of 3D mapping and odometry tools, and of a visualization system for analyzing accidents of unmanned aerial vehicles. In *2018 23rd International Symposium on Artificial Life and Robotics*, pages 389–394, January 2018.

Our target is to replace the accident conditions of the unmanned aerial vehicles (UAVs) using data obtained from the sensors and flight recorder loaded on the UAVs to analyze their causes. In this paper, we have first investigated the performances of three types of tools for 3D mapping and odometry to reproduce the surrounding environment and its orbit, and found that the tool using the LIDAR data are more accurate and can reproduce broader areas compared with methods that use monocular and stereo camera images. Second, we applied an optical flow method to images taken by a monocular camera rotating with 4 types of velocities, and found that imaging over 120 fps is required to analyze accurately the velocity field of the rotating and falling UAV. Finally, we have developed a visualization system that displays the reproduced situations of the UAV flights and accidents on a computer screen.

[yoshiko-403-079-03:2017] Ogawa Y. Hirata N. Demura H. Narusawa M. Hayashi Y. Kato, H. Application of Deep Learning for Automatic Detection of Lunar Swirls by Combining Data from Multi-Band Imager and DEM. In *49th Lunar and Planetary Science Conference*, page 1869, March 2018.

This study challenges automatic identification of lunar swirls by deep learning. We conducted evaluations.

[yoshiko-403-079-04:2017] Fukuhara T. Tanaka S. Taguchi M. Arai T. Senshu H. Sakatani N. Ogawa Y. Demura H. Kitazato K. Kouyama T. Sekiguchi T. Hasegawa S. Matsunaga T. Wada T. Imamura T. Takita J. Shimaki Y. Kyoda H. Aoki Y. Helbert J. Mueller T. G. Hagermann A. Okada, T. Thermal Infrared Imager TIR on Hayabusa2 and Its Preparation for Asteroid Proximity Phase Operations Around 162173 Ryugu. In *48th Lunar and Planetary Science Conference*, page 1403, March 2018.

Thermal infrared imager on Hayabusa2 is to investigate thermo-physical properties of 162173 Ryugu. Its in-flight performance and observation plan are presented.

[yutaka-403-079-02:2017] T. Yamashita and Y. Watanobe. Consensus Building

Algorithm with BFT for Permissioned Blockchain. In *World Congress 2018*, February 2018.

In the blockchain technology, distributed consensus building algorithms are employed so that multiple peers can keep the same states. Generally, the consensus building algorithm in the blockchain must have a feature of Byzantine Fault Tolerance (BFT) which guarantees proper operations even if some peers with Byzantine obstacles are involved in the ledger. Although, for permissioned blockchain, the consensus building algorithms can be applied to the blockchain with a basis of PBFT, another mechanism called OrderingService for constructing a block of transactions is required. Besides, algorithms with BFT which consider all phases from transactions provided by clients to storing data into the blockchain, have not been published. In this paper, a novel algorithm with strict BFT for the blockchain which has a basis of PBFT, is presented.

[yutaka-403-079-03:2017] C.M. Intisar and Y. Watanobe. Fuzzy Rule Mining by Clustering Approach to Estimate the Difficulty of Programming Problems. In *World Congress 2018*, February 2018.

Programming is one of the vital skill for the next generation. Currently there exists many online platforms where programmers compete and solves programming problem. Those platforms are composed of problems with varying degree of difficulty. For expert programmer the difficulty level is not a concern, but it is very important for novice programmers to approach programming problems based on their experience and level. Thus there rises a need for an expert system which can categorize the programming problems based on their difficulty. In our research we have proposed a knowledge based system which is implemented based on fuzzy rules derivation. These fuzzy rules have been derived from cluster analysis of programming problems. Later, inference system has been build based on these rules and knowledge to estimate the difficulty of the programming problems.

Unrefeered proceedings of an academic conference

[chonda-403-079-06:2017] M. Yamada S. Kameda H. Suzuki T. Kouyama R. Honda H. Sawada N. Ogawa K. Ogawa T. Morota C. Honda N. Sakatani M. Hayakawa Y. Yokota Y. Yamamoto S. Sugita N. Tanabe, E. Tatsumi. Multi-band image analysis of Itokawa and optical properties analysis of Hayabusa2/ONC-T. In *JpGU-AGU Joint Meeting 2017*, 2017.

Aerospace Exploration Agency, 8. Kobe Univ., 9. Nagoya Univ., 10. Univ. of Aizu Hayabusa2 is planned to bring samples from Ryugu back to the earth. Choosing sampling sites on Ryugu is very important. Sampling fresh materials not affected by space weathering very much is important for obtaining information on early evolution of the Solar System, because space weathering may overwrite record from the long past. In order to understand where on small asteroid we can find fresh materials, we analyzed the data taken by AMICA/Hayabusa. In addition, we analyzed optical characteristic, especially the point spread function (PSF), of the multi-band visible camera (ONC-T) of Hayabusa2 in order to carry out the same spectral analysis of space weathering.

[chonda-403-079-07:2017] H. Demura N. Hirata C. Honda S. Kamata Y. Karouji J. Kimura M. Morota H. Nagaoka R. Nakamura S. Yamamoto Y. Yokota M. Ohtake M. Hareyama, Y. Ishihara. Global classification map of lunar absorption spectra and new impression of lunar crust formation. In *JpGU-AGU Joint Meeting 2017*, 2017.

This report presents the global classification map of lunar absorption spectra by unsupervised classification methods and new impression of lunar crust formation based on the map.

