Abstract Book

19th IIAI International Congress on Advanced Applied Informatics

December 15-17, 2025, Phuket, Thailand

Venue: M Social Hotel

December 15: Onsite Sessions

	Room 1 (Rhythm ball room)	Room 2 (Tempo)
8:45AM-9:15AM	Registration	
9:15AM-9:30AM	Opening Ceremony	
9:30AM-10:20AM	Keynote Session	
10:20AM-10:30AM	Cofee Break	
10:30AM-12:10PM	DSIR1 + ESKM 1	
12:10PM-1:00PM	Lunch	
1:00PM-3:30PM	DSIR2 + LTLE 1	SCAI 1
3:30PM-3:45PM	Cofee Break	
3:45PM-6:15PM	ESKM 2	SCAI 2
6:30PM-8:00PM	Welcome Reception	

December 16: Onsite Sessions

	Room 1 (Fusion 1)	Room 2 (Fusion 2)
9:00AM-10:40AM	ESKM 3	SCAI 3
10:40AM-11:00AM	Cofee Break	
11:00AM-12:15PM	ESKM 4	SCAI 4
12:15PM-1:00PM	Lunch	
1:00PM-3:30PM	LTLE 2	ESKM5 + SCAI 5
3:30PM-3:45PM	Cofee Break	
3:45PM-5:50PM	DSIR 3	SCAI 6
6:00PM-8:00PM	Banquet & Award Presentation at Rhythm Ballroom	

December 17: Onsite and Online Sessions (GMT+7)

	Room1 and Online 1	Online 2 only
9:00AM-10:40AM	LTLE 3 + DSIR 4 + ESKM 6	SCAI 7
10:40AM-10:50AM	Cofee Break	Break
10:50AM-11:30PM	SCAI 8	
11:30PM-12:00PM	Conference Adjournment	

Note:

Onsite Presenters will have a total of 25 minutes to use for their presentation and Q&A.

Online Presenters will have 20 minutes to use for their presentation and Q&A.

Message from the Congress General Chair

Welcome to IIAI AAI 2025-Winter Congress.

The 19th IIAI International Congress on Advanced Applied Informatics (IIAI AAI 2025-Winter) is sponsored by the International Institute of Applied Informatics (IIAI), Japan and IIAI ASEAN Region.

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 21th International Conference on e-Services and Knowledge Management (ESKM), the 19h International Conference on Learning Technologies and Learning Environments (LTLE), the 19th International Conference on Data Science and Institutional Research (DSIR), and the 18th International Conference on Smart Computing and Artificial Intelligence (SCAI), are held with the AAI 2025-Winter.

We would like to thank Executive Vice General Chair Dr. Ford Lumban Gaol, Executive Program Chair Prof. Yuichi Ono, Organizing Committee Vice-Chair Prof. Katsuihde Fujita, Publication & Finance Chair Dr. Tokuro Matsuo, Director of Local Management Dr. Satoshi Takahashi, Local Management 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 2025-Winter will be successful and enjoyable to all participants.

Kunihiko Takamatsu
Institute of Science Tokyo, Japan
Congress General Chair, IIAI AAI 2025-Winter Congress

A Message from the Program Chair

Welcome to the 19th IIAI International Congress on Advanced Applied Informatics (IIAI AAI 2025-Winter), sponsored by the International Institute of Applied Informatics (IIAI), Japan and IIAI ASEAN Region. 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 2025-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 164 papers from 10 different countries/regions. These papers were refereed by 140 Program Committee Members. After careful and rigorous review, 40 papers in CPS were selected as regular papers and 21 papers in CPS were selected as short papers to be presented at the congress and published in the congress proceedings. And, 15 papers in IIAI OPCS were accepted. 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. Kunihiko Takamatsu, 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. Naruhiko Shiratori (DSIR), and Prof. Takafumi Nakanishi (SCAI), for their valuable contributions not only to their subconferences but also to the whole IIAI AAI 2025-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!

