

Conference Program at-a-glance

15th IIAI International Congress on Advanced Applied Informatics

December 11-13, 2023, Bali, Indonesia

Venue: Bali Dynasty Resort

December 11: Onsite Sessions

	Nusa Pedina 1	Nusa Pedina 2	Nusa Pedina 3
9:30AM-10:30AM	Registration & Welcome Coffee		
10:30AM-11:30AM		Opening Ceremony	
11:30AM-1:00PM	Lunch		
1:00PM-3:05PM		SCAI 1	DSIR 1
3:05PM-3:25PM	Coffee Break		
3:25PM-5:05PM	SCAI 2	SCAI 3	ESKM 1
6:00PM-8:00PM	Welcome Reception		

December 12: Onsite Sessions

	Nusa Pedina 1	Nusa Pedina 2	Nusa Pedina 3
9:00AM-10:40AM	LTLE 1	SCAI 4	ESKM 2
10:40AM-11:00AM	Coffee Break		
11:00AM-12:00PM		Keynote Session	
12:00PM-1:15PM	Lunch		
1:15PM-2:55PM	LTLE 2	SCAI 5	DSIR 2
2:55PM-3:15PM	Coffee Break		
3:15PM-4:55PM	SCAI 6	SCAI 7	ESKM 3
6:00PM-8:00PM	Banquet & Award Presentation		

December 13: Online Sessions

	Online 1	Online 2
9:00AM-10:40AM	ESKM 4	SCAI 8
10:40AM-11:00AM	Break	Break
11:00AM-1:00PM	LTLE 3	ESKM 5
1:00PM-1:30PM	Lunch on your own	Lunch on your own
1:30PM-3:00PM	Invited Talks	
3:00PM-3:20PM	Break	Break
3:20PM-6:20PM	LTLE 4 & DSIR 3	SCAI 9

Message from the Congress General Chair

Welcome to IIAI AAI 2023-Winter Congress.

The 15th IIAI International Congress on Advanced Applied Informatics (IIAI AAI 2023-Winter) is sponsored by the International Institute of Applied Informatics, Indonesia.

The purpose of IIAI AAI is to bring together researchers and practitioners from academia, industry, and government to exchange their research ideas and results and to discuss the state of the art in the areas of the conference. Four sub-conferences, the 17th International Conference on e-Services and Knowledge Management (ESKM), the 15th International Conference on Learning Technologies and Learning Environments (LTLE), the 15th International Conference on Data Science and Institutional Research (DSIR), and the 14th International Conference on Smart Computing and Artificial Intelligence (SCAI), are held with the AAI 2023-Winter.

We would like to thank Executive Vice General Chair Dr. Ford Lumban Gaol, Program Chair Dr. Kunihiko Takamatsu, Publication & Finance Chair Dr. Tokuro Matsuo, Director of Local Management Dr. Satoshi Takahashi, Local Arrangement Chair Dr. Takaaki Hosoda, the organizing committee chairs, the organization staff, and the members of the Program Committee for their hard work. And most importantly, we would like to thank all the authors for sharing their ideas and experiences through their outstanding papers contributed to the congress. I hope that IIAI AAI 2023-Winter will be successful and enjoyable to all participants.

Yuichi Ono

University of Tsukuba, Japan

Congress General Chair, IIAI AAI 2023-Winter Congress

A Message from the Program Chair

Welcome to the 15th IIAI International Congress on Advanced Applied Informatics (IIAI AAI 2023-Winter), sponsored by the International Institute of Applied Informatics, Indonesia. This congress consists of four subconferences to cover a wide range of topics of applied informatics: ESKM...International Conference on e-Services and Knowledge Management; LTLE...International Conference on Learning Technologies and Learning Environments; DSIR...International Conference on Data Science and Institutional Research; and SCAI...International Conference on Smart Computing and Artificial Intelligence. Each subconference and their topics of interests are related to each other. IIAI AAI 2023-Winter provides an international forum for researchers, scientists, engineers, industry practitioners, and students throughout the world to share their experiences, new ideas, and research results about all aspects of computer and information science.

The congress received a total submission of 161 papers from 19 different countries/regions. These papers were refereed by 141 Program Committee Members. After careful and rigorous review, 45 papers were selected as regular papers and the acceptance rate was 27.9%. And, 20 papers were selected as short papers to be presented at the congress and published in the congress proceedings. We would like to thank all the researchers who submitted papers to this congress and we are pleased to have with us those who are accepted.

I would like to express my appreciation to the following people: the congress general chair, Prof. Yuichi Ono, executive vice general chair, Prof. Ford Lumban Gaol, publication & finance chair, Prof. Tokuro Matsuo, who supervised and personally contributed to every step including paper review and session organization. My appreciation also goes to the program/conference chairs of Prof. Daisuke Ikeda (ESKM), Prof. Yuichi Ono (LTLE), Prof. Yoshikazu Asada (DSIR), and Prof. Naoki Fukuta (SCAI), for their valuable contributions not only to their subconferences but also to the whole IIAI AAI 2023-Winter. Also, I would like to express my appreciation to the organizing chairs, the members of the program committee and secondary reviewers who contributed a great amount of their time to evaluate the submissions to maintain high quality of the congress; and all the authors, attendees, and presenters who really made this congress possible and successful. I would like to express my special gratitude to associations and companies to support the congress.

We sincerely hope you will enjoy the congress!

Kunihiko Takamatsu, Ph.D.

Program Chair, IIAI AAI 2023-Winter Congress

Tokyo Institute of Technology, Japan

IIAI AAI 2023-Winter Organizing Chairs

Steering Committee

Sachio Hirokawa, Kyushu University, Japan

Naohiro Ishii, Advanced Institute of Industrial Technology, Japan

Kiyota Hashimoto (Chairperson), Prince of Songkla University, Thailand/Shunan Public University, Japan

Norihisa Komoda, Code Solution K.K. / Osaka University, Japan

Masao Mori, Tokyo Institute of Technology, Japan

Yuichi Ono, University of Tsukuba, Japan

Honorary Co-Chairs

Sachio Hirokawa, Kyushu University, Japan

Naohiro Ishii, Advanced Institute of Industrial Technology, Japan

General Chair

Yuichi Ono, University of Tsukuba, Japan

Executive Vice General Chair

Ford Lumban Gaol, Bina Nusantara University, Indonesia

Program Chair

Kunihiko Takamatsu, Tokyo Institute of Technology, Japan

Vice Program Co-Chairs

Haryono, Bina Nusantara University, Indonesia

Spits Warnars, Bina Nusantara University, Indonesia

Yaya Heryadi, Bina Nusantara University, Indonesia

Finance Chair / Publication Chair

Tokuro Matsuo, Advanced Institute of Industrial Technology, Japan

Director of Local Management

Satoshi Takahashi, The University of Electro-Communications, Japan

Local Management Chair

Takaaki Hosoda, Advanced Institute of Industrial Technology, Japan

Local Arrangement Chairs

Yulyani Arifin, Bina Nusantara University, Indonesia

Yuya Yokoyama, Advanced Institute of Industrial Technology, Japan

Maria Susan, Bina Nusantara University, Indonesia

Abstracts

ESKM 2023-Winter

A Novel Classification System for Faster Assessment of IDS Alerts Using Convolutional Neural Network

Satoshi Kimura and Hiroyuki Inaba

The Intrusion Detection System (IDS) is designed to detect cyberattacks. However, given the vast number of alerts generated by IDS for different registered attack signatures, there's a growing demand for a method to quickly assess the status of IDS alerts. In this study, we propose a novel approach where we create image data, termed "composite block diagram", based on the alert counts for each signature in IDS. These composite block diagrams are labeled with the corresponding alert detection time as the ground truth. We trained the pairs of composite block diagrams and alert detection times by using Convolutional Neural Network (CNN). The results indicate that our proposed method can recognize patterns in the composite block diagrams corresponding to the detection times with an accuracy of 75.44% on unseen data.

Analysis of Factors Affecting Hotel Occupancy Rate

Saya Kodera, Akihisa Kodate and Yu Ichifuji

The purpose of this study is to analyze the factors contributing to the improvement of hotel occupancy rates based on the data on room occupancy obtained from a web-based reservation system for hotels (an EC site of a leading travel agency). We analyzed the change in sellout probability before and after Covid-19 pandemic and also examined how user reviews of hotels, could affect the sellout probability of hotel travel plans. The results showed that the hotel occupancy rate decreased during Covid-19 pandemic, which means that the probability of travel plan sellouts decreased. Furthermore, we found that the overall numerical evaluation on the Web reservation system had no direct impact on the probability of the plan sellouts.

Analysis of Tourist Behavior Between Tourist Spots Depending on Tourists' Residence Area Using Location-based Data

Yu Ichifuji and Daisuke Murakami

Tourism is one of Japan's major industries. Especially in rural cities, it plays a crucial role in economic revitalization. The COVID-19 pandemic has caused significant damage, and it is not possible to return to the pre-COVID-19 conditions. Therefore, in the era of 'living with COVID-19,' there is a demand to find ways to revitalize tourism. Currently, there is a demand from the field to analyze tourists' behavior in detail based on information like GPS, but the results are not being fully utilized. Furthermore, the more complex the data aggregation, the more expensive it becomes, making it less accessible for easy implementation. In this study, we utilized mobile carrier location registration data to assess the connections between tourism spots within Nagasaki Prefecture using only basic aggregate data for each location. As a result, we revealed that tourist behavior varies depending on the place of residence and uncovered trends in behavior based on the season.

Analyzing the Impact of Customer Service Chatbots on User Satisfaction

Elkana Rahadian Putra Antonio, Muhammad Farras Fadhilah Fadhilah, Fikri Faiq, Renaldy Fredyan and Hady Pranoto

In this current digital era, chatbot apps are widely used in customer service with great automation, round-the-clock customer service, and constant customer support. The main problems with chatbots are that they are unable to provide the intended end solution and fail to reproduce the typical customer experience with human interaction. This research aims to see the impact of customer service chatbots on user satisfaction. This paper uses a quantitative review method that results from the translation of the impact given by the customer service chatbot. The results of this study show that customer service chatbots for most users increase their satisfaction compared to conventional customer service, with chatbots providing customer comfort and efficiency, reducing customer service time, improving information, increasing productivity, and giving customers tailored experiences.

Analyzing the Impact of Service Design on Maintainability Factor in Microservices Architecture

Gintoro, Ford Lumban Gaol, Haryono Soeparno and Yulyani Arifin

Applications designed utilizing Microservices Architecture (MSA) provide the desirable trait of good maintainability. To ensure optimal maintainability, it is important to provide services that are suitable and adhere to prescribed rules. Multiple aspects must be taken into account while designing services to ensure optimal maintainability. The objective of this study is to examine the elements that impact the capacity to sustain and improve maintainability in service design, ultimately resulting in an application that possesses strong maintainability. The Systematic Literature Review (SLR) will be utilized to identify variables and strategies for their enhancement, by examining pertinent publications on the subject. After examining 45 publications, the study discovered 8 elements and 14 solutions that can enhance the highlighted parameters throughout the services design process. The outcomes of this systematic literature review (SLR) are anticipated to give valuable insights to application developers, empowering them to generate service designs that exhibit commendable maintainability for the developed applications.