[chonda-403-079-08:2017] C. Honda M. Ohtake SLIM MBC team K. Saiki, H. Shiraishi. Design and development of Multi-band Camera proposed for SLIM mission. In *JpGU-AGU Joint Meeting 2017*, 2017.

Smart Lander for Investigating Moon (SLIM) is being planned by Japan Aerospace Exploration Agency (JAXA). SLIM aims to research and demonstrate the engineering key issues related to the smart landing on the gravitational planets.

[chonda-403-079-09:2017] C. Honda Y. Yasuda. Improvement of the extraction method of lunar secondary crater using the Voronoi tessellation. In *JpGU-AGU Joint Meeting 2017*, 2017.

One of the estimation methods of formation age of planet surface is the crater chronology. Generally, craters are increasingly formed on the planet surface at random over time. From this perspective, the crater chronology utilizes the crater number density to estimate the formation age of planet surface. When we utilize the crater chronology, we should exclude secondary craters. Secondary craters are formed by ejecta thrown out from primary crater produced by the impact object from interplanetary space.

[chonda-403-079-10:2017] C. Honda T. Sato. Positive openness map for visual inspection of fault scarp associated with lunar wrinkle ridges. In *JpGU-AGU Joint Meeting 2017*, 2017.

Wrinkle ridges are topographic features observed often in plains of the moon. Both edges of wrinkle ridge have scarps related to the fault slip in the subsurface. According to a hypothesis of the origin of wrinkle ridges (e.g., Suppe et al., 1983), the scarps are defined as fore-limb and back-limb, and the fore-limb which has abrupt slope compared with back-limb corresponds to a fault scarp. These fault scarps are formed by horizontal pressure related to tectonic deformation of subsurface of the moon. The spatial distribution and their scale of fault scarps with wrinkle ridges lead us to understand the evolution of the lunar subsurface.

[chonda-403-079-11:2017] C. Honda R. Ito, R. Nakamura. Automatic detection of lunar sub-km craters via deep learning. In *JpGU-AGU Joint Meeting 2017*, 2017.

Crater chronology is a method that estimates generated age on surface of a body from size-frequency distribution (SFD) of impact craters. Coordinates and diameter are needed for computing SFD, and measurement accuracy of crater information is factored into the estimation accuracy of crater chronology. So, highly accurate crater information is important for discussing evolution process of the lunar surface.

[keita-n-403-079-10:2017] S.Kaminokado, Y.Oyama, K.Mineta, M.Yokokawa, T.Matsumoto, H.Nakazawa, F.Abe, T.Honda, K.Nakamura, and K.Naruse. Investigation of Observation Points Distribution Using GPS Modules for Weeding Robot. In *Proceedings of the 2017 JSME Conference on Robotics and Mechatronics*, 2017.

[keita-n-403-079-11:2017] W.Chen, Y.Yaguchi, K.Naruse, Y.Watanobe, and K.Nakamura. Latency-Aware Computation Offloading Algorithm for Cloud Robotics. In *Proceedings of the 2017 JSME Conference on Robotics and Mechatronics*, 2017.

[keita-n-403-079-12:2017] K.Hamatani, J.Ogawa, K.Nakamura, K.Naruse, N.Ogawa, and T.Kubota. Self-Localization Method for a Super Decentralized Camera Robots System Based on Consensus. In *Proceedings of the 2017 JSME Conference on Robotics and Mechatronics*, 2017.

[keita-n-403-079-13:2017] D.Yoshino, Y.Watanobe, Y.Yaguchi, K.Nakamura, and K.Naruse. Application possibility of OpenRTM-aist-based integrated robot systems using CORBA interfaces and brokered Pub/Sub messaging interfaces. In *Proceedings of the 2017 JSME Conference on Robotics and Mechatronics*, 2017.

[keita-n-403-079-14:2017] H.Nakazawa, J.Ogawa, K.Nakamura, and K.Naruse. The Proposal of Path Planning for Sweeping Robot with Movement Instability. In *Proceedings of the 2017 JSME Conference on Robotics and Mechatronics*, 2017.

[keita-n-403-079-15:2017] F.Abe, K.Nakamura, J.Ogawa, and K.Naruse. Gripping Point Suggestion of Target Object by Ellipse detection Using Hough Translate for Large Scale Remote Control Robot. In *Proceedings of the 2017 JSME Conference on Robotics and Mechatronics*, 2017.

[keita-n-403-079-16:2017] T.Matsumoto, Y.Oyama, J.Ogawa, K.Nakamura, and K.Naruse. Modeling of Generating Driving Force Mechanism for Rod Wheel Interacting with Particles in the Soil. In *Proceedings of the 2017 JSME Conference on Robotics and Mechatronics*, 2017.

[keita-n-403-079-17:2017] Y.Oyama, K.Nakamura, J.Ogawa, T.Matsumoto, and K.Naruse. Modeling of bulldozed soil volume by rod wheel considering interaction by soil particles. In *Proceedings of the 2017 JSME Conference on Robotics and Mechatronics*, 2017.

[keita-n-403-079-18:2017] F.Abe, K.Nakamura, J.Ogawa, and K.Naruse. Gripping Point Suggestion of Target Object by Image Processing for Large Scale Remote Control Robot. In *The 6th Workshop of Sustainable / Robotics System Design*, 2017.

[keita-n-403-079-19:2017] H.Nakazawa, J.Ogawa, K.Nakamura, and K.Naruse. The Proposal of Path Planning for Sweeping Robot considering Movement Error. In *The 6th Workshop of Sustainable / Robotics System Design*, 2017.