Yuichi Ono, Ph.D.
Program Chair, IIAI AAI 2025-Winter Congress
University of Tsukuba, Japan

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Abstracts

ESKM 2025-Winter

A consideration of Information Extraction Techniques for highly uncertain information in Agile Development

Yasuto Nishiwaki, Kenta Fukushima, Kazuyoshi Karatsuya and Kazuhiko Tsuda

In recent years, Japan's domestic workforce has been rapidly declining, leading to increased use of global resources in system development. In the 2000s, Japan-style offshore development, mainly in China, leveraged cost and time differences. Since the COVID-19 pandemic, remote collaboration and cloudbased system development have become more common. In Japan, the waterfall model remains the mainstream approach to system development. However, globally, many projects are increasingly adopting Agile methodologies, particularly Scrum. When requirements are defined in Japan and development is carried out overseas, various gaps emerge—such as language barriers, cultural differences, differing perspectives on resource utilization, and team structuring. Addressing these gaps has become an urgent issue. In particular, accurately understanding the requirements that form the foundation of system development, and ensuring successful completion from development through testing, is a critical challenge. This study analyzes expressions and sentences related to Acceptance Criteria based on Agile Development process that contain a high degree of uncertainty and ambiguity. It evaluates patterns based on relevance and word endings, and assesses methods that can help reduce errors. The paper presents perspectives for product owners to better understand, define, accept, and verify requirements in future Agile-based system development.

A Greedy Algorithm for Priority-Based Vehicle Routing Problem

Yuchao Guo and Masakazu Muramatsu

This study addresses a variant of the Vehicle Routing Problem (VRP) with customer priorities. In the variant, we assume the hard priority constraint where customers should be served in a predefined order. We formulate this problem into a mixed integer programming problem. We then prove some fundamental properties of optimal solutions. Based on these properties, we propose a novel greedy algorithm. Numerical experiments show that our greedy algorithm gives reasonably good solutions, while its running time is almost negligible.

A study on manga character classification based on CNN

Shuta Shimoide and Eisuke Ito

In recent years, the proliferation of manga piracy sites and the unauthorized uploading of manga images, including slide videos and partial copies to avoid copyright infringement, have become serious problems. These actions infringe on the rights of authors and publishers, causing great damage. To solve this problem, a system is needed that can mechanically identify manga authors, titles, and characters from manga images and return the benefits of using the images to copyright holders. In this study, we attempted to use machine learning technology to detect character face regions from manga page images and classify characters. By training several existing CNN models on the Manga109 dataset, we were able to extract characters with an accuracy of over 80% and classify characters with an accuracy of over 90%.

Analysis of Channel State Information of Environment Change Detection Using Wavelet Aanlysis

Hidekazu Yanagimoto, Teppei Otsuki and Kiyota Hashimoto

Privacy-preserving environmental monitoring system using WiFi CSI, without relyingon suverillance cameras, have attracted increaing attention. CSI represents radio propagation characteristics and the observed values vary dependingon enbironmental changes. Approaches that use CSI as input to machine learning models for state recognition ahve benn proposed and have achieved hight classification accuracy. However, machine learning-based methods require labeled training data and constructing a large-scale training dataset is labor-intensive and costly. To address this issue, this paper propose a method that anlyzes the observed CSI using wavelet analysis, a signal processing technique, as a preprocessing step. Experimental results demonstrate that significant human and environmental changes can be detected without the use of machine learning. In future work, we aim to design task-specific features using signal processing, thereby reducing the burden of constructing training datasets while maintaining detection performance.

Analysis of the Relationship Between CSR Activities for the Natural Environment and Product Sales

Toshifumi Matsuda and Kazuhiko Tsuda

Environmental corporate social responsibility (CSR) activities have been reported to influence consumer purchase intention. However, it re-mains unclear which type of CSR—product-related or corporate-level social initiatives—has a stronger effect. To address this issue, this study used nationwide survey data collected in Japan. Both CSR types were entered into the same statistical model to directly compare their effects on purchase intention. The results showed that both CSR types positively influenced purchase intention. However, corpo-rate-level contributions to society and nature showed approximately 55 percent stronger effects than product-related initiatives. This effect remained sig-nificant even after controlling for satisfaction and liking. These findings

suggest that focusing only on product-level improvements is insufficient. Continuous communication of corporate environmental and social initiatives is more effective in enhancing consumer trust and purchase intention.