Basic investigation of code edit distance measurement by CodeBERT

Wakana Hashimoto, Masahito Yasui and Kazuhiro Takeuchi

This paper investigates the use of CodeBERT, a well-known large-scale language model for program code, in computing code edit distance, an important aspect of software development. We perform two experiments to evaluate CodeBERT's ability to discriminate between code changes, detect deletions of functional parts, and understand structural and grammatical aspects of code. In the first experiment, we aim to detect the deletion of specific functional parts in abstract syntax trees (ASTs). The experimental results show that CodeBERT exhibits high accuracy in identifying the presence or absence of arbitrary subtrees in the AST, indicating its potential for understanding the structural aspects of code. In the second experiment, we use CodeBERT to train code similarity computation using SBERT (SentenceBERT), demonstrating its ability to capture both semantic and grammatical aspects of code. These results are valuable for the further development of comprehensive large-scale language models for program code.

Business Model Proposal for Agriculture and Tourism Business Sectors Supported by ICT System in Nepal through Systematic Business Analysis Process

Pabitra Chaudhary and Koji Okada

Nepal is a least developed country in the world. Most people live in rural areas that have poor economic conditions. With limited job opportunities within the country, there is a massive outflow of labor overseas and we must depend on remittance for our daily lives. To resolve this problem, an effective business model is needed to create sufficient job opportunities and improve the economic situation. Many researchers suggest that im-provement of the agricultural sector and investment in tourism would facilitate the job opportunities and assisted the importance of ICT based business model; however, none of them proposed a model with systematic methodology. Therefore, a series of business analysis was conducted to investigate the overall scenario. First, we conducted a (i) PASTLE analysis, (ii) SWOT analysis followed by case studies and (iii) 3C analysis. The following results were obtained (i) PASTLE

analysis and (2) SWOT shows the massive mobile connection rate exceeding the total population and high primary education completion rate indicating the possibility of agribusiness and tourism business, but the demand and supply chain is fragmented due to lack of information. To understand the actual situation, I investigated two specific areas: Dang, which is known as the grain basket of Nepal, and Pokhara city, a melting point of tourist destination for mountaineering, adventures activities along with enormous trekking sites holding the massive consumption of Agri-product (iii) 3C analysis helped to figure out the key success factor of ICT business to link the production and consumption sites. Therefore, I proposed the mobile application-based business model using business model canvas. Our goal is to link the demand of tourists and farmers food supply and connect to technical support for modern farming technique for mass production and cultivation by using ICT technology such as mobile application.

Door Locking System Based on Fingerprint and LoRa Wireless Technology

Yulianto Yulianto, Nyoman Wira Prasetya and Andhika Pramalyantio

The architecture of the Internet of Things (IoT) makes it possible to monitor and control a real environment from any location. Nowadays, the use of the IoT has been successfully implemented in many sectors, such as industry, research, and home appliances. In the field of home appliances, popular research has explored the use of an IoT concept to enhance the security system, particularly the security of a room. In order to increase the security of the room, the researcher tried to change the conventional mechanical locking door to an electronic one. The fingerprint sensor is one of the sensors that is most often used to realize the unlocking the door based on the keyless access. The FPM10A is the type of fingerprint sensor that can be found quite often in literature reviews and is used for the realization of biometric security based on fingerprint recognition. However, the FPM10A only stores the fingerprint image and data identification in its chipset, making any enrolment process need to be connected directly from the computer to the circuit for flashing. To overcome this drawback, this study proposed a framework composed of the combination of a fingerprint sensor with a LoRa module connected to Java application to control the enrolment process, which can be done in just one click. In the evaluation of the response time obtained in the test, the total delay of the enrolment process is 15.6 seconds on average and the response time for unlocking is 5 seconds on average.

Drug Demand Prediction Based on Epidemiology Factors Using Random Forest

Gunadi Emmanuel, Muhammad Zarlis, Yulyani Arifin and Ilvico Sonata

The disease characteristics that spread quickly, the number of sufferers, and the severity of coronavirus 19 sufferers are components of uncertainty during the pandemic. Public panic has driven an increase in demand for medicines and medical devices. In uncertain situations, prediction models for the need for medicines and medical devices are of great concern to policymakers in the government, drug manufacturers, distributors, and management of pharmaceutical installations. Epidemiological factors deserve to be one of the parameters of drug demand prediction models, the majority of which have so far relied on historical data on drug use. This study implements the Random Forest algorithm to predict drug needs by entering disease features that are in the top 10 in private hospital units. The research method uses literature studies, field data processing from pharmaceutical installations, and analysis processes using KNIME software. The research produced a prediction model for drug use needs based on the consumption cycle and classification of drug therapy groups with a model accuracy rate of 81.818%. The process of data pre-processing stages affects the level of prediction accuracy.

Effectiveness of Refactoring Techniques to maximize Code Coverage Metric

Johannes Simatupang, Haryono Soeparno, Ford Lumban Gaol and Yulyani Arifin

Refactoring is a technique used in software development to improve the quality of code without changing its functionality. One metric that is often used to measure code quality is Code Coverage. This study aims to examine refactoring techniques that can maximize Code Coverage Metric. Through the study, identification, evaluation, and summary of empirical evidence from various literature sources are carried out. The results of this SLR provide guidance on effective refactoring techniques to improve Code Coverage as well as other positive impacts for software development. There are ten refactoring techniques that can be used to improve Code Coverage Metrics in software testing.

Impression and Suitability of Q&A Statements through Factor Scores Using 2-gram

Yuya Yokoyama

In order to solve the mismatches between the intentions of questioners and respondents at Question and Answer (Q&A) sites, nine factors of impressions were obtained through impression evaluation experiments. Through multiple regression analysis, factor scores were then estimated using feature values of statements. The factor scores obtained were subsequently used for finding the respondent who would be expected to appropriately answer a question. However, this method largely depended on the syntactic information extracted through morphological analysis. Thus, it was also partially shown that N-gram was also applicable as an alternative method. In applying N-gram, estimation of factor scores has been realized so far. Therefore, in this paper, using the distances between the factor score of a question and those of answers based on N-gram, whether this would also be applicable to detecting the respondent capable of giving appropriate answers to a question is inspected as well. The analysis result using N-gram has shown that a similar tendency as the previous analysis employing Syn-Info was observed. It has also been shown that users with sufficient knowledge in specific categories can be thought as appropriate respondents.

Moisture Detection Using CSI of Reflected Radio Waves

Hidekazu Yanagimoto, Watru Tokioka, Kiyota Hashimoto and Tokuro Matsuo

This paper presents a CSI-based moisture detection system with a commodity sensor, M5Stack, and only reflected radio wave propagation. To discuss moisture detection, we carried out an experiment on whether a towel contained water or not to simulate the water content on a cliff. The proposed system achieved 99% prediction accuracy in this experiment using Gradient Boosting Decision Tree as a classifier. CSI represents WiFi propagation conditions and we can detect environmental changes by changing the CSI values. To measure CSI, we usually need specific devices to extract CSI information from WiFi packets. However, we construct a CSI measurement system at a low cost using commodity sensors: M5Stack since it is difficult to get such specific devices. We measure CSI with our proposed system and detect moisture content with Gradient Boosting Decision Tree, which is a nonlinear ensemble machine learning, according to observed CSI amplitude and phase. The proposed system is superior to other machine learning algorithms: Decision Tree, Random Forest, and SVM, from the viewpoint of prediction accuracy. Speaking concretely, the proposed system achieves approximately 99% because the proposed system can capture the nonlinear structure contained in the observed CSI dataset. From the analysis results, we find the proposed method contributes to the availability of CSI which reflected radio wave generates.

Parallel Task Allocation in Multi-robot Environment under Uncertainty based on Auction Mechanism

Md Sabbir Hossain, Ihsan Ibrahim and Naoki Fukuta

Parallel task allocation in multi-robot task allocation is essential across industries, optimizing efficiency, resource management, and performance. It impacts productivity, cost effectiveness, and safety in real-world applications such as manufacturing, agriculture, emergency response, e-commerce, and space exploration. In this paper, we propose an auction based approach for parallel task allocation in a multi-robot environment. We introduce an approach based on a multistage iterative combinational auction to create a parallel task allocation schedule, considering task preferences and avoiding path collisions. In this paper, we mainly focus on resolving real time conflicts and avoiding collusion during task allocation and execution. We also consider task prioritization, task importance, and deadline which can be helpful for allocating and executing tasks in the multi-robot environment.

Proposal on a choreographic systematization for Service Robots with Referencing Noh and Ninyo Joruri, Traditional Japanese Performing arts **Masahiko Narita, Sachiko Nakagawa and Yasufumi Takama**

We are conducting research with the goal of utilizing the accumulation and knowledge of traditional performing arts for communication between service robots and humans. We have already modeled, developed, and evaluated OSONO, a robot based on Joruri puppets, and proposed a method for systematizing the choreography of Ningyo Joruri based on "Associative model" that derives the choreography from the acting script of the performance. On the other hand, Noh, which combines drama, dance, musical instrument and voice music, is traditional Japanese performing, has influenced the performing arts since its inception, incorporating many performing arts. Therefore, it is natural to expect that if we expand the scope of analysis to these, we can obtain more diverse and sophisticated choreographies. However, Noh is very different from Ningyo Joruri, therefore, the issues are the systematization method that can handle Noh and Ningyo Joruri in a common manner and the extraction of various choreographies derived from Noh. In this paper, we find the common relation between the acting script and the choreography to Noh and Ningyo Joruri, and we propose an extended method of "associative model", which is adoptable to them. At the same time, we clarify some of Noh's derived concepts that create diverse choreographies.

Prototyping an Agent for Dynamic Generation of Attack-Payloads in Web Application Vulnerability Assessment **Suzuki Ryotaro and Naoki Fukuta**

Web applications can now be easily built by anyone and become an important part of providing a variety of information and services on the Internet. On the other hand, security threats are always present. Therefore, vulnerability assessments are generally performed before Web applications are released to the public. However, conventional diagnostic tools are inefficient because they are data-driven can only perform fixed attacks, and ignore responses from web applications. Therefore, we propose the use of an agent that considers the responses of web applications to generate attack-payloads for vulnerability assessment tools. We aim to generate flexible attack-payloads by using pattern mining and heuristic rules for generating attack-payloads. In addition, the agent can be modeled as a feature vector to generate attack-payloads that consider the responses from complex web applications, thereby making learning more efficient.

Simulation Modeling of a Conceptual Model for Supply Chain Risks in Japan's Automobile Industry **Toko Sasaki and Akira Nagamatsu**

Japan's automobile industry suffered enormous losses as a result of the 2011 Tohoku earthquake that halted supplies of assemblies/products and interrupted production worldwide. Four years earlier, the 2007 Niigata Chuetsu offshore earthquake had damaged Riken's Kashiwazaki plant in Niigata, impeding operations among most Japanese automakers. Five years after the 2011 Tohoku earthquake, many plants, including semiconductor manufacturer Renesas and automotive parts maker Aisin Kyushu in Kumamoto were affected by the 2016 Kumamoto earthquake, the impact affected entire Japan's automobile industry. Thus, production stoppages at lower-tier suppliers have often affected nearly every Japanese automobile maker. This paper describes how these disasters affected the supply chain network and production systems in Japan's automobile industry where concentration was occurring at the lower tiers. Furthermore, by constructing the conceptual model, it was possible to visualize the effects of two structures: pyramid and diamond.

The Definition of De-identification by Act on the Protection of Personal Information and International Standard Framework for De-identification **Sanggyu Shin**

This paper introduces the legal definitions of de-identification, re-identification, anonymization, and pseudonymization based on the revised Personal Information Protection Law enforced on April 1, 2022, and the current international standardization trends in the de-identification field, including the standardized frameworks ISO / IEC 27551 and ISO / IEC 20889, ISO / IEC 27559. identification process for telecommunication service providers), ISO / IEC 20889, and ISO / IEC 27559. Personal data de-identified by anonymization or pseudonymization must be de-identified adequately before being used as part of publicly available big data sets. Dealing with Big Data and sensitive personal data requires knowledge and technical competence to maintain the appropriateness of that data. Many companies are currently implementing Big Data projects and need to have a sound legal understanding and to develop in line with international standards to remain compliant with the ever-increasing regulatory risk requirements.