[keita-n-403-079-20:2017] T.Matsumoto, Y.Oyama, J.Ogawa, K.Nakamura, and K.Naruse. Modeling of Generating Driving Force Mechanism for Rod Wheel considering Interaction with the Soil. In *The 6th Workshop of Sustainable / Robotics System Design*, 2017.

[keita-n-403-079-21:2017] S.Kaminokado, F.Abe, J.Ogawa, K.Nakamura, and K.Naruse. Investigation of Position Accuracy using RTK-GNSS for Control of Weeding Robot. In *Proceedings of The Autum Conference on Precision Engineering*, 2017.

[keita-n-403-079-22:2017] M.Yokokawa, J.Ogawa, K.Nakamura, and K.Naruse. Three-Dimensional Attitude Estimation of Mobile Robot in Unsmooth Loose soil by Extended Kalman Filter and Inertial Sensor. In *Proceedings of The Autum Conference on Precision Engineering*, 2017.

[keita-n-403-079-23:2017] K.Nakamura, J.Ogawa, and K.Naruse. Behavior pattern labeling based on coaching in evolutionary robotics. In *Proceedings of The Autum Conference on Precision Engineering*, 2017.

[keita-n-403-079-24:2017] J.Ogawa, M.Taira, K.Nakamura, and K.Naruse. Crawler Robot Simulation by using Elastic Voxels. In *Proceedings of The Autum Conference on Precision Engineering*, 2017.

[keita-n-403-079-25:2017] H.Nakazawa, K.Nakamura, J.Ogawa, and K.Naruse. Path Planning Based on Probability Theory for Uncetain Robot's Movement. In *Proceedings of the 18th SICE System Integration Division Annual Conference*, 2017.

[keita-n-403-079-26:2017] F.Abe, K.Nakamura, J.Ogawa, and K.Naruse. Stable Pull Out Strategy Considering Instant Change of Rotation Center for Dual-arm Robot. In *Proceedings of the 18th SICE System Integration Division Annual Conference*, 2017.

Best presentation award

[keita-n-403-079-27:2017] D.Yoshino, Y.Watanobe, Y.Yaguchi, K.Nakamura, J.Ogawa, and K.Naruse. Publish/Subscribe Messaging Interface using Bridges among Message Brokers on RT Middleware. In *Proceedings of the 18th SICE System Integration Division Annual Conference*, 2017.

Best presentation award

[keita-n-403-079-28:2017] K.Naruse, K.Hamatani, K.Nakamura, J.Ogawa, N.Ogawa, and T.Kubota. Localization Using Extended Kalman Consensus Filer for a Super Distributed Camera Robot System. In *Proceedings of 61st Space Sciences and Technology Conference*, 2017.

[keita-n-403-079-29:2017] J.Ogawa, K.Nakamura, and K.Naruse. Biological expression by coupled oscillator system of fixed topology. In *Proceedings of the 18th SICE System Integration Division Annual Conference*, 2017.

[keita-n-403-079-30:2017] I.Otani, K.Nakamura, Y.Yaguchi, and K.Naruse. The relation between robot operability and video delay based on benchmark. In *Proceedings of the 48th JSME Tohoku chapter conference for graduation research*, 2018.

[keita-n-403-079-31:2017] S.Kaminokado, J.Ogawa, K.Nakamura, and K.Naruse. Simultaneous Measurement System of Position and Direction using Dual RTK-GNSS. In *Proceedings of The Spring Conference on Precision Engineering*, 2018.

[kitazato-403-079-04:2017] T. Inasawa, K. Kitazato, N. Hirata, and H. Demura. Cluster analysis of near-infrared reflectance spectra of asteroid Itokawa. In *American Astronomical Society, DPS meeting 49*, number 110.03. AAS, October 2017.

[kitazato-403-079-05:2017] K. Kitazato, N. Hirata, H. Demura, T. Inasawa, M. Abe, Y. Yamamoto, A. Miura, and J. Kawaguchi. Thermally induced rock breakdown on asteroid Itokawa. In *American Astronomical Society, DPS meeting 49*, number 204.10. AAS, October 2017.

[kitazato-403-079-06:2017] D. Takir, C. A. Hibbitts, L. Le Corre, J. P. Emery, K. Kitazato, S. Sugita, and Y. Nakauchi. Hayabusa2 NIRS3 Investigation to Characterize and Select Sampling and Landing Sites on Asteroid (25143) Ryugu. In *American Astronomical Society, DPS meeting 49*, number 219.07. AAS, October 2017.

[kitazato-403-079-07:2017] K. Kitazato, S. Nasu, T. Iwata, M. Abe, M. Ohtake, and Hayabusa2 NIRS3 Team. Near-Infrared Spectroscopy of Mars and Jupiter from the NIRS3 Instrument on Hayabusa2. In *48th Lunar and Planetary Science Conference*, number 1964, page 1508. LPI, March 2017.

[nakamura-403-079-03:2017] Sato Y., Fujii Y., and Nakamura A. Development of Health Care Applications using Personal Data Store. In *IPSJ SIG Technical Report, 2018-GN-104*, March 2018.