Cost-effective Stationary Human Detection Using 2D LiDAR for Security Robots

Haruki Mochizuki and Ryozo Kiyohara

Since the COVID-19 pandemic, Japanese industries have been facing labor shortages across various sectors. In particular, the security industry has been affected due to an aging workforce and a lack of younger employees. This shortage has also impacted university security operations, where wide-area patrols place a considerable burden on security guards. Meanwhile, advancements in robotics have enabled not only the automation of simple tasks but also those involving human interaction. As a result, the development and deployment of patrol robots have been actively pursued, with high-precision situational recognition being a critical requirement for their practical implementation. However, existing robots are typically equipped with various sensors such as LiDAR and cameras, leading to high costs that hinder their adoption in university security. In this paper, we propose a cost-effective human detection method using multiple 2D LiDAR sensors. The proposed method focuses on the detection of stationary humans, an aspect that has not been sufficiently addressed in previous research. In addition, this paper outlines the key technical components necessary for the practical deployment of patrol robots in university security operations.

Course Recommendation Using Fine-Tuned SBERT with LoRA

Shion Tsuchida and Minoru Sasaki

This study proposes a course recommendation method that matches learners' free-form descriptive texts (PR texts) with course descriptions. Our approach utilizes Sentence-BERT (SBERT) and introduces Low-Rank Adaptation (LoRA) for parameter-efficient fine-tuning. The core of our method is a dual-adapter architecture, where independent LoRA adapters are applied to the SBERT model to separately capture the distinct linguistic characteristics of learner texts and instructor-written course descriptions. In experiments using corporate training data, the proposed dual-adapter method achieved higher accuracy and precision than the standard SBERT and shared-adapter LoRA models. Furthermore, it efficiently achieved performance comparable to full fine-tuning. These results demonstrate that our method provides an efficient and effective approach for adapting large language models to specialized recommendation tasks in educational and corporate environments.

Designing a Knowledge-Driven Team Development Framework Based on the Psychological Safety Capability Maturity Model

Yuhei Kotani and Seiko Shirasaka

This study developed the Psychological Safety Capability Maturity Model (PS-CMM) as a knowledge-driven team development framework and proposed a Team Development Pro-gram using the PS-CMM. This program standardizes efforts to improve psychological safety, which tend to become dependent on individual initiatives, by positioning them as team-based practices. It is structured so that teams can take a multifaceted approach to promote psychological safety. After implementing the four-week program with Japanese student sports teams, which is one type of team where top-down decision-making is strong and knowledge management is difficult, psychological safety for mental health showed a statistically significant improvement ($p < .001$). Qualitative analysis further suggested that team psycho-logical safety improved, and members felt a decrease in psychological barriers to communicating with the coach and core members. These findings contribute to the development of evidence-based intervention methods for improving psychological safety and propose a knowledge-driven team development framework that standardizes individual-dependent initiatives, thereby advancing knowledge management.

Determination of Dissaving Risk against Life Expectancy for Elderly People Through Clustering Analysis Applied to Additional Anonymous Data

Yuya Yokoyama

In order to detect if the economic activity of elderly people at age sixty-five or older has begun to decline, anonymous data (AD) are used to extract characteristic features. AD are provided by the National Survey of Family Income and Expenditure published by the Ministry of Internal Affairs and Communications. So far, a methodology to detect dissaving risk among extremely low income and savings were validated for the AD on 2004. However, it would be meaningful to investigate if this method would be applicable as well in other AD datasets. Therefore, in this paper, with the addition of AD on 1999, 2009, and 2014, a method to detect dissaving risk is reanalyzed. Firstly, clustering analysis based on standardized income and savings for AD on 1999, 2009, and 2014 produced similar tendency as AD on 2004. Then clustering analysis based on savings is applied to the clusters with greatly low income and savings. As a result, it has been shown that a method to detect the data determined as dissaving risk was also applicable in the additional AD datasets

Dimensionality Reduction and Visualization for Clustering of Cypher Payloads

Takeshi Matsuda, Daiki Ogawa, Chao Jinhui and Michio Sonoda

Machine learning has long been applied to attack detection, with recent studies increasingly focusing on reducing false positives caused by the dominance of benign data. This study introduces a novel approach that incorporates the distinction between expected and unexpected inputs into the detection process. We propose an unsupervised learning-based visualization method that highlights behavioral differences in Cypher payloads, offering new insights into context-aware anomaly detection.