The Impact of Emotion Recognition Models Towards Believability Factor of Chatbots **Rhio Sutoyo, Harco Leslie Hendric Spits Warnars, Sani Muhamad Isa and Widodo Budiharto**

Emotionally-aware chatbots that are equipped with emotional intelligence. Based on the literature, using emotional elements in chatbots can improve user engagement and believability factors. This study attempts to make a novel contribution by empirically evaluating the impact of emotion recognition models on the believability factor of chatbots. This study examines the impact of the emotions model and avatar on chatbot interactions through three implementations. Thirty-one participants volunteered to evaluate emotionally aware chatbots. The participants evaluated the interaction with the chatbot using the Godspeed Questionnaire Series (GQS). The questionnaire results are utilized to measure the effect of the emotions model on the chatbot's believability factor. The evaluation results of the experiment show that implementing the emotion recognition model on the chatbot increases its believability factors. On average, the believability measures in interaction type B (with an emotion model) are enhanced 1.71 times compared to interaction type A (a basic model). Furthermore, the believability measures in interaction type C (with an emotion model and an avatar) are enhanced 2 times more than in interaction type A (a basic model). The believability factor is also heightened by integrating a chatbot avatar into the interaction system. Using avatars in chatbots increases the believability variables of the system by 1.17 times if compared with not using avatars.

The Role of Industry 4.0 Technology in Enhancing SMEs Stability and Growth **Yuthsi Aprilinda, Harco Leslie Hendric Spits Warnars, Meyliana Meyliana and Harjanto Prabowo**

The purpose of this study is to find out and analyze what has been done by previous studies in knowing the problems faced by SMEs today and how the influence of Industry 4.0 technology in dealing with problems in Small and Medium Enterprises (SMEs), so that they become developed and can maintain their business continuity. Most studies show that SMEs have considerable barriers when trying to use the potential of Industry 4.0 to improve the competitiveness and long-term sustainability of their business. This systematic literature review uses the Kitchenham technique to identify SME problems and the role of Industry 4.0 technologies in SMEs in various industrialized and developing countries. Through several databases including: IEEE, Science Direct, Web of Science, Taylor & Francis, Emerald and Springer between 2019 - 2023 were used to find relevant research articles in this study. The research findings offer valuable perspectives on the strategies, obstacles and prospects that SMEs in different countries face in adjusting to Industry 4.0. The contribution of academics in this research is to provide solutions by designing more robust approaches to promote the business sustainability of SMEs and their role in driving economic progress in their countries.

Visualization of Members' Activities in a Series of Group Works by Time-series Feature Comparison Method **Rikito Ohnishi, Ryotaro Okada, Yuki Murakami, Takafumi Nakanishi, Teru Ozawa, Yutaka Ogasawara and Kazuhiro Ohashi**

This paper presents a method for visualizing members' activities in a series of multiple group work sessions with the same members each time, using a time-series feature comparison method. It is becoming increasingly important for organizations to produce deliverables through group work. However, inefficient activities owing to a lack of review of the group work itself, which is performed by the same members each time, have become a problem. If it is possible to capture and visualize who is talking about what and when in group work, it will be possible to reflect on the work and improve its efficiency

of group work. In this study, we propose a method for cross-sectional visualization of the progress of group work for a series of group works conducted by the same members each time.

LTLE 2023-Winter

An Attempt at Peer Learning with Explanation in Introductory Programming Education

Satoshi Cho and Hisashi Sato

This paper introduces "Peer Learning with Explanation" (PLE), an innovative approach in introductory programming education, inspired by pair programming. PLE is a collaborative learning strategy where students work in pairs to solve programming tasks, with one student explaining their reasoning and methods to their partner. This approach aims to deepen understanding and enhance learning outcomes through the sharing of ideas and feedback. A key feature of PLE is its structured method for addressing exercise problems, clearly outlining the steps involved, what actions to take, what to explain, and what to discuss. This structured approach ensures that students are focused on their learning goals, thereby improving their comprehension and problem-solving abilities. The study, conducted with first-year students at the Kanagawa Institute of Technology, Department of Information Media, investigated the effectiveness of PLE compared to traditional solo programming methods. Results indicated that students engaged in PLE demonstrated a better grasp of programming concepts and skills. PLE encourages students to articulate their thought processes and problem-solving strategies, leading to a more profound understanding and retention of programming knowledge. It is also expected to foster improved communication and collaboration skills, which are essential in the programming field. The findings suggest that PLE can be a valuable tool in programming education, significantly contributing to students' learning experiences and outcomes.

Assessment of ChatGPT's Validity in Scoring Essays by Foreign Language Learners of Japanese and English

Ayaka Obata, Takumi Tagawa and Yuichi Ono

In light of the significant advancements in Natural Language Processing (NLP), research on Automated Essay Scoring (AES) has gained widespread attention worldwide. This heightened interest can be attributed, in part, to the release of OpenAI's ChatGPT in late 2022. The focus of this research lies in exploring the potential application of ChatGPT for grading essays produced by learners in both Japanese and English. This paper presents a comparative analysis of two models for predicting proficiency scores. The first model incorporates linguistic feature indices, while the second model integrates ChatGPT scores alongside the linguistic feature indices. The results revealed a moderate correlation between GPT scores and proficiency scores. Moreover, no significant differences were observed when comparing models that combined both GPT scores and linguistic features with those that did not. These findings underscore the effectiveness of models based on linguistic features, which is consistent with previous studies in this field.

Changes in students' motivation to study and their predictions -Verification of similarity to radioactive decay of atoms for changes in motivation and these predictive equations-

Katsuichi Higuchi, Hiroshi Konashi and Kenji Kume

The students' motivation to study in class is presumed to be closely related to their concentration. Previously, we have pointed out the similarity between the temporal variation of the motivation to study and the radioactive decay process. (A) In this paper, we attempted to verify the radioactive-decay approximation for the students' motivation. We also examined the validity for the predictive equation to describe the motivation. (B) For these verifications, we used data from 2022 and 2023 academic year. As a result, although there remains some degree of uncertainty in the approximation using continuous functions (including decay functions), we confirmed that the assumption of the radioactive-decay approximation is valid for the entire flow of ten sessions. It is also noted that the accuracy of the assumption of the radioactive-decay approximation is found to be higher than that of the linear approximation for only the six classes in the present study. Furthermore, we conclude that the formula for predicting radiative decay derived by the method we have found are valid to some extent. This implies that motivation level to study follows a natural law.

Dependence of perception of vocabulary difficulty on contexture

Parisa Supitayakul, Rika Kuramitsu, Zeynep Yucel, Akito Monden and Koichi Takeuchi

Abstract—In the collation and scheduling of learning material, it is common to collect feedback from learners about how confident they feel in remembering the items that they just studied. Based on such subjective opinion, the content of future learning tasks is decided such that the items which learners feel confident in remembering are reviewed after a relatively long interval and the ones which they do not feel confident about are reviewed sooner. However, it is not clear how reliable is such an opinion or whether it can be biased by posing the inquiry in different modes. In this study, we focus on a learning scenario where non-native English speakers read passages, take a comprehension test and then evaluate a set of related vocabulary regarding their difficulty. We pose and test three hypotheses: (i) Learners' evaluations will be in line with the number of occurrences of the vocabulary (the more frequent the easier), should all options have the same lexical class, (ii) A word with an odd lexical class is likely to stick out, should all options be comparable in the number of occurrences and (iii) The option with the odd lexical class is likely to be ignored, should the remaining options have a clear ranking of the number of occurrences. In order to test our hypotheses, we made experiments with 10 participants. By assuming the independence of all observations, independence of all participants, and independence of all questionnaire items, we depict that the observed behavior has an underlying pattern that supports our claims in a statistically significant way.

Design of an Employment Ethics Educational Mobile Game Combined with Realistic Situations

Yu-Chi Chen and Huei Tse Hou

Employment ethics are the standards that need to be observed in the workplace and are one of the teaching contents of universities to help students bridge to employment, but according to past studies, many students think that they are not familiar with these concepts before they enter the workplace. Therefore, this study designed an employment ethics mobile educational game with the integration of the real-life situation and popular swipe selection operation for students to experience the application of employment ethics. 17 students from universities and colleges were enrolled as participants in this study. The results of the study indicated that the design of the game could enhance engagement and motivation and did not cause too much anxiety. The operation and situation design of the game were also accepted and empathized by the students, and this design can be used for more in-depth research in the future.

Development of A Cybersecurity Training System Based on SaaS

Sanggyu Shin

This study proposes the development of a cloud-based cyber attack and defense exercise system that enables practical cybersecurity exercises and experiences by using the Cyber Range environment built in a virtual space on the cloud via a local web browser. The platform and exercise programs will be developed on an open-source software platform built on the cloud as an ecosystem. The exercise contents will be developed using Docker, which has excellent portability, and attack and defense exercise scenarios will be developed as containers. By building the system in the cloud, this study proposes a platform that can be configured with various exercise scenarios independent of local PC performance. This study will (1) develop a SaaS platform that can

be connected to the cloud-based training environment via a web browser. (2) Enable users to interactively respond to attacks and defenses in a virtual space on the cloud in an Internet environment. (3) The curriculum will be structured based on the concept of microservices so that it can be configured flexibly. Finally, (4) develop and validate a system that provides virtual IoT devices in a virtual space and enables related exercises.

Developing Interactive Learning Media Design for Futuristic Learning Activities

Matthew Anderson Chandra, Nyoman Wira Dhimas Arya Dhanendra, Reynard Renato, Renaldy Fredyan and Hady Pranoto

In this digital literacy era, learning methods with interactive media are increasingly popular and are also used to improve the quality of education in various regions, especially in Indonesia. Many media can be used, such as presentations, learning videos with interesting visuals, and games with characters designed based on learning needs. In this research topic, we will figure out principles of what to use to create an LMS while maximizing the interaction with students to support them in this modern era of education. Our research will be conducted using an experimental method in the form of a questionnaire involving teachers and students. The data we have collected will be processed into a reference to build a digital interactive media based on the study of human-computer Computer Interaction

Effects of AR educational games on spatial ability of primary school students

Hainachuan Huang, Ping Yin, Yuhua Zhang and Su Cai

Augmented Reality (AR) technology has shown great prospects in education, and AR educational games are an important field within AR technology. Spatial ability is crucial for elementary school students, particularly in STEM subjects. However, it remains unclear whether primary school students can enhance their spatial ability development when learning with AR educational games. In this study, an AR educational game was designed and developed for primary school students in grades 3-4 to learn content related to three-view perspectives. A total of 66 students participated in this experiment. The experimental group used AR educational game for teaching activities, and the control group used traditional education mode for teaching. Pre- and post-test were taken, the purpose of the current study is to learn about the effect of AR-based educational game and the students' attitudes to AR-based educational game. The experimental results show that the use of AR educational game in mathematics class can improve the spatial ability (mental rotation, spatial orientation) of primary school students, and primary school students are very willing to learn in this way.