With the rapid advances in AI and IoT technologies, personal data became valuable resources to society and business. Vendor Relationship Management (VRM) is an activity which aims to provide customers with control of personal data and independence from vendors. A software tool called PDS (Personal Data Store) realizes VRM. Although VRM and PDS are factors that are important in personal data utilization, they have not become common. We are proceeding with the research of PDS technology by developing applications in the field of health care. The objectives are definitions of the functional requirements and the external interfaces of PDS. In this paper, we present user cases and applications which utilize health care data and PDS. We use an open source PDS, Personium, for implementation. The base system collects user's health care data via wearable devices and stores them in PDS. The applications assist user's effort to promote good health by visualization of health care data and automatic reminding. The prototype confirmed that PDS facilitates implementation of self-information control rights and data portability requirements demanded by VRM.

[nakamura-403-079-04:2017] Nochi T. and Nakamura A. Network Simulator for IoT. In *IPSJ 80th National Convention*, March 2018.

[nakamura-403-079-05:2017] Kokubun Y. and Nakamura A. Analysis of Malicious URLs on Social Networking Services and Protection. In *Society of Socio-Informatics (SSI) Annual Meeting*, September 2017.

Cyber attack is one of the most serious threats facing many organizations in the Internet era. In addition to hardening computer and network systems, it is important to surely deliver security information to end users. This paper presents the results of analysis on malicious messages and URLs sent on a social networking service; Twitter. We also present a method and system for safe-browsing of URL links. URLs, and sometimes shortened URLs, on SNS may be utilized for malicious activities to redirect users to unexpected resources, e.g. phishing and malware, by obscuring the final destinations. The analysis results show that about 20 percent of messages contain at least one URL, 0.1 percent of messages contain malicious URLs. The users sent such messages and messages themselves have short lifetime on Twitter. That is, they are removed soon after malicious activities; 99 percent of them are disappeared within one month. The proposed system enables users to know how safe a particular Web resource might be before users dereference it. Our system retrieves and delivers safety information of the URLs on user's demand by a simple operation.

[yaguchi-403-079-07:2017] D. Yoshino, Y. Watanobe, Y. Yaguchi, K. Nakamura, J. Ogawa, and K. Naruse. Proposal of MQTT and MQTT-SN Communication Interfaces on RT Middleware for IoR System Construction. In *The 18th Meeting of SICE System Integration Department, SI2018*, 2017.

[yaguchi-403-079-08:2017] Y. Yaguchi and K. Moriuchi. Real-time 3D Maze Searching by A Drone Using The Depth Cameras. In *2017 JSME Conference on Robotics and Mechatronics, ROBOMECH2017*, 2017.

[yaguchi-403-079-09:2017] D. Yoshino, Y. Watanobe, Y. Yaguchi, K. Nakamura, and K. Naruse. Application possibility of OpenRTM-aist-based integrated robot systems using CORBA interfaces and brokered Pub/Sub messaging interfaces. In *2017 JSME Conference on Robotics and Mechatronics, ROBOMECH2017*, 2017.

[yaguchi-403-079-10:2017] Y. Yaguchi, Y. Nitta, S. Ishizaka, T. Tannai, T. Mamiya, K. Naruse, and S. Nakano. RT Components for Formation Flight with The Hetero Manufacturer Drones. In *2017 JSME Conference on Robotics and Mechatronics, ROBOMECH2017*, 2017.

[yaguchi-403-079-11:2017] K. Amma, Y. Yaguchi, Y. Watanobe, and K. Naruse. Constructing Cloud base RTM and automatic deploy to Raspberry Pi. In *2017 JSME Conference on Robotics and Mechatronics, ROBOMECH2017*, 2017.

[yaguchi-403-079-12:2017] I. Otani and Y. Yaguchi. The Simple Robot Prototyping for RT-Midlleware of the FaBo.inc Sensors. In *2017 JSME Conference on Robotics and Mechatronics, ROBOMECH2017*, 2017.

[yaguchi-403-079-13:2017] M. Yoshida and Y. Yaguchi. 3D Environment Map Reconstruction with Aerial Camera on A Drone. In *2017 JSME Conference on Robotics and Mechatronics, ROBOMECH2017*, 2017.

[yoshiko-403-079-05:2017] Y. Ogawa Y. Hayashi N. Hirata H. Demura T. Matsunaga S. Yamamoto Y. Yokota M. Ohtake Iimura, S. Extension of the lunar Web-GIS GEKKO: Toward statistical analyses of the lunar spectral data. In *JpGU-AGU Joint Meeting 2017*, pages PPS08–P02, May 2017.

[yoshiko-403-079-06:2017] Y. Ogawa M. Ohtake Y. Hayashi N. Hirata H. Demura T. Matsunaga S. Yamamoto Matsubara, Y. Implementation of assortment algorithm for excluding noisy data in the lunar web-GIS: GEKKO. In *JpGU-AGU Joint Meeting 2017*, pages PPS08–P03, May 2017.

[yoshiko-403-079-07:2017] Y. Ogawa Y. Hisada H. Demura S. Miura T. Ozawa Abe, K. Crustal deformation around Azumayama volcano : InSAR analysis compared with GNSS data. In *JpGU-AGU Joint Meeting 2017*, pages STT57–07, May 2017.

[yoshiko-403-079-08:2017] Y. Ogawa H. Demura Nakamura, Y. Detection of phyllosilicates around ouflow channels in the northeast of the Hellas basin, Mars. In *JpGU-AGU Joint Meeting 2017*, pages PPS05–P05, May 2017.

[yoshiko-403-079-09:2017] Y. Ogawa H. Demura Oya, N. Distribution of phyllosilicates in relation with topographic features on Utopia Region, Mars. In *JpGU-AGU Joint Meeting 2017*, pages PPS05–P06, May 2017.