Comparative Analysis of Image Denoising Using Median, Gaussian, and Bilateral Filters

Atayev Ashyrgeldi, Yuuki Oishi, Sanggyu Shin

This study lays the groundwork for a series of follow-up investigations that span the fields of computer vision, AI, and cybersecurity. As images continue to form the foundation of intelligent systems—from healthcare to autonomous vehicles to surveillance—the importance of clean, interpretable, and resilient image data cannot be overstated. By advancing both the understanding and practical application of denoising filters, this research contributes meaningfully to the ongoing dialogue around AI safety, efficiency, and transparency.

Linking Data across Diverse Domains Using Latent Cluster with Differential Privacy

Hiroshi Yoshiura, Masatsugu Ichino, Tetsuji Kuboyama, Hideki Yoshii, Yoichi Midorikawa, Ryunosuke Shimmura and Akira Shuto

As online activities expand across diverse domains, generating extensive datasets, the need for using data across a wide variety of similar and dissimilar domains grows. However, data in dissimilar domains describe neither the same persons nor the same items, making standard methods of joining databases difficult. As valuable data often contains personal information, transferring data across domains requires privacy protection. This paper describes a technique that combines databases across domains by utilizing latent clusters shared among domains, rather than individual persons and items. Differential privacy is used to prevent direct and indirect transfer of personal information. Data distortion due to differential privacy is reduced by using fully homomorphic encryption to halve the application scope of differential privacy. Design and preliminary evaluation are described with a clarification and discussion of the burdens of privacy protection.

Multigroup Exploratory Factor Analysis of Entrepreneurial Characteristics: Differences by Firm Size and Revenue in Japan

Katsuki Yasuoka, Takaaki Hosoda, Kiyomi Miyoshi, Tokuro Matsuo and Qiang Ma

We investigate the latent structure of entrepreneurial characteristics in Japan by integrating internal factors (mindset/skillset) with external ecosystem conditions in a qualitative EC model. We surveyed entrepreneurs in June 2025 (n=604) and ran multigroup exploratory factor analyses (ML extraction; Promax rotation) for the full sample and subgroups by employee size (1–5 vs. ≥6) and annual revenue (<¥50M vs. ≥¥50M). To enable cross-group comparability, dimensionality was fixed at five under pre-specified free-exploration criteria. Items were retained primarily at |loading|≥.40, with theory-guided handling of cross-loadings. Results show label-level reproducibility of Public Support and Innovation Execution, limited item-level overlap, and a context-dependent factor (F3) whose composition shifts with scale. Congruence with the full solution is high for the employee split (Tucker's φ≈.998, .976) but weaker for the lower-revenue subgroup; reliability generally exceeds practical thresholds. Findings imply interventions should combine a minimal common core with stage-specific modules, and that factor comparisons are better anchored to substantive labels than numeric ordering. A companion manuscript using the same dataset applies CFA/SEM to test measurement properties and mechanisms; this article is limited to multigroup EFA and evaluates replication and reconfiguration using Jaccard, MALD, and Tucker's φ. Aims, methods, and claims are distinct. Cross-references will follow upon acceptance.

Reference Citation in High School Student Papers

Yuno Mikasa, Haru Ishibiki and Haruki Ono

Recently, the adoption of inquiry-based learning has grown in high schools, increasing student-led research activities. However, concerns remain about whether students are citing sources appropriately. This study investigates the actual state of reference citations in high school students' papers. The methodology involved collecting papers from high school students and analyzing the references in the bibliography. The survey targets were papers written by high school students from Super Science High Schools certified by Japan's Ministry of Education, Culture, Sports, Science, and Technology. The targets included citations of journal and E-journal Papers, books, web pages, and magazine articles. Findings revealed that only 4.0% of submissions included all essential bibliographic information. Citation deficiencies varied by the type of media referenced, and longitudinal comparisons indicated no significant improvement even after the introduction of new educational guidelines promoting inquiry-based learning. These results suggest that the current emphasis on inquiry does not necessarily enhance students' citation competence. The findings imply that many students cite sources without fully understanding their purpose or value in academic writing. Hence, this study highlights the need to systematize practical instruction in academic writing, provide continuous feedback during the research process, and strengthen collaboration with school libraries.