Effects of Habit-Enhanced Assignment Design on Learning Behaviors and Psychological Factors of Japanese EFL Learners Under a Distant Online Learning Environment

Asuka Takahashi and Yuichi Ono

The COVID-19 pandemic has accelerated the integration of Information and Communication Technology (ICT) into education, with blended learning - a combination of in-person and online teaching - gaining significant attention. This study investigates two primary aspects: (1) how classroom interventions enhance habitual learning, focusing on the promotion and control of students' habitual learning behavior, and (2) the role of psychological factors, including cognitive aspects of Self-Regulated Learning and International Posture as a motivational factor, in facilitating habitual learning. This investigation takes place within a blended learning environment where asynchronous online learning complements traditional instruction. During a thirteen-week period, students were tasked with engaging in coursework in a habitual manner, completing one lesson every two or three days. At the beginning of each class every week, "Reflection" and "Foresight" interventions were conducted. Subsequently, students' learning behaviors were meticulously analyzed and classified into distinct types. The findings revealed that some students displayed habitual learning behavior, some showed semi-habitual learning behavior, while others struggled to complete the tasks. Through a quantitative and qualitative analysis of psychological factors, including questionnaire responses and open-ended interview data, it was evident that students from various behavior types exhibited a diverse range of psychological influences. Despite these differences, almost all students concurred that classroom interventions effectively served as reminders to maintain habitual learning awareness. In conclusion, while these interventions proved effective as reminders and sources of encouragement, further attention to task design is imperative for enhancing habitual learning behavior across a spectrum of psychological factors.

Experiment design and verification for assessing the acquisition of strategic planning ability

Natchanon Manatphaiboon, Shogo Hamachi, Zeynep Yucel, Pattara Leelaprute and Akito Monden

Exposing healthy subjects to Tower of London (ToL) task several times enables the observation of the evolution of skill level over time as well as its reflections on eye gaze patterns. In order to identify such effects, one needs a carefully designed set of ToL tasks (i.e. problem sets). In particular, problem complexity should be gradually increasing within each problem set and comparable across different problem sets as assessed in terms of objective measures, for enabling a smooth progress and accumulation of experience. In that respect, this study uses goal hierarchy, search depth, and the number of optimal solutions for assessing complexity and establishing the gradual relation. Namely, two problem sets Base-1 and Base-2 are designed. For satisfying the comparability condition, six color-permutations are derived from Base-1 (experiments-1 to -6) and are delivered to the subjects on two consecutive days. Finally, another problem set derived from Base-2 with exact same structural properties is delivered on the last day (experiment-7). We carried out experiments with 15 participants and examined the evolution of their planning, trial and execution times as well as rule violations and number of moves beyond optimal. The results suggest that there are indeed improvements in speed and accuracy in experiment-7 compared to experiment-1, even though both are novel to the participants. In addition, these improvements are shown to be similar and consistent for different (initial) problem sets. Additionally, the proposed problem sets' difficulty and planning time for all experiments have a strong positive correlation at an average of 0.868189 ($\sigma = 0.066365$). In that respect, we believe that also the eye gaze patterns have to potential to withhold important information during are worth further investigation in future studies.

Fully automated system for the marking and quantitative assessment of reading skills of students on the basis of abridgement.

Koichi Akashi, Hibiki Ito, Kunihiko Takamatsu, Shotaro Imai, Sayaka Matsumoto, Katsuhiko Murakami and Tetsuhiro Gozu

Systematic methodology to develop and cultivate the reading capabilities of pupils and students in school education with sufficient efficacy and efficiency is widely considered quintessential. Nevertheless, it has been suggested that doing so would require educators to pay out large amount of time and labour in monitoring them and marking their submissions. Furthermore, it has been a prominent challenge to establish the quantitative approach to assess their reading skills only assisted by the conventional methods such as summarising whose model answers are prone to a huge variability. To confront that issue, this research focused on a newly suggested method called "abridgement", and attempted to lay the foundation of an automated system that enables educators to complete the whole procedures other than creating a model answer, as well as proffering a sprinkling of statistical information that could be utilised for future researches, in a fully computerised fashion.

How Smartphone Natives can learn Animation Principle: Introductory Animation Class for Students with No Art Background

Yoriko Murakami and Hisashi Sato

This paper reports and discusses a case study of animation education for students in an Information Media department using smartphones in animation class for the past four years. The use of animation has become more and more common among various kinds of visual communication on all kinds of digital devices over the last few decades. However, animation has been most commonly taught in the fine arts departments of high schools and colleges, based on the premise that it is for students with some art background. At Kanagawa Institute of Technology's Department of Information Media, it is considered that teaching our students basics of animation is essential because of several related course subjects, despite the fact that most of the students

who have entered our school have no art background (such as drawing and sculpting). As art making is certainly not their strength (much like most of the general public), we have adopted stop-motion on smartphone as a teaching tool for the basic concept of animation, considering its relatively low learning cost to all students. One of the goals of this introductory animation course is to improve the efficiency of animation education to our students by applying and executing exercises that require no drawing skill. That even in the first year of the 2020 academic year, when the COVID-19 pandemic forced all classes to be conducted remotely, some of the goals were achieved and the use of smartphones improved the outreach of animation and animation education. This approach has continued even after classes have returned to a face-to-face format. The purpose of this paper is to confirm the potential of ubiquitous and mobile technology to enhance learning.

Identifying Student Learning Styles using Support Vector Machine in The Felder-Silverman Learning Style Model **Jeffri Prayitno Bangkit Saputra, Harjanto Prabowo, Ford Lumban Gaol and Gatot Fatwanto Hertono**

This research explores the intricate relationship between questionnaire structures and the accuracy of learning style predictions among students. Focusing on the balance between core and secondary questions, the study meticulously analyzes various ratios, emphasizing their impact on the learning style classification system. Through rigorous testing and integration of the Felder-Silverman Learning Style Model (FSLSM) with the Support Vector Machine (SVM) algorithm, the research uncovers crucial insights. Results showcase that a careful balance and distribution of questions significantly enhance the accuracy of predicting student learning styles, with accuracy rates reaching up to 89%. This study not only emphasizes the importance of personalized education but also demonstrates the practical applicability of advanced machine learning techniques. The findings provide a roadmap for the future of education, emphasizing a nuanced, question-specific approach for a more accurate, tailored, and responsive learning experience.

Nge-BatikVR: Innovative Batik Learning and Marketing through Virtual Reality Serious Games with Immersive Hands-On Experience **Dimas Ramdhan, Galih Dea Pratama, Michael Francis Wijaya, Muhammad Edo Syahputra and Wihendro Wihendro**

Batik is a cultural heritage of Indonesia, recognized by WHO as an Intangible Cultural Heritage. Batik is dyed by skilled craftsmen who make patterns with dots and lines on the fabric from melted wax. The process is complicated, so few people can experience all the steps in crafting Batik. From these problems, immersive learning media are needed so everyone can learn and gain experience in Batik crafting from start to finish. In this study, we will present Nge-BatikVR, a serious game application that introduces Batik through Virtual Reality and offers an immersive experience of learning Batik from various regions with interactive hands-on feature aimed at people to better understand and learn Batik. Nge-BatikVR offers four main features called Sinau (Learn), Kuis (Quiz), Nge-Batik (Simulation) and Toko (Shopping), with the main purpose to present interactive and engaging media useful for introducing and learning Batik with a fully immersive experience.

One Solution to the Cost-Sharing Issue by the Sweden Game Experiment and Educational Effects **Masashi Kawaguchi, Takashi Kusaka, Naohiro Ishii and Masayoshi Umeno**

The issue of cost-sharing has been familiar since ancient times. Even today, it is used in various situations, such as cost-sharing for infrastructure development and contributions to neighborhood associations. Many methods have been proposed for the cost-sharing problem. One typical solution is the Shapley value. However, there are cases where the best solution cannot be obtained. In addition, if the solution is disadvantageous to the parties, there is a risk of dissatisfaction and failure to reach an agreement. On the other hand, gaming solutions are attracting attention. A mutually satisfactory solution can be obtained by gaming by solving the cost-sharing problem between the parties. Furthermore, better solutions than other methods have been derived. In this paper, we report on the optimal solution derived from the gaming results, its educational effects, and the results of a webinar on gaming in Finland and Japan.

Question Generation for English Reading Comprehension Exercises using Transformers **Alexander Maas, Kazunori D Yamada, Toru Nagahama, Taku Kawada and Tatsuya Horita**

In secondary language education, one tool used by teachers to test students' language ability is reading comprehension. The construction of these problems can take a lot of time as the text needs to contain only the vocabulary and grammar the students know, and the questions also need to test the reasoning skills the teachers want to evaluate. To allow educators to use reading comprehension exercises more frequently, this research aims to alleviate the time constraint of creating these questions by training a controllable transformer-based natural language processing model to create questions of varying types and about a passage of text as specified by the user. After fine-tuning, the questions generated using the new controls either suffered from overfitting or from a lack of diversity between them, however the output of an existing question generation control was altered and became capable of generating questions suitable for use in reading comprehension. To improve the output of the new controls, more data could be used in the training, or an alternative training scheme would need to be utilized.

Survey of Middle and Upper Elementary School Students' Knowledge of Cloud Computing **Mitsuhiro Watanabe, Kazuki Mitsui, Kazunori Sato, Taku Kawada, Toru Nagahama and Tatsuya Horita**

In this study, a questionnaire was administered to middle and upper elementary school students to evaluate their cloud computing knowledge to obtain suggestions for in-structional strategies to understand and promote the utilization of cloud computing. Pictures and sentences explaining cloud computing were evaluated based on the evaluation criteria developed from the points of view proposed by Mitsui et al. As a result, we found that some viewpoints were easy to understand, and some were difficult to understand. Overall, we found that the general level of cloud computing knowledge acquisition was low. In addition, the upper grades were not necessarily more proficient, and there were differences between classes. In addition, we analyzed the relationship between the students' cloud computing knowledge and the teacher's experience. As a result, students whose homeroom teachers had limited experience and students whose homeroom teachers had extensive experience teaching students to utilize one-to-one devices were more likely to have acquired knowledge of cloud computing.

The Effect of Classroom Interventions of Reflection and Foreseeing on Mitigating Passive Procrastination in a Hybrid Learning Environment **Rika Yaguchi and Yuichi Ono**

Online learning is less visible to teachers than face-to-face learning, and is more likely to cause learners to procrastinate. On the other hand, the online environment has the advantage that learners can study where and when they want. Hybrid learning is a form of learning that takes advantage of both online and face-to-face learning, and is expected to become a standard form of teaching in the future. In this study, we analyze the effect of self-regulated learning (SRL) awareness improvement by teacher's support in a face-to-face environment while respecting the learner's freedom of engagement when conducting online learning assignments. The results showed that students' procrastination behavior couldn't be controlled by difficulty optimized assignments. However, some students were able to achieve learning without procrastination through task reflection efforts, even though the tendency to procrastinate was predictable based on psychological factors.

DSIR 2023-Winter

Diploma Supplements in Japanese Higher Education -Findings from a Nationwide Survey of Undergraduate Education - Satoshi Ozeki, Kiyoshi Fujiki, Toru Hayashi, Shorb Patrick and Masamitsu Mochizuki

Over the last decade, diploma supplements (DS) have been introduced into Japanese higher education as part of a broader reform of its quality assurance system. Scholars argue that Japanese DS, which typically include university-issued summaries of students' academic coursework, qualifications, and competencies, focus on individual student learning but not on articulation and student mobility, as observed in the European Higher Education Area. This study aims to investigate the implementation of DS in Japanese higher education. An online questionnaire was developed to examine the implementation rate and information type included in DS. The survey targeted all 787 national, public, and private universities offering bachelor's degrees in Japan. The study obtained a total of 240 responses, resulting in a response rate of 30.5%. Subsequent analysis revealed that 29.6% of the universities implemented DS, with the rates being higher in national and private universities than in prefectural and municipal universities. The main reason for DS implementation was to "visualize student learning outcomes" (93.0%) while the most popular information type included in DS was "indicators of attainment based on diploma policy learning outcomes" (73.2%). This study supports the argument that the use of DS in Japanese higher education is related to student learning outcomes.