[yoshiko-403-079-10:2017] T. Dairaku K. Suko T. Takahashi H. Demura Y. Ogawa T. Arai T. Fukuhara T. Okada S. Tanaka Endo, K. HEAT: Image and database browser for the thermal imager on Hayabusa2. In *JpGU-AGU Joint Meeting 2017*, pages PPS02–P22, May 2017.

[yoshiko-403-079-11:2017] T. Fukuhara S. Tanaka M. Taguchi T. Arai H. Senshu Y. Ogawa H. Demura K. Kitazato R. Nakamura T. Kouyama T. Sekiguchi S. Hasegawa T. Matsunaga T. Wada T. Imamura J. Takita N. Sakatani Y. Horikawa K. Endo J. Helbert T. G. Mueller A. Hagermann Okada, T. Detectability Performance of Thermal Infrared Imager TIR on Hayabusa2. In *JpGU-AGU Joint Meeting 2017*, pages PPS02–P20, May 2017.

[yutaka-403-079-04:2017] D. Yoshino, Y. Watanobe, Y. Yaguchi, K. Nakamura, J. Ogawa, and K. Naruse. Proposal of MQTT and MQTT-SN Communication Interfaces on RT Middleware for IoR System Construction. In *The 18th Meeting of SICE System Integration Department, SI2018*, 2017.

[yutaka-403-079-05:2017] D. Yoshino, Y. Watanobe, Y. Yaguchi, K. Nakamura, and K. Naruse. Application possibility of OpenRTM-aist-based integrated robot systems using CORBA interfaces and brokered Pub/Sub

messaging interfaces. In *2017 JSME Conference on Robotics and Mechatronics, ROBOMECH2017*, 2017.

[yutaka-403-079-06:2017] K. Amma, Y. Yaguchi, Y. Watanobe, and K. Naruse. Constructing Cloud base RTM and automatic deploy to Raspberry Pi. In *2017 JSME Conference on Robotics and Mechatronics, ROBOMECH2017*, 2017.

Research grants from scientific research funds and public organizations

[ogawa-403-079-01:2017] J. Ogawa. Evolutionary Soft Robotics for Traveling Rough Terrain at Disaster Site, 2017–2019.

Academic society activities

[naru-403-079-10:2017] Chair of the committee for information system, The Japanese Society for Planetary Sciences

[naru-403-079-11:2017] A Member of the steering committee, The Japanese Society for Planetary Sciences

[ogawa-403-079-02:2017] J. Ogawa., 2017.

ROBOMECH2017 Organizing Committee Member, Industrial exhibition, Robotics and Mechatronics Division, The Japan Society of Mechanical Engineers, 2017

[ogawa-403-079-03:2017] J. Ogawa., 2017.

Committee menber, Sustainable Systems Design Conference, 2017

[ogawa-403-079-04:2017] J. Ogawa., 2017.

Committee menber, Technical Committee on Swarm Systems, The Society of Instrument and Control Engineers, 2017

[ogawa-403-079-05:2017] J. Ogawa., 2017.

Committee menber, RoboCon in Aizu 2017, 2017

[yoshiko-403-079-12:2017] Y. Ogawa, 2016.

Member of Diversity Promotion Committee

[yoshiko-403-079-13:2017] Y. Ogawa, 2016.

Member of Foreign Cooperation and Collaboration Technical Committee

[yoshiko-403-079-14:2017] Y. Ogawa, 2016.

Member of Planning Committee

[yutaka-403-079-07:2017] Y. Watanobe, August 2017.

Program Committee, The International Conference on Big data, IoT, and Cloud computing.

[yutaka-403-079-08:2017] Y. Watanobe, December 2017.

Program Committee, The 9th International Conference on Computer Science and its Applications

[yutaka-403-079-09:2017] Y. Watanobe, December 2017.

Organizing Committee Member, ACM-ICPC Asia Regional 2018 Tsukuba

Advisor for undergraduate research and graduate research

[kitazato-403-079-08:2017] Tomoki Inasawa. Master Thesis: Near-infrared reflectance spectral analysis of asteroid Itokawa based on re-estimating trajectory data of Hayabusa spacecraft, University of Aizu, 2018.

Thesis Advisor: K. Kitazato

[kitazato-403-079-09:2017] Yasuhiro Takahashi. Graduation Thesis: Pseudo-fieldwork on asteroids using virtual reality, University of Aizu, 2018.

Thesis Advisor: K. Kitazato

[kitazato-403-079-10:2017] Takefumi Onodera. Graduation Thesis: Investigation of doublet craters on the Moon using spatial statistics, University of Aizu, 2018.

Thesis Advisor: K. Kitazato

[kitazato-403-079-11:2017] Ryuta Nozaki. Graduation Thesis: Search for doublet craters on Mare Moscovience of the Moon, University of Aizu, 2018.

Thesis Advisor: K. Kitazato

[kitazato-403-079-12:2017] Natsuko Mori. Graduation Thesis: Development of space educational VR content on Hayabusa touchdown operation, University of Aizu, 2018.

Thesis Advisor: K. Kitazato

[okudaira-403-079-01:2017] author = Tomoki Azuma. title = Track morphology estimation using improved image analysis method for JAXA TANPOPO mission, University of Aizu, 2018.

note = Thesis Advisor: K. Okudaira

[okudaira-403-079-02:2017] author = Takashi Sonoke. title = Screening candidates of unicellular organisms in microscopic images using machine learning, University of Aizu, 2018.

note = Thesis Advisor: K. Okudaira

[yaguchi-403-079-14:2017] Ikumi Otani. Graduation Thesis: Quantitative evaluation of streaming image quality for the robot teleoperation, University of Aizu, 2017.