Script-to-Slide Grounding: Grounding Script Sentences to Slide Objects for Automatic Instructional Video Generation

Rena Suzuki, Masato Kikuchi and Tadachika Ozono

While slide-based videos augmented with visual effects are widely utilized in education and research presentations, the video editing process---particularly applying visual effects to ground spoken content to slide objects---remains highly labor-intensive. This study aims to develop a system that automatically generates such instructional videos from slides and corresponding scripts. As a foundational step, this paper proposes and formulates Script-to-Slide Grounding (S2SG), defined as the task of grounding script sentences to their corresponding slide objects. Furthermore, as an initial step, we propose ``Text-S2SG,'' a method that utilizes a large language model (LLM) to perform this grounding task for text objects. Our experiments demonstrate that the proposed method achieves high performance(F1-score: 0.924). The contribution of this work is the formalization of a previously implicit slide-based video editing process into a computable task, thereby paving the way for its automation.

SDT-DA: A Signal Decomposition and Transform Framework with Self-Supervised Quality Assurance for Reliable Data Augmentation in HAR

Gangkai Li, Yugo Nakamura, Hyuckjin Choi and Yutaka Arakawa

With the development of deep learning, many deep neural networks have been proposed for accelerometer-signal-based human activity recognition (HAR) tasks. However, training deep learning models with numerous parameters requires a considerable amount of labeled data, while building an HAR dataset is expensive. Data augmentation (DA) is an effective method to address this problem. In this paper, we propose SDT-DA, a signal decomposition and transform framework equipped with a self-supervised quality assurance mechanism that ensures the fidelity of generated signals. For accelerometer signals, we assume the low- and high-frequency parts can be regarded respectively as the content and the style of each data. Therefore, we can remove the high-frequency part and reconstruct signals to get signals with the same class but different style. SDT-DA has a transform network and a pre-trained classifier network, where the input signal is first decomposed to remove the high-frequency part and then fed into the transform network to generate new data. The pre-trained classifier network acts as a content-consistency validator, penalizing deviations from the original signal's semantic representation. The experimental results show the data generated by our method have a similar distribution of original data, and can be used to improve the performance of HAR tasks.

Self-Supervised Reward Shaping via Dynamic Potential-Based Approach

Kota Minoshima and Sachiyo Arai

Self-Supervised Online Reward Shaping (SORS) learns a dense reward from an agent's own trajectories to improve sample efficiency in sparse or delayed-reward settings. However, the theoretical guarantees of SORS rely on strong assumptions (e.g., total-order equivalence under deterministic MDPs) that may not hold in practical, stochastic environments. We revisit SORS through the lens of Potential-Based Reward Shaping (PBRS) and propose Potential-Based SORS (PBSORS), which constrains the learned network to be state-only and repurposes its output as a dynamic potential function. By applying the PBRS shaping term to the environment reward, PBSORS inherits the policy invariance guarantees of Dynamic PBRS without requiring handcrafted heuristics. Empirically, on MuJoCo control tasks with 20-step delayed rewards, PBSORS consistently stabilizes learning compared with SORS and improves sample efficiency over strong baselines, while preserving the original task optimum.

Toward Process Improvement Framework for Software Development Using Generative AI

Shigeru Kusakabe and Manato Tsutsushio

Software development projects, in which humans are trying to effectively use generative AI work are becoming more popular. While the introduction of generative AI into software development projects is expected to be effective in design, implementation, testing, and document processing, issues such as hallucination can have a negative impact on quality, cost, and delivery time, resulting in the risk of project failure. In conventional software development, development process is considered important for stabilizing and improving quality, cost, and delivery time. We also believe that process is equally important in software development using generative AI. We made a hypothesis that a prescriptive process is particularly effective, and we tried to devise a process framework in which developers can establish and continuously improve software development process with generative AI based on the Personal Software Process (PSP). This paper describes our effort to such a process framework focusing on the process architecture.

A Quantitative Analysis of AI-Evaluated Educational Video Thumbnails: Correlation with Viewership

Tomohiro Kawata, Takumi Kato and Kazuhiko Tsuda

As the online educational video market becomes saturated, creators face intense competition. Their efforts to optimize video thumbnails often rely on intuition rather than scientific evidence, leading to significant opportunity loss. This research addresses this gap by analyzing 5,322 thumbnails from Excel tutorial videos published between 2022 and 2023. This study employs a multimodal Generative AI to quantify subjective visual appeal. Grounded in Dual-Process Theory, our method maps AI-generated scores to human cognitive systems: intuitive "System1" (e.g., Surprise, Urgency) and rational "System2" (e.g., Benefit, Trustworthiness). A sampling test validated the AI as a measurement tool, confirming high consistency with human perception (e.g., 88.7% accuracy for "Person Present"). Using correlation, hierarchical regression, and machine learning models, we analyzed the relationship between these AI variables and log-transformed video view counts. Key findings reveal: (1) System1 scores had a stronger correlation with view count than System2; (2) the presence of a "person" was a strong independent predictor; and (3) a significant interaction effect was found, where a "person" amplified the positive

effect of "Surprise" on viewership. An integrated Gradient Boosting model demonstrated the highest predictive accuracy. This study helps elucidate AI's evaluative capabilities and provides creators with evidence-based guidelines for thumbnail design.