Gender Equality and Digital Education as Catalysts for Economic Growth: A Comparative Study of Japan and the Nordic Countries

Noriko Ito, Yoshiro Seki, Masao Mori and Nobuhiko Seki

This study conducts a comparative analysis of the economic growth models of Japan and the Nordic five countries, Denmark, Finland, Iceland, Norway, and Sweden, from 1990 to 2022, with a particular emphasis on three aspects: education systems, political participation, and digitalization. Progress and challenges in achieving gender equality, promoting digital education, encouraging entrepreneurship, and fostering innovation are examined to discern how these aspects have affected economic growth in both regions. Through the analysis, the differences in economic growth models of Japan and the Nordic countries, especially in the realms of educational reforms brought about by gender equality and economic growth, are discussed.

Is Dual Enrollment a Predictor of Academic Success?

Jennifer Lude and Faxian Yang

As almost all institutions of higher education continue to face enrollment issues, they must consider evidence-based strategies to sustain and increase recruitment, matriculation, retention, and graduation. Policy makers at different government levels and educational administrators expect that dual enrollment provides institutions of higher education an opportunity to invest early in student success by encouraging students to pursue postsecondary education while decreasing cost and time to graduation. However, findings across multiple studies suggest that dual enrollment does not necessarily always increase a student's chance for positive post-secondary school outcomes. This study analyzed data from a R1 southern flagship institution to determine if dual enrollment was a predictor for college graduation.

Launch Out on a Practical Platform for Institutional Research Toward Sharing of Its Technology and Knowledge

Shotaro Imai, Yoshikazu Asada, Akira Ito, Toshiki Katanosaka, Aoi Kishida, Naruhiko Shiratori, Kunihiko Takamatsu, Sayaka Matsumoto and Masao Mori

Terenzini classified the intelligence required for an Institutional Research (IR) conductor into three tiers. "Technical and analytical intelligence" is a general technique of statistical analysis but the other two are difficult to learn since they require experience in IR and a deep understanding of the institute to which each belongs. In addition, there is no definitive definition of IR in Japan. These facts confuse IR beginners. To overcome the problem, we launched a platform for sharing technology and knowledge of IR. The IR beginner can access to learn the methodology of IR and an IR expert can share ingenious ideas and techniques through the platform. We named the platform PAIR (Platform of the Art of Institutional Research) and provided it by GitHub. In this paper, we describe the background, the concept, and the future visions of the PAIR.

Predicting Student Dropout Risk Using LMS Logs

Takaaki Ohkawauchi and Eriko Tanaka

Traditionally, the prediction of student dropout in university classes has often been based on students' pre-enrollment information or confirmed grade data for each semester after enrollment. However, effective support requires early intervention when signs of dropping out appear. In this study, we propose a model to continuously measure dropout signs using log data accumulated in a learning management system during classes. By applying machine learning to the log data in the learning management system, we could continuously update information on at-risk students with high accuracy from the beginning to the end of the class.

Proposing a new field: Institutional Research (IR) Philosophy based on Eduinformatics — Bridging the Gap Between Practice and Theory in IR

Kunihiko Takamatsu, Taion Kunisaki, Kenya Bannaka, Katsuhiko Murakami, Takafumi Kirimura, Ryosuke Kozaki, Sayaka Matsumoto, Aoi Kishida, Hibiki Ito, Yasuhiro Kozaki, Shotaro Imai, Yasuo Nakata and Masao Mori

Amid the transition from Society 4.0 to Society 5.0, the role of Institutional Research (IR) in higher education is evolving. We have proposed an interdisciplinary field named "Edu-informatics," which integrates education and informatics, offering fresh insights into data-driven educational strategies. In this study, we further introduce "IR Philosophy" as a novel approach to bridge the gap between the theoretical and practical aspects of IR. By examining the current state of IR in Japanese universities, we emphasize the significance of technical skills and the importance of understanding the broader educational context, termed "contextual knowledge." Our findings suggest that while technical proficiency is crucial, a profound understanding of the broader educational context, referred to as "issue knowledge," is equally vital. Furthermore, as we move into the era of Society 5.0, our research underscores the need for a more integrated approach to IR, emphasizing its pivotal role in shaping the future of education.

Student Retention Factors in a Teacher-Training Course

Eriko Tanaka, Takaaki Ohkawauchi and Atsushi Fujihira

Every year, many newly enrolled students register for teaching training courses at our university, and many graduates obtain teaching licenses. The university's Teacher Education Center holds annual information sessions for each grade and provides consultation services to students to support those aspiring to become teachers. However, many students drop out of the course as their academic year progresses. In this study, we analyzed the results of academic performance and periodic awareness surveys and identified specific factors for the early detection of at-risk students who have learning problems or lost motivation to become teachers.

Survey Analysis of Students' Attitudes in PBL Activities

Takaaki Hosoda, Koji Okazaki and Tokuro Matsuo

This paper shows the results of a questionnaire survey conducted in 2023 for students enrolled in PBL courses at the Advanced Institute of Industrial Technology. The purpose of this survey was to develop a unified evaluation index for PBL activities as part of the Institutional Research (IR) activities of the Centre for Research and Education of Highly Skilled Professionals. As a result, it was found that they tend to avoid extremely difficult themes due to their anxiety of completing the course while the students value the originality and novelty of the PBL themes. Furthermore, they expect their PBL themes to be practical by discovering it by their own, rather than being given by someone else. Also, they prefer team-based work to individual work. The PBL faculty members are expected to build good relationships with the students and provide a guidance based on their expertise. While the students want to keep a relationship with the graduate school for the future, it is unclear what type of relationship they need. It would be a future work to be investigated. Finally, the results shows that their expectations for competencies to be acquired through PBL activities were high enough across the board and indicates the willingness of the students to acquire competencies through PBL activities.

SCAI 2023-Winter

A Complexity Feature Extraction Method by Chord Progression and Transition Density for Music Media Content

Ayako Sugiyama, Ryotaro Okada, Ayako Minematsu and Takafumi Nakanishi

This study presents a complex feature extraction method based on chord progression and transition density for music media content. While various metrics have been proposed to represent the features of music media content, viewing music media content as time series data and extracting complexity based on its temporal structure can provide a feature set that includes the temporal variations of music media content. In this study, we focus on chord features that are effective as features of music content as perceived by users. We define complexity based on three aspects: the frequency of chord changes, the individual complexity of chords, and whether chords are part of a diatonic chord. This method uses chord progressions, the time signature of each chord, the tempo (BPM) of the music, and the key of the music as inputs, thus enabling the extraction of the complexity of a musical composition. We assume that complexity is closely related to the preferences of human songs. For example, some users prefer music with chords with a lot of tension, such as jazz, whereas others prefer music with simple power chords, such as hard rocks. These were compared in terms of complexity with respect to the notes that comprise the chord at a given time. We define these as global and local complexities, because music media content is characterized by chords that change or do not change over time. This allowed us to represent an aspect of a user's musical preferences. By implementing this method, it is possible to compare the complexity of music from the perspective of the chord features. This allows for the construction of a system that selects music that matches a user's preference based on complexity. This research is verified through comparative experiments between different songs and different arrangements of the same song.

Adaptive Retraining Head Selection Method in Vision Transformer

Kaoru Ito and Naoki Mori

In recent years, research has been conducted on human visual illusions using deep learning. The application of machine learning to ambiguous figures, a type of optical illusion, is challenging due to the various interpretations influenced by human sensibilities. In this study, we introduce a novel method to enhance functional specialization and versatility based on head selection in the Attention mechanism of the Vision Transformer (ViT). The cornerstone of this approach is the Attention Cosine Head Selection (ACHS). This technique pre-determines and trains the most effective head for a specific task by selecting from the heads of multi-head attention. Our method provides a fresh perspective to optimize the Transformer learning algorithm and holds promise for a wide range of applications. To verify the efficacy of our proposed method, computer experiments were conducted using ambiguous figures created by humans. The findings indicate that our method can attain superior performance in terms of both function-specificity and generality for ambiguous figures, all while being more cost-effective than the standard ViT. We anticipate that our approach will enhance generalization across tasks while accommodating the diversity of human perceptual cognition.

A Dynamic Balancing Framework for Facial Expression Recognition in Games

Adewiryu Niko Sidharta, Maverick Sean Therry, Jurike V. Moniaga and Andry Chowanda

This research proposes an innovative approach to dynamically balance games using Facial Expression Recognition, enhancing the player's experience. By integrating a facial expression detection system with Unity through pipelines and Python, real-time modifications based on facial expressions improve game responsiveness. Future research should focus on expanding the framework to support multiple game engines, considering the diverse gaming landscape as it will drive advancements in game development practices, leading to immersive and captivating gaming experiences across various engines.

A Live Concert Performance Recommender System Utilizing User Ideal and Antithesis Ideal Setlist Preferences

Edward Abel and Andrew Goddard

Recommender systems look to curate personalized content and have become a ubiquitous part of our digital lives, including within the music domain. At the same time, numerous high quality live concert performances from illustrious music artists are becoming readily available, providing fans with an unwieldy abundance of choice. Whereas much work has explored music recommendation for tasks such as choosing songs for personalized playlist curation, the task of historic live music performance recommendation is less explored. Thus, in this paper we propose CPR, a Concert Performance Recommender system for historic live concert performance recordings. CPR provides an artist's fan the ability to define preferences via the notion of ideal setlist songs, denoting songs that would be part of an ideal concert, and negative ideal setlist songs, denoting songs that would represent part of the antithesis of an ideal setlist for the user. The user can then define additional semantic information regarding why the ideal and negative ideal setlist songs have been chosen. This information is then utilized to recommend live concerts by the artist that are most aligned to the user's preferences. A user is provided with explanations regarding the whys behind potential recommendations, in terms of the alignment to his/her preferences. Such explainability aids a user to then interactively explore and fine tune their preferences and recommendation results.

A Neuroevolution Approach to Keypoint-based Sign Language Fingerspelling Classification

Jordan J. Bird, Isibor Kennedy Ihianle, Pedro Machado, David J. Brown and Ahmad Lotfi

Non-verbal communication frameworks such as Sign Language and Makaton serve as a vital means of communication for millions of people with hearing impairments. The development of accurate and efficient recognition systems for non-verbal communication is of great importance towards fostering inclusion through accessible systems. In this paper, we propose a novel approach to improving fingerspelling recognition through the application of neuroevolution as a means to hyperheuristically improve deep neural networks. We propose the use of these algorithms to optimise the classification of low-dimensional datasets given the mixed levels of computational resources in the community setting. A dataset of 1678 images comprised of seven subjects performing ASL fingerspelling is processed into normalised keypoints, and three neuroevolution simulations are executed to search the problem space for the most effective topology. The results show that the simulation finds a promising set of hyperparameters, achieving a best mean 10-fold cross-validation accuracy of 97.44% by using a total of 1478 hidden units within four layers. Our neuroevolution approach demonstrates remarkable potential for the enhancement of fingerspelling recognition in non-verbal communication systems, paving the way for more inclusive technologies in the future.