Thesis Advisor: Y. Yaguchi

[yaguchi-403-079-15:2017] Kazutake Suzuki. Graduation Thesis: A Characters Select Recommendation System for League of Legends Beginners, University of Aizu, 2017.

Thesis Advisor: Y. Yaguchi

[yaguchi-403-079-16:2017] Masaki Sakuma. Graduation Thesis: Comparison of Cameras and Sensors for 3D Mapping by using mobile robot, University of Aizu, 2017.

Thesis Advisor: Y. Yaguchi

[yaguchi-403-079-17:2017] Pham Hung Cuong. Master Thesis: Sensor Fusion of 3D LiDAR and Fish-eye Camera for Landscape Mapping, University of Aizu, 2017.

Thesis Advisor: Y. Yaguchi

[yaguchi-403-079-18:2017] Yuta Oshima. Master Thesis: Generation of similar disease map based on disease similarity and sparse network, University of Aizu, 2017.

Thesis Advisor: Y. Yaguchi

[yaguchi-403-079-19:2017] Yukinori Inoue. Master Thesis: Collision Avoidance for Drone Fleets using Potential Method, University of Aizu, 2017.

Thesis Advisor: Y. Yaguchi

[yaguchi-403-079-20:2017] Takaaki Mamiya. Master Thesis: Data Fusion of LIDAR and Stereo Camera for Real Time 3D Dense Mapping, University of Aizu, 2017.

Thesis Advisor: Y. Yaguchi

[yoshiko-403-079-15:2017] m5201113 Hiroaki Kato. Master Thesis: Application of Deep Learning for Automatic Detection of Lunar Swirls by Combining Data from Multi-Band Imager and DEM, University of Aizu, March 2018.

Thesis Advisor: Y. Ogawa

[yoshiko-403-079-16:2017] s1220031 Koji Sato. Graduation Thesis: Development of a GIS tool for viewing volcanic and tectonic data in Japan, University of Aizu, March 2018.

Thesis Advisor: Y. Ogawa

[yoshiko-403-079-17:2017] s1220015 Masaki Narusawa. Graduation Thesis: Evaluation of deep learning for identifying lunar swirls, University of Aizu, March 2018.

Thesis Advisor: Y. Ogawa

[yoshiko-403-079-18:2017] s1220163 Kazuya Matsumoto. Graduation Thesis: Seasonal change of water environment in Oze marsh indicated by ALOS/PALSAR data, University of Aizu, March 2018.

Thesis Advisor: Y. Ogawa

[yutaka-403-079-10:2017] Takumi Yamashita. Graduation Thesis: Consensus Building Algorithm with BFT for Permissioned Blockchain, University of Aizu, 2018.

Thesis Advisor: Y. Watanobe

[yutaka-403-079-11:2017] Motohiko Abe. Graduation Thesis: Rose: New Byzantine Consensus on Hashgraph based Data Structure, University of Aizu, 2018.

Thesis Advisor: Y. Watanobe

[yutaka-403-079-12:2017] Keigo Ebihara. Graduation Thesis: Evaluation of Language Network System, University of Aizu, 2018.

Thesis Advisor: Y. Watanobe

[yutaka-403-079-13:2017] Yunosuke Teshima. Graduation Thesis: Bug Detection based on Deep Learning and Solution Source Codes, University of Aizu, 2018.

Thesis Advisor: Y. Watanobe

[yutaka-403-079-14:2017] Ryoya Komatsu. Graduation Thesis: Online Text Editor with Logical Error Correction, University of Aizu, 2018.

Thesis Advisor: Y. Watanobe

[yutaka-403-079-15:2017] Kazuya Watanabe. Master Thesis: Grading Algorithm using Difficulty Level Estimation of Problem Sets, University of Aizu, 2018.

Thesis Advisor: Y. Watanobe

Others

[ogawa-403-079-06:2017] J. Ogawa. Embodiment Intelligence of Evolving Soft Robot, 2017.

Invited Talk, SWEL lecture, Yamagata Univ.

[ogawa-403-079-07:2017] J. Ogawa. Motion Analysis Simulator for Soft robot, Nov. 2017.

Panel Exhibition, 2017 Fukushima Prefecture New Technology / New Construction Method Exhibition Business Talks (in Daihatsu)

[yoshiko-403-079-19:2017] Y. Ogawa. Reviewer of Grants-in-Aid for Scientific Research ¡KAKENHI¿ Research Activity Start-up, 2017.

[yoshiko-403-079-20:2017] Y. Ogawa. Member of satellite data analysis group in Coordinating Committee for Prediction of Volcanic Eruptions created by Japan Meteorological Agency, April 2017.

[yoshiko-403-079-21:2017] Y. Ogawa. Co-I of the Special Collaborative Research (B) funded by Earthquake Institute, the University of Tokyo, Research for crustal deformation by using synthetic aperture radar of new generation, PI: Taku Ozawa (NIED), 2017.

[yoshiko-403-079-22:2017] Y. Ogawa. Cooperation member of the MEXT project: Integrated project of developing the human resources for volcano researches in the Next generation: Development of the new observation technology, 2017.

[yoshiko-403-079-23:2017] Y. Ogawa. The 4th Oze academic research team member, 2017.