Analysis of LLM-Based Narrative Generation using the Agent-based Simulation

Naoto Aoki, Naoki Mori and Makoto Okada

Automatic narrative generation is garnering significant interest in artificial intelligence. Research has explored methods such as repurposing existing literature and the agent-based simulation. The rise of large language models (LLMs) has notably advanced this field. In this study, we introduce an LLM-based narrative generation technique via the agent-based simulation (ABS). Within the ABS framework, we employ LLM to create agents with distinct personas including names, ages, and personalities. We demonstrate a method to craft narratives by interacting these agents. Focusing on a classic "dragon-slaying" scenario typical in RPGs, we generated agents representing characters such as a brave hero, a warrior, a wizard, and a dragon, and weaved a narrative around their roles. By applying the rich expressive power of LLMs to story generation with the ABS, a variety of creative works can be generated. From the experimental results, it is confirmed that the story may not reach a peaceful ending or describe the battle scene in detail due to the influence of reinforcement learning based on human feedback of LLMs. However, the expected results were obtained in terms of the conversation before and after the battle and the agent's autonomous consideration of motives. As a future prospect, we expect that there will be an increase in the number of requests to specifically generate battle scenes when generating stories. For this reason, introduction of another LLM model specifically trained to describe combat scenes, or an approach that presents choices such as "fight," "escape," "use item," "use magic," etc. similar to a typical RPG game screen, and progresses the story according to the choices, may also be considered.

A Novel AutoAugment utilizing Surrogate Model-Based Thermodynamical Genetic Algorithm

Takumi Washino and Naoki Mori

Automated data augmentation is an AutoML method and an effective technique for stabilizing learning by improving the generalization of machine-learning models. Recently, TDGAAutoAugment (TDGAAA), which combines evolutionary computation and AutoML, has been proposed. TDGAAA has been shown to be an effective method to automatically search for various useful augmentation sub-policies from a dataset. However, when using a large machine learning model, the problem of high computational cost remains because it is also used to evaluate individuals in the TDGAA. To solve this problem, this study proposes a novel TDGAAA that reduces the computational time by using a surrogate model to estimate the fitness value of the TDGAA without actual calculations. To confirm the effectiveness of the proposed method, computational experiments were conducted using two benchmark datasets, CIFAR-10 and SVHN, and one real problem, comic dataset, as examples. The experimental results show that the proposed method can reduce the computational cost while maintaining search accuracy.

A User-Devised Search Query and Clustering Technique for Searching through Research Papers

Satoshi Fukuda

When searching through previous literature to confirm the novelty of a research project, it is important to collect a large number of papers that are potentially relevant to the user's needs from the vast number of available papers. In general, when searching for relevant papers, a user inputs a search query that reflects the information they need into an academic search engine. Assuming that papers that completely satisfy the search query are likely to be related to the information needed, papers that have some relation to these papers may also be relevant. In this work, we propose an approach to uncover paper groups related to a user's information needs using a search query and a topic analysis technique called Bertopic. We also determine whether this group information can be used for ranking methods that differ from existing search approaches. Through experiments using NTCIR-1 and -2, we discuss the effectiveness of our approach and how a system that implements our approach can be constructed.

Banking method: dealing with resource token bias in a P2P human resource sharing PF

Miki Saito, Kenta Abe and Hisashi Hayashi

In many small and medium-sized enterprises (SMEs), workloads fluctuate. Managing human resources under these fluctuating conditions is challenging for many companies. During busy periods, employees struggle to do all the work, but during idle periods, there may not be enough work to go around. This study has two objectives: first, to propose a new peer-to-peer (P2P) human resource sharing platform to balance employees' working hours, and second, to propose the banking method, a coping mechanism for stablecoins called share-P (sharing points). The first aim is to enable companies experiencing idle time to offer employees to other busy companies through automated negotiation techniques. The second aim is to reduce the share-P bias that hinders the smooth distribution of share-P and employees within the platform. The effectiveness of the new platform and the new distribution method will be evaluated and validated through a multi-agent simulation using NetLogo.

Country by Country Comparison of Thumbnail Features Contributing to Views Using AIME for YouTube

Rintaro Fukui, Ryotaro Okada, Ayako Minematsu and Takafumi Nakanishi

This study proposes a thumbnail feature extraction method that contributes to the number of views on YouTube using AIME and examines the differences in thumbnail features by country using this method. In recent years, video media content, including YouTube, has become scattered all over the Internet and continues to increase enormously. For users to click and play this video media content, it is important to present appropriate thumbnails to creators. However, it is not known what kinds of thumbnail features contribute to the number of views. In this study, we propose a new method to extract thumbnail features that contribute to the number of views using AIME, which can extract features that contribute to the target variable by deriving the approximate inverse operator of a machine learning black box model. Furthermore, we collected YouTube videos from the U.S., Canada, Japan, France, Germany, the U.K., and Australia to show the differences in thumbnail features.

COCOMO II Analysis of Developing Multi-Account Partner Software for Crypto Exchange

Oscar Darmawan, Ford Lumban Gaol, Haryono Soeparno and Yulyani Arifin

The technique of calculating the work required for software development is known as software development estimation. The objective cost estimating technique for organizing and carrying out Multi Account Partner (MAP) software projects, COCOMO II, was employed in this study. The MAP software is a software architecture designed to support brokerage cryptocurrency exchanges using the order book and liquidity of established crypto exchanges. This research uses data sets from MAP project development at Indonesia Crypto Exchange Platform. It aims to create a software cost estimation model for MAP software using COCOMO II so that the resulting estimation model can be used as input or reference for estimates of subsequent MAP software development. The result estimated that MAP software finished in about four to five months, with a price range for software development of \$7,441 to \$8,780. Further research is needed with datasets from other crypto exchanges tested to increase cost estimation accuracy using COCOMO II.

Deep Learning-Based Brain Tumor Prediction: An Analysis of Performance Evaluation of Convolutional Neural Network

Jason Jason, Felix Venesius, Yonatan Sie, Renaldy Fredyan and Hady Pranoto

Over the years, Magnetic Resonance Imaging (MRI) has become increasingly prominent in the field of medical science for diagnosing brain tumors. This study presents an analysis of the performance evaluation of a convolutional neural network (CNN) for deep learning-based brain tumor prediction. The study aims to investigate the accuracy and effectiveness of using a CNN for the early detection of brain tumors in medical imaging. The proposed CNN architecture was trained and evaluated on a large dataset of brain MRI images, and the performance metrics were compared with traditional machine learning techniques. The results demonstrate that the CNN model outperforms the traditional machine learning models in terms of accuracy and specificity,

showing promise as an effective tool for brain tumor detection. The findings of this study have important implications for the development of accurate and efficient tools for brain tumor prediction, which could potentially lead to earlier diagnosis and improved treatment outcomes for patients.

Detection of Cardiovascular Disease Using Machine Learning Algorithms and Principal Component Analysis

Pradipta Syifa Narfian, Dylan Christiandi Halim, Albert Nathan Sembiring, Renaldy Fredyan and Hady Pranoto

cardiovascular disease is a family of diseases that are the leading cause of death worldwide. Late diagnosis and treatment contribute to the high number of deaths caused by this family of diseases. To increase accessibility for the general public to get diagnosed and treatment, a cardiovascular disease detection system powered by artificial intelligence (AI) can be developed and used. The healthcare sector has already utilized AI for many purposes and has proven to be as reliable as trained professionals. This study aims to develop an AI model that can detect whether a person has cardiovascular disease through analyzing their clinical data. Both the support vector machine and the decision tree classifier algorithm were trained with the Cleveland heart disease dataset and a version of the dataset that has undergone dimensionality reduction through the principal component analysis (PCA) algorithm, with a 75:25 ratio of training and testing data. The performance of the two algorithms was then evaluated using the confusion matrix which found that the PCA algorithm enhanced the performance of both algorithms and that the SVM model paired with PCA achieved the highest performance of 86.67% accuracy, 90% precision, and 79.41% recall.

Development of Cough Detection Pre-screening System Architecture Methodology using PSKVE-S with a Design Thinking Approach

Arifa Fauziya and Armein Z R Langi

The relationship between population and health services is a reciprocal relationship that influences one another so comprehensive health services to detect, diagnose, and treat 275 million people are needed to overcome the respiratory disease pandemic in Indonesia. In response to this, a cough detection application has been developed to help prevent the spread of COVID-19 by conducting a pre-screening system. Although the development of this cough detection system has developed quite rapidly, there has been no research discussing the design of a national integrated system architecture through a scalable system and optimal costs. In this study, the authors will focus on designing the architecture of a cough detection system as a nationally integrated pre-screening system through a scalable system with the lowest possible cost for the people of Indonesia. This research uses the Elastic Mobile Cloud framework that supports the concept of seamlessly providing users access to mobile cloud services by leveraging all available resources on all possible platforms. The architecture will also be designed using the Product-Service-Knowledge-Value-Environment System (PSKVE-S) to increase system sustainability.

Effectiveness of Reward Functions for Deep Reinforcement Learning in Chick-feeding System

Masato Kijima and Katsuhide Fujita

Animal welfare has become a universal standard since the establishment of global standards. Livestock is raised cage free, and it is crucial to develop an appropriate livestock management system. The key to constructing an appropriate system is the animal-computer interaction technology of understanding livestock and controlling feeders automatically. However, it is difficult to control feeders without targeting because there are many unknown things about behaviors of livestock. Therefore, optimizing the system using reinforcement learning is an effective approach to constructing a production management system. This research aims to develop and analyze a reward function for deep reinforcement learning in a chick-feeding system. We developed a simulator to model an environment with many chicks and feeder robots and assessed the proposed approaches using the simulator. The effectiveness of the proposed reward function was evaluated by comparing its accuracy in post-training tests. The experimental findings demonstrated that rewarding food consumption with a bonus and penalizing food dispersion resulted in the shortest number of steps. Furthermore, the dispersal reward effectively reduced the number of steps.

Effect of tool specificity on the performance DNN-based saliency prediction methods

Kengo Matsui, Zeynep Yucel and Timothée Languille

In this research, we focus on performance on saliency models concerning a specific type of images, i.e. hand tools. Having functionally distinct segments as functional or manipulative, such objects are shown by various studies in behavioral science to assert a particular inherent guidance on how attention is to be steered. However, it is not clear whether this intrinsic aspect is well-addressed by saliency models. To clarify this, we choose four remarkable saliency map models out of the recently proposed ones, i.e. EML-NET, SalGAN, DeepGaze-III, DeepGaze-III, which heavily revolve around transfer learning. To assess their performance in addressing the influence of semantic segments of tools, we handpicked several tool and non-tool object images from a large standardized data set and ran each saliency model on those images. Subsequently, we present these images to a group of human participants and record empirical gaze data. Finally, we assess the correspondence (or discrepancy) between the saliency maps and the empirical data using six different evaluation criteria (CC, NSS, LL, IG, KL, SIM). Our findings reveal that across all four models, the accuracy concerning tool images often lags behind that of non-tool images. Moreover, two out of the four models exhibited lower accuracy in making saliency predictions on tool images than non-tool images across all six evaluation criteria. This indicates that the specificity of tools is not well-addressed in these recent saliency models and it is necessary to propose a remedy to eliminate this shortcoming.

Empirical analysis of people flow in Saga Arashiyama area in Kyoto City Using the Location Registration Information

Hiroshi Tsuda and Yu Ichifuji

During the long spring holidays of 2023, movement restrictions will no longer be necessary for the first time in four years, and Kyoto City's tourist spots have regained their hustle and bustle with an increase in the number of visitors. Since the movement restrictions became unnecessary in 2023, the number of visitors has increased rapidly, and the overtourism problem is occurring again. Estimating and predicting the flow of people, which is important information when considering measures to prevent the overtourism problem from occurring again in the Saga Arashiyama area, the most popular tourist destination in Kyoto City. The purpose of this research was to contribute to Kyoto City's sustainable tourism policy, which aims for better tourism rather than a return to the past. In order to grasp which areas in Japan are visited by tourists to the Saga Arashiyama area, which has not been quantitatively grasped so far, we will clarify the flow of people from the demographics of the visitor's place of residence by time zone. In addition, we propose a time-series pattern model of human flow and show the results of an attempt to predict human flow up to one year in advance.

Enhancing Classification Performance through the Synergistic Use of XGBoost, TABPFN, and LGBM Models

Sarwo Sarwo, Yulius Denny Prabowo and Sarwo Sarwo

This research presents a new approach for classification optimization by comparing three algorithms, namely XGBoost (XGB), TABPFN, and Light Gradient Boosting Machine (LGBM). Through a series of experiments, this research shows the contribution of this combination of models. In the problem of Time Aware, the Bayesian Personalized Ranking with Factorization Machines (TABPFN) classification algorithm has had a good influence. TABPFN was corroborated by Ari Smith and Lee (2018), who were the first to emphasize the enhanced predictive capabilities of TABPFN compared to its predecessor [7]. Furthermore, based on research from Kim and Clark (2020), this research outlines the role of algorithms on comprehensive datasets for more optimal accuracy [8]. Patel and Wang (2022) then provide a deeper understanding of TABPFN's superior feature: its integration with temporal dynamics, although not without the associated computing [9]. By integrating three algorithm models, the researchers succeeded in increasing Balanced Log Loss in k-fold5 by 0.16, better than XGBoost and TABPFN for this research. Researchers believe that, cumulatively, this model has a positive impact

on the future of recommendation systems.

Enhancing the Generalization Performance of Drowsiness Estimation AI in Drivers using Time-Series Data from FAU with Limited Datasets **Tomoya Kubo, Tomoyuki Yokogawa, Kazutami Arimoto, Masaki Hokari and Isao Kayano**

We developed an AI for Facial Expression Estimation to predict driver drowsiness levels, mimicking human evaluation. Traditional Image-based AIs struggle with limited data generalization in drowsiness prediction. Our proposed AI framework overcomes this by extracting Facial Action Units (FAU) from facial images, using these dynamic expression elements as primary features, making evaluation more humanlike. In our study involving 19 participants, we validated the generalization performance using a Gated Recurrent Unit (GRU) with FAU values and compared it with a Convolutional Neural Network (CNN) model based on VGGFACE (ResNet50). The proposed method demonstrated enhanced performance, showcasing potential improvements in drowsiness estimation with limited data, expecting to significantly reduce the data required for accurate drowsiness level estimation. Furthermore, the results obtained through the process of improving generalization performance imply that there exists a trade-off relationship between performance specialized to specific individuals and generalized performance in learning models utilizing features such as FAUs.

Epistemic stance and Contextualization on MLM and NSP: How Japanese Chatbots recognize the long-distance cohesion between utterances **Kaoru Amino**

The error analysis on the non-task-oriented dialogue systems has been discussed from many perspectives, mainly in the field of Artificial Intelligence or Informatics. However, the current trend of error analysis seems to focus only on the local element different from the whole discourse, as shown in Masked language model or Next language prediction. From linguistic perspective, it seems that there are several reasons of error or unnatural flow in conversation with chatbot, mainly separated into 1) Narrowly sphered fragment of discourse and the concept of cohesion, and 2) the lack of social intelligence in Chatbot due to limited variety of corpus, 3) The uncertainty of algorithm based on this limited variety of data. This paper analyses the range of reference between sentences to seek cohesion beyond 2-3 sentences, based on case studies about on 3 different data: Yui spot (2016), Air friend (2021), and contrastive connective "but" in conversation between human beings (Schffrin, 1987). Then it adopts some psychological or linguistic theory.

Factor Extraction of Preference in Musical Performances Using AIME with Focus on Time-Series Derivative Features **Ayako Minematsu and Takafumi Nakanishi**

In this study, we propose a method for explicitly visualizing preferences for artistic work. There is a growing use of machine learning systems to identify or recommend artwork that aligns with individual preferences. However, these systems often lack transparency and fail to provide sufficient explanations for why particular artwork is recommended. To address this issue, we aim to apply an approximate inverse model explanation (AIME) to build and evaluate a system that can provide reasons for an individual's preferences regarding artworks. In this study, we focus on classical music performers and attempt to explain user preferences using features such as the music performance tempo, its first and second derivatives, music dynamics, and its first and second derivatives. In the case of music, preferences are influenced not only by the composition itself but also by who performs it. We demonstrate that it is possible to visualize the reasons behind a user's preferences for piano pieces' performers using this system, even with limited data, without the need for extensive datasets. This method can also be applied to analyze trends in human-labeled training data using machine learning.

Gaze Direction Classification Using Vision Transformer **Shogo Matsumo, Daiki Niikura and Kiyohiko Abe**

In this paper, as a study of basic technology for developing input interfaces using eye movement, we proposed a method for constructing a model for estimating eye direction using the Vision Transformer and evaluated its performance. Gaze input is an input method that does not require hand-finger manipulation and allows operation using only the line of sight. Although gaze measurement has traditionally been studied mainly by model-based methods, appearance-based methods have been attracting attention due to the rapid development of machine learning technology. Appearance-based methods can provide relatively robust and accurate estimation even for video images captured by ordinary video cameras, but they require a certain amount of computational resources to process with sufficient accuracy. Therefore, in this paper, we aim to develop a machine learning model that detects only eye movement, not the gazing point, to simplify inference for the practical use of calibration-free and low-cost eye input interfaces. The proposed method constructs a gaze direction estimation model by fine-tuning a large-scale pre-trained model of Vision Transformer using a constructed dataset. The dataset is constructed by extracting the face region from a frontal image of a person captured by a common webcam as a still image for each frame, and then cropping the region near the eyeballs. In addition, to evaluate the performance of the gaze direction estimation model constructed by the proposed method, we conducted an experiment to compare it with a classification model constructed by a conventional CNN-based method. The experimental results showed that the proposed ViT model has a higher classification performance than the conventional CNN model by approximately 6.0 points in terms of Accuracy and 5.9 points in terms of Macro Average F-value, confirming the overall improvement of the classification performance. This indicates that the gaze direction estimation model constructed using the proposed method is effective as a fundamental technology for gaze input interfaces.

Genetic Algorithm for Prompt Engineering with Novel Genetic Operators **Hiroto Tanaka, Naoki Mori and Makoto Okada**

In recent years, the advancement of Large Language Models (LLMs) has garnered significant attention in the field of Artificial Intelligence (AI), exhibiting exceptional performance across a wide variety of natural language processing (NLP) tasks. However, despite the high generality of LLMs, there exists a problem in controlling them to produce the desired output for each task. Fine-tuning is a conventional approach to improve performance for specific tasks, albeit at the expense of substantial time and computational resources. Prompt engineering serves as an effective alternative, steering models towards desired outputs for particular tasks, and has been validated to enhance the performance of LLMs. However, manual design of prompts is labor-intensive, which has increased interest in the automation of prompt engineering. In this study, we propose a method to automate prompt engineering optimization utilizing a genetic algorithm with novel genetic operators. Through experiments conducted to explore instructional prompts for solving Japanese multiple-choice questions, the efficacy of the proposed method was affirmed. The findings of this study underscore the feasibility of genetic algorithm-based automatic prompt engineering and genetic operators for prompts, and show their efficacy for Japanese, which has distinct linguistic characteristics compared to English and other languages.

Incorporating Rating: Abstractive summarization of review sentences considering rating **Yuta Yamada and Katsuhide Fujita**

Document summarization is very effective when a review on a review site is lengthy. Abstractive summarization is flexible because it can include words and expressions not included in the original document. On the other hand, because this method is based on deep learning, if the dataset to be trained has a lot of positive content, the generated summary will be biased toward positive content. In this study, we propose an abstractive summarization model that takes into account user evaluations unique to web reviews. Specifically, we propose a method for improving the accuracy of the model by incorporating the rating of reviews into the model. The abstractive summarization model is based on a specialized model for abstractive summarization called PEGASUS. As a result, the learning model using the proposed method improves the ROUGE value compared with existing methods. In addition, the proposed method obtained a better human evaluation than existing methods, depending on the domain and method.

Identification of Fake News in Low Resource Language: A Deep Learning Approach

Raquiba Sultana and Tetsuro Nishino

On social media, misinformation can spread quickly, posing serious problems. Understanding the content and sensitive nature of fake information, it is critical to prevent the damage caused by them. Motive of this research is to analyze the characteristics of human expression and based on the results, successfully detect fake news by implementing different machine learning models in a low resource language. To identify false information on the internet, a transformer-based hybrid ensemble models is employed on resource constraint, Bangla language data. By using various text-classification tasks, such as sentiment analysis, emotion analysis, hate speech detection, irony detection, and grammatical analysis, we initially tried to comprehend news from numerous perspectives. In first part of this study, several pre-trained BERT models were used to successfully calculate prediction scores. Scores were effectively generated from all the pre-trained text classification models. In second part, Voting Regressor was implemented along with Boosting Algorithm. Voting Regressor was implemented on the prediction scores achieved from all the text classification tasks, then Boosting Algorithm was implemented. Model performed efficiently; Accuracy, precision, recall, f1-score, and AUC scores, all exhibited excellent performance. Accuracy (0.98), precision (0.98), recall (0.99), f1-scores (0.99) are also promising. AUC score (0.92) also exhibits excellent result. Our research provides excellent results on this model on Bangla language. That means, proposed model is performing successfully overall.

Integrated Analysis by Utilizing AIME: Unveiling Correlations and Identifying Keywords for SDG Achievement through Country Action Plans and Scores

Takafumi Nakanishi

In this study, we propose an integrated analysis method using an approximate inverse model explanation (AIME) to extract keywords related to each goal and action from texts containing the achievement scores and action plans of each country in the sustainable development goals (SDGs) program. In recent years, environmental problems on a global scale, social disparities, and economic challenges have emerged, and the international community has adopted SDGs to solve these issues. However, it is challenging to determine the specific efforts, status, and characteristics of each country within the SDGs. In addition to the achievement scores and various numerical data for each SDG, textual data on the SDGs of each country describe the characteristics and challenges of each country's efforts in detail. We believe that by conducting an integrated analysis of these data, it is possible to derive keywords related to actions that are important for achieving each SDG. In addition, AIME, an existing method, can provide clear and simple explanations by constructing an approximate inverse operator of the forward operator, such as machine learning, which predicts achievement scores based on each country's efforts. Using AIME in the integrated analysis, this study attempted to extract keywords for the potential elements necessary to achieve each goal of the SDGs. This study proposes a new perspective and methodology for achieving the SDGs for policymakers, researchers, and the public.

IoT/AI Technology for Aqua Colony

Toru Kobayashi, Yudai Tanaka, Daiki Togawa, Junpei Takaishi, Rina Ishishita, Kazuki Fukae, Tetsuo Imai and Kenichi Arai

From the viewpoint of food self-sufficiency, aquaculture is attracting attention. Since aquaculture is a typical labor-intensive industry, it is desirable to improve productivity through the use of IT. Therefore, this paper presents a study of Aqua Colony for aiming fully automated aquaculture. Aqua Colony automates the aquaculture industry, which has relied on manual labor, by utilizing IoT, AI, and drones. Specifically, AI calculates the optimal amount of food to be fed based on information from IoT like sensors, and drones automatically feed fishes. This paper describes overview of Aqua Colony, and the automatic feeding system, which is characterized by optical flow to Support Vector Machine (SVM) to determine the degree of fish activity.