[yoshiko-403-079-24:2017] Y. Ogawa. JAXA/ISAS science team members.

[yoshiko-403-079-25:2017] Y. Ogawa. Hayabusa 2 project members.

[yoshiko-403-079-26:2017] Y. Ogawa. Part-time Lecturer at Shibaura Institute of Technology, 2017.

Applied physics: Thermodynamics

[yutaka-403-079-16:2017] Y. Watanobe, Feburary 2018.

Programming Challenge on New Aizu Online Judge

Contributions related to syllabus preparation

[chonda-403-079-12:2017] Computational geometry for visual computing 1 Course outline Computational geometry is one of important field of computer science to solve geometric problems. In recent, to solve geometric problem with large data and handle with high-speed processing is required for such as geographic information system (GIS), computational graphics (CG), computer-aided design (CAD), and pattern recognition, robotics, and others. In the class, students learn about computational geometric concepts in the first half section (Chap.1-7), and learn about information visualization on the premise of various concepts / algorithms in the latter part (Chap.8-14). ...

[nakamura-403-079-06:2017] CSC01 Information Security

[nakamura-403-079-07:2017] L06 Information Security

[yaguchi-403-079-21:2017] A undergraduate school course syllabus constructed: [IT03] Digital Image Processing

[yaguchi-403-079-22:2017] A graduate school course syllabus constructed: [ITC05] Pattern Recognition and Machine Learning

[yaguchi-403-079-23:2017] A graduate school course syllabus constructed: [ITA06] Image Rcognition and Understanding

[yutaka-403-079-17:2017] A undergraduate school course syllabus constructed: [F01] Algorithms and Data Structures

[yutaka-403-079-18:2017] A undergraduate school course syllabus constructed: [IE03] Integrated Exercise for Software I

[yutaka-403-079-19:2017] A undergraduate school course syllabus constructed: [OT04] Courses for the Information Technology Examination

[yutaka-403-079-20:2017] A graduate school course syllabus constructed: [CSC11F] Advanced Data Structures and Algorithms

[yutaka-403-079-21:2017] A graduate school course syllabus constructed: [SEC04A] Programming Strategies and Software Development Tools

Preparation of course examination to measure comprehension

[yutaka-403-079-22:2017] Problem Setter for Entrance Exam Questions of Mathematics

Scholarly paper prepared by undergraduate/graduate student(s) you advised

[naru-403-079-12:2017] Wataru Ueno, Hirohide Demura, and Naru Hirata. HARMONICS: A Visualization Tool for Hayabusa and Hayabusa 2 Missions. *TRANSACTIONS OF THE JAPAN SOCIETY FOR AERONAUTICAL AND SPACE SCIENCES*, 60(3):132–136, 2017.

Contribution related to the selection of library or textbook materials

[chonda-403-079-13:2017] Library committee member

Contribution related to toward equipment management, classroom management, building management, and crime or fire prevention.

[yoshiko-403-079-27:2017] Fire prevention manager of 223B and 245

Advisor of a student club or circle

[yaguchi-403-079-24:2017] Circle Advisor: Pokemon Circle

[yaguchi-403-079-25:2017] Circle Advisor: Confort Utopian Orchestra

[yaguchi-403-079-26:2017] Circle Advisor: Soccer Circle

[yutaka-403-079-23:2017] Circle Advisor: Competitive Programming Club (ICPC), ACM-ICPC World Finals 2017, ACM-ICPC Asia Regional 2017 Tsukuba, ACM-ICPC Asia Regional 2017 Hualien, ACM-ICPC Asia Regional 2017 Daejeon, ACM-ICPC Asia Regional 2017 Ho Chi Minh

Contribution related to the building or operation of the university computer system

[nakamura-403-079-08:2017] ISTC Steering Committee, member

[naru-403-079-13:2017] ISTC steering committee

Contribution related to on-campus/off-campus publicity work

[yoshiko-403-079-28:2017] Exhibition of UoA at University Information Fair (Astrology and planetary science major), August 27, 2017 at Tokyo University of Science, Shinjuku-ku, Tokyo

Summary of Achievement

Contribution related to educational planning management

[yaguchi-403-079-27:2017] A member of Curriculum Working Group

Contribution related to planning administration for research, research conferences, or international research

[terazono-403-079-01:2017] Operation of CAIST Managing Office

[terazono-403-079-02:2017] Management of The 1st CAIST Symposium

[yoshiko-403-079-29:2017] LOC of 10th Practical training seminar on the data analysis in planetary missions at UoA, March 5-7, 2018

Contribution related to educational research technology and facility planning management

[nakamura-403-079-09:2017] Revitalization Center Steering Committee, member

Other significant contribution toward university planning, management, or administration

[terazono-403-079-03:2017] Management of CAIST

[yaguchi-403-079-28:2017] A member of PC Koshien

[yaguchi-403-079-29:2017] A member of entrance examination working group

[yoshiko-403-079-30:2017] Member of committee for Claim Management

[yoshiko-403-079-31:2017] Member of Harassment Prevention Committee

[yoshiko-403-079-32:2017] Member of committee for Harassment management

[yutaka-403-079-24:2017] A member of Judge for Programming Division of PC Koshien

[yutaka-403-079-25:2017] A member of entrance examination committee

Contributions related to regional education

[keita-n-403-079-32:2017] Instructor for RT middleware workshop in College of engineering, Nihon University (2017-09-29)

[keita-n-403-079-33:2017] Instructor for RT middleware workshop in University of Aizu (2017-12-14, 2017-12-15)

[keita-n-403-079-34:2017] Instructor for robot engineers in a training course by Fukushima Prefecture (2017-02-03, 2017-02-10, 2017-02-24, 2017-03-03)

[nakamura-403-079-10:2017] Cyber Security Trends, lecture at Fukushima Prefecture Police, April 2017

[nakamura-403-079-11:2017] Cyber Security Trends, lecture at Fukushima Prefecture Police School, September 2017

[yoshiko-403-079-33:2017] Committee member of Aizu-Wakamatsu city Disaster Control Council

[yoshiko-403-079-34:2017] On-campus lecture for Sukagawa municipal Nida junior high school students, 1st grade students + teachers, 53 attendees, May, 18, 2017

[yoshiko-403-079-35:2017] Open lecture for public at Aizu IT Aki Forum, October 20, 2017

[yoshiko-403-079-36:2017] Dispatched off-campus lectures at Shizuoka City high school, October 26, 2017, 2nd grade students, 40 attendee

[yoshiko-403-079-37:2017] Preparation for Exhibition of UoA at Fukushima Aerospace Fair, November 23, 2017 Fukushima City

[yutaka-403-079-26:2017] Special Lecture: Programming Education for Elementary Schools, Koriyama Central Public Hall, 2017, July

Proposal/implementation of a new industry

[nakamura-403-079-12:2017] Secure Cloud Computing, presentation and exhibition at Industry, Academia, Government, Finance, Collaboration Fair 2018 in Miyagi, January 2018

[yaguchi-403-079-30:2017] A vice chairman of the investigation and review meeting of wireless system related to grasp of flight position of small unmanned aerial vehicles, Tohoku Integrated Communication Bureau

[yaguchi-403-079-31:2017] A member of the bid for UTM to be implemented in Fukushima Robot Test Field

Contribution toward education for employees of regional industries

[nakamura-403-079-13:2017] Cyber Security Seminar for Business Leaders, Aizu, November 2017 and Koriyama, December 2017

[nakamura-403-079-14:2017] Cyber Security Seminar and Drill for IT Professionals, Aizu, January 2018

[yaguchi-403-079-32:2017] A lecturer of the Fukushima Robot Software Study Meeting

[yutaka-403-079-27:2017] Lecture for RT Middleware in Minamisoma-City, Minamisoma, 2017, August

[yutaka-403-079-28:2017] Software for Robot, Koriyama, 2017, August

[yutaka-403-079-29:2017] Fukushima Human Resource Development Curriculum, Koriyama, 2018, Feburary

Other noteworthy contribution related to regional industries

[yaguchi-403-079-33:2017] A member of the Fukushima Prefecture Industry-Robot Technology Development Support Project

Did you participate in Public Lectures, and/or Open Campus? (Yes or No) If yes, please describe what you did.

[chonda-403-079-14:2017] Off-campus Lectures: 2 Off-Campus Public Lectures by Dispatched Faculty Members: 2 Open Campus (summer / autumn): both

[nakamura-403-079-15:2017] Information Security, open lecture, Aizu Keikodo, August 2017

[nakamura-403-079-16:2017] Building Secure Computing Environment, open labs, August 2017

[nakamura-403-079-17:2017] Building Secure Computing Environment, open labs, October 2017

[naru-403-079-14:2017] exhibition in Open Campus of the University of Aizu, 2017.8.11

[naru-403-079-15:2017] lecture in Aizu-Wakamatsu 5th Junior Highschool, Aizu-Wakamatsu, 2017.7.18

[naru-403-079-16:2017] lecture in Aizu-Wakamatsu 1st Junior Highschool, Aizu-Wakamatsu, 2017.10.6

[naru-403-079-17:2017] lecture in Kaneyama Village, Fukushima, 2017.8.4

[naru-403-079-18:2017] lecture in Aizu-Wakamatsu Kawahigashi Junior Highschool, Aizu-Wakamatsu, 2017.11.7

[naru-403-079-19:2017] exhibition in Open Campus of the University of Aizu, 2017.10.7-8

[okudaira-403-079-03:2017] note = Summer/Fall Open Lab, poster exhibition, TANPOPO mission

[yoshiko-403-079-38:2017] Preparation of posters for open campus

[yutaka-403-079-30:2017] Trial Lesson of Programming, Gakuho High School, 2017, July

[yutaka-403-079-31:2017] Sports Programming and Online Judge System, Lecture for Computer Science Summer Camp, 2017, August

[yutaka-403-079-32:2017] Introduction to Programming, Kitakata High School, 2017, October

[yutaka-403-079-33:2017] Introduction to Programming, Yamagata Institute High School, 2017, November

[yutaka-403-079-34:2017]

[yutaka-403-079-35:2017]

[yutaka-403-079-36:2017]

Research achievement that can be used for University-Industry collaboration and its characteristics.(for UBIC's information)

[yutaka-403-079-37:2017] Online Judge System (Aizu Online Judge): https://onlinejudge.u-aizu.ac.jp/

[yutaka-403-079-38:2017] Visual Programming Language and Environment (*AIDA): http://aida.u-aizu.ac.jp/

Do you have experience of University-Industry collaboration? If yes, please describe your experience. (for UBIC's information)

[yaguchi-403-079-34:2017] Commissioned research: UAV Security, East-Japan Accounting Center, co.

[yaguchi-403-079-35:2017] Commissioned research: Motion recognition of drive recorder on forklift, Toolmart, co.

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