Neural Network and Resampling to Handle Imbalance Class on Estimate Software Defect

Tri Agus Setiawan, Haryono Soeparno, Ford Lumban Gaol and Yulyani Arifin

Rapid progress in the field of artificial intelligence has created opportunities for extensive applications in software development. One area that receives attention is the evaluation of code quality using machine learning techniques. In this investigation, we examined the possible application of machine learning to predict the likelihood of defects in computer code. We employ NASA archival data as case studies. Machine learning models employ neural network algorithms. Our exploration involves partitioning the dataset into training data and test data for performance evaluation. The findings indicate that the Neural Organize technique with resampling yields a high level of accuracy in predicting software defects. Our simulated neural network is capable of identifying intricate patterns in the data and providing precise measurements of the size and intensity of defects. These results have significant implications in the software business, enabling developers to promptly identify possible vulnerabilities and take preventive measures before product release.

Objective-Driven Modular and Hybrid Approach Combining Machine Learning and Ontology

Ouassila Labbani Narsis, Erik Dujardin and Christophe Nicolle

Hybrid artificial intelligence is rapidly advancing, particularly in the domain of combining ontology and machine learning models. However, existing approaches in this field still encounter several limitations. Most current works tend to combine a single ontology model with a specific learning algorithm and often have a strong focus on specific application domains, which can complicate system adaptation and generalization. To address these limitations, we introduce in this paper an objective-driven, hybrid, and modular approach that promotes the integration of multiple machine learning and ontology models. The approach consists of decomposing the studied application into several tasks, each of them using the most appropriate ontological and machine learning models applied to a subset of knowledge and data. Our approach enhances adaptability and flexibility by tailoring artificial intelligence models to specific goals and reasoning requirements, thereby promoting a more effective hybrid artificial intelligence system and enabling the abstraction and reuse of developed solutions in various application domains. The proposed approach is applied in the design of a hybrid artificial intelligence model for the development of a compact all-optical Arithmetic and Logic Unit.

Off-Rhythm Detection System for Beginner Violinists

Miyu Momozawa, Ryotaro Okada, Ayako Minematsu and Takafumi Nakanishi

It is important for beginners to know how to play a violin in general and how to play it correctly in particular. Maintaining rhythm is very important for progress, especially in violin playing. If a system that allows beginners to easily receive feedback on rhythmic deviations in their own play can be implemented, it will contribute to the improvement of violin players' skills. In this study, we present a method for detecting off-rhythm in beginner violin players. This method uses an onset envelope to estimate the rhythm of a teacher's performance prepared in advance, normalizes the teacher's performance and the user's own performance, extracts rhythmic features using tempo diagrams, and derives the differences between them. This is a method. By implementing this method, users who are beginners in violin playing can smoothly practice rhythm on their own, using feedback from the system.

Parameter Optimization of PI Controller for Three-Phase Permanent Magnet Synchronous Motor

Chang-Yu Chiang, Yi-Hua Liu, Kun-Che Ho and Ying-Yu Shih

This article proposes to use particle swarm algorithm and genetic algorithm to optimize Proportional-Integral-Derivative (PID) controller parameters. The main purpose is to use Particle Swarm Optimization (PSO) and Genetic Algorithm (GA) to search the speed and current loop PID control parameters of vector control of three-phase permanent magnet synchronous motor. This article uses MATLAB to implement PSO and GA and uses Simulink simulation software to establish a three-phase permanent magnet synchronous motor vector control platform. Through the algorithm, the PI parameter combination that minimizes the objective function can be obtained. This article compares the simulation results of particle swarm optimization algorithm

and genetic algorithm with other parameter adjustment methods. The results show that the PSO method is better than the engineering design method, PID Tuner design method, Ziegler-Nichols (Z-N) method and GA method. Optimized parameter method, the obtained optimized PI parameters can be improved by 96%, 69%, 99% and 12% respectively in Integrated Square Error (ISE).

Scam Email Clustering by Ordered Pair of Modality Representations and Dimensionality Reduction

Takeshi Matsuda, Takeshi Fujimaki and Michio Sonoda

Cyber-attacks that deceive people in various ways, such as phishing scams that exploit personal information by pretending to be a real service, are gaining momentum. Scam email sometimes includes important keywords that are cleverly used to deceive people, but not always. This study focused on the modality representation contained in scam emails that make people uneasy and defined order pair of modality representation of 100 dimensions. Furthermore, we applied a dimensionality reduction algorithm to verify the accuracy of unsupervised learning of scam and normal emails.

SimilaCode: Programming Source Code Similarity Detection System based on NLP

Diego Vallejo, Jair Morocho and Juan Salgado

Some tools have been developed in the scientific field to detect similarities in texts; however, some software is not very efficient in detecting plagiarism in programming source codes. In computing, it is expected to find cases of plagiarism in the source code, and there are currently tools that measure the degree of similarity, but they require paid licenses. This scientific article proposes constructing a system that uses Natural Language Processing (NLP), vector space models, and similarity metrics to identify the degree of divergence between pairs of source codes in the Python programming language, with the possibility of extrapolating its applicability to other programming languages. The proposed system is structured in several modules, each with a specific function for both the back-end and front-end of the prototype deployed on the web. The experimentation was carried out using pairs of source codes subjected to modifications at a linguistic and structural level. The results show that our system, Similacode, can detect 100% similarities between source code pairs that have changed their comments. It was observed that the system could identify similarities, even when modifications have been made to the names of variables and functions, reaching levels of similarity higher than 88%. In addition, comparisons were made with two other plagiarism detection tools to assess the degree of similarity, obtaining results with less than 1% differences between the different software. The experiments in Similacode have yielded satisfactory results, demonstrating the system's efficiency in detecting similarities in the analyzed source codes.

Towards a Tourist Village Ontology for Tourism Management Systems

Nurul Firdaus

As the tourism industry rapidly grows, the need for Tourism Management Systems (TMS) designed to attract potential tourists is increasing. The limitations of the traditional approach to TMS often rely on static databases and keyword-based searches, restricting the TMS's capabilities to cater to the complex and ever-changing nature of the tourism industry. To address this issue, we used an ontology-based approach to build an intelligent TMS that improves information management, promotes interoperability, and supports various applications in the tourism industry. This paper proposes to develop a specific tourism ontology called the "Tourism Village Ontology," which intends to serve as a basis for creating an intelligent TMS. The main goal of the ontology is to comprehensively capture the diverse and dynamic aspects of the tourism sector, thereby improving the organization, integration, and retrieval of data related to tourism villages in Indonesia. This article describes the proposed methodology, data collection process, tourism village ontology design, and the tourism management system for use in tourism villages.

Transformer and CNN Comparison for Time Series Classification Model

Ilvico Sonata and Yaya Heryadi

In real life, many activities are performed sequentially. These activities must be carried out sequentially, such as the assembly process in the manufacturing production process. This series of activities cannot be reduced or added so that the main goal of the series of activities is achieved. Apart from that, there are also time series events that occur naturally, such as rainy and hot conditions in a certain area. The classification process of time series activities is very important to see the possibility of anomalies occurring. The significant development of machine learning models in recent years has made the process of classifying time series data increasingly researched. Several previous studies stated that deep learning models were more accurate in classifying time series data. In this paper, we will compare Convolutional Neural Network (CNN) and Transformer deep learning models in classifying time series data. Experimental results using the same public datasets for CNN and Transformer model show that the CNN model is more accurate than the Transformer model. The results of measuring accuracy using confusion matrix show that CNN has an accuracy of 91% and Transformer has an accuracy of 80%.

Trainable Weighted Pooling Method for Text Classification with BERT

Hidenori Yamato, Makoto Okada and Naoki Mori

Text classification is one of the central challenges in natural language processing, encompassing techniques for categorizing large amounts of text data into meaningful categories. This field plays an important role in many applications, such as information retrieval, sentiment analysis, and recommendation systems. In recent years, the remarkable development of deep learning technology has led to the proposal of large language models, which have achieved high performance in various tasks. BERT is one of the large language models widely recognized for its potential in text classification. Although BERT can effectively learn context-dependent word representations, an appropriate pooling strategy is necessary to obtain a representation of the entire document. In this study, we propose a pooling method called CLS-average pooling (CAP) that combines the commonly used the [CLS] embedding and the average pooling method in BERT for text classification. We obtain the sentence representations by taking the weighted sum of the embedding obtained from the [CLS] embedding and the average pooling. At this time, we treat the weights used in CAP as trainable parameters to automatically acquire appropriate weights for text classification. We demonstrated that the proposed method is more effective than conventional pooling methods in text classification tasks by applying it to a dataset for text classification.

Using a personality-aware recommendation system for comparing inventory performances

Natsu Nishimura, Zeynep Yucel and Akito Monden

This study focuses on two Japanese language personality inventories NEO-FFI and TIPI-J derived from the Big Five trait model. In a series of experiments, 17 participants completed these inventories and then proceeded to rank 10 movies. Employing a Leave-One-Out strategy, we developed a straightforward personality-aware recommendation system to suggest movies and subsequently tested its effectiveness. Our recommendation system operates on the assumption that each personality trait holds a distinct influence on the variation between personalities, and this influence correlates differently with the differences observed in participants' movie rankings to their liking. By generating 64 configurations out of 2 inventories, 4 pre-processing procedures, 2 weight initialization methods, and 4 optimizers, we measured the disparity between the resultant movie rankings and the actual ones. Furthermore, we explored two alternative recommendation approaches and investigated which configuration outperforms each alternative the most. It turned out that the scheme deploying NEO-FFI outperformed the alternatives more often than TIPI-J. Notably, in both scenarios, SLSQP turned out to be the best-performing optimization method, and the pre-processing scheme has minimal impact on the outcome. Finally, when comparing the outcomes of the best configuration with the ideal standard, our analysis confirmed that even the most closely aligned ranking available in the dataset is seen to exhibit a greater disparity from the ground truth compared to what the personality-aware method achieves.

IIAI AAI 2024

16th International Congress on Advanced Applied Informatics July 6-12, 2024, Takamatsu, Japan

Co-located events

- 18th International Conference on E-Service and Knowledge Management (ESKM 2024)
- 16th International Conference on Learning Technologies and Learning Environments (LTLE 2024)
- 16th International Conference on Data Science and Institutional Research (DSIR 2024)
- 15th International Conference on Smart Computing and Artificial Intelligence (SCAI 2024)
- 9th International Conference on Business Management of Technology (BMOT 2024)
- 9th International Conference on Social and Business Information Technologies (SBIT 2024)
- 7th International Conference on Interaction Design and Digital Creation / Computing (IDDC 2024)
- 5th International Conference on Decision Science, Theory and Management (DSTM 2024)

Event Summary (TBD)

- July 6, 2024
 - Workshop/Special Sessions
 - **Social event:** Ice-cold Beer and Beverage Greeting
- July 7, 2024
 - Workshop/Special Sessions
 - **Social event:** Welcome Beverage & Cocktail
- July 8, 2024
 - Opening Ceremony & Keynote Addresses & Technical Sessions
 - **Social event:** Welcome Reception & Poster Sessions & Japanese Sake Tasting
- July 9, 2024
 - Technical/Factory Tour & Luncheon Keynote Address
 - **Social event:** Banquet & Award Presentation
- July 10, 2024
 - Technical Sessions
 - **Social event:** Farewell Reception & Wine, Beer, and Beverages
- July 11, 2024
 - Technical Session
 - **Social event:** Conference Adjournment & Ice-cold beer Networking Reception
- July 12, 2024
 - Technical Session (online)

Important Dates

Paper submission open: January 9, 2024

Workshop and Special Session Proposal: February 28, 2024

Full/Short/Poster Paper Submission due: April 15 (PST), 2024

Notification of acceptance/rejection: May 10, 2024

Cameraready due: May 25, 2024