LTLE 2025-Winter

An Augmented Reality Application for Learning Printed Circuit Board Fabrication

Rittichai Nooson, Santi Hutamarn, Sunphong Thanok, Suppachai Howimanporn and Sasithorn Chookaew

Today, vocational educational systems focus on developing skills to meet the demands of the Intelligent automation industry, especially in the printed circuit board (PCB) manufacturing industry, which is a crucial foundation for producing students in Vocational education in mechatronics. However, students still lack the understanding and confidence to complete the task successfully. The present study aimed to examine the students' learning achievement using augmented reality (AR) technology, which enables students to visualize the location of equipment clearly, reduces errors during operations, and fosters motivation and confidence in learning about PCB manufacturing. The participants in the study were 30 vocational students (male 16 and female 14) in Thailand. This study employed a pre-experimental research design, utilizing pre- and post-tests as research tools to evaluate learning outcomes on the topic of power supply circuits. The results showed that student learning achievement increased, leading to improved vocational education efficiency and alignment with modern industries. The students were able to understand better the workflow, which included assembling the circuit, soldering the components, and verifying the circuit's correctness. The findings offer further opportunities for utilizing AR technology to motivate students in vocational learning contexts.

Developing a Visual-Scaffolding-Based Computational Thinking Platform to Enhance Students' Computational Thinking and Problem-Solving Abilities

Yu-Jie Zheng and Chia-Jung Chang

This study, based on the Cognitive Theory of Multimedia Learning, explores the effects of different prompting modes (visual and text-based) on learners' computational thinking and problem-solving abilities. A Blockly-based visual block learning system was developed with a robot vacuum task to guide students through problem-solving activities. A quasi-experimental design was used, including 62 university and graduate students divided into a visual-prompt group and a text-prompt group. The results showed a significant difference in computational thinking performance in the post-test, with the visual-prompt group outperforming the text-prompt group. In terms of problem-solving abilities, the visual-prompt group showed significant improvement in problem-solving confidence and personal control. Qualitative analysis also indicated that visual prompts helped students decompose problems, plan strategies, reduce cognitive load, and improve problem-solving performance. Overall, the findings suggest that visual prompts can enhance students' computational thinking, problem-solving abilities, confidence, and initiative, providing useful insights for future research and instructional design.

Development of the Descriptive-Relational-Graphical (DRG) Model for Eduinformatics: Fostering Relational Understanding through Representational Transformation in Data-Driven Mathematics Education

Akira Nakamura and Kunihiko Takamatsu

The Organization for Economic Co-operation and Development (OECD) Learning Compass 2030 envisions education as cultivating transformative competencies for navigating uncertain futures. This study proposes the Descriptive-Relational-Graphical (DRG) Model as a comprehensive framework for understanding mathematical learning through representational transformation. The DRG Model integrates three comple-mentary modes: descriptive language for articulation through natural expression, rela-tional language for quantitative and logical structures, and graphical language for spatial visualization. This framework emerged from data-driven education research within Eduinformatics, an interdisciplinary field integrating educational sciences with infor-matics methodologies. Building on Ainsworth's DeFT framework, Duval's semiotic representation theory, and Skemp's distinction between instrumental and relational understanding, this study demonstrates that mathematical learning develops through recursive movement across representational systems. Visualization functions as a central mediating pathway connecting internal cognition with external representation. Analysis of geometric examples illustrates how bidirectional transformations among descriptive, relational, and graphical representations foster relational understand-ing—comprehending both what to do and why. The DRG Model supports OECD Learning Compass 2030 goals by enhancing learner autonomy, metacognitive reflection, and agency in mathematics education and beyond.

Enhancing Vocational Students' Industrial Automation Learning through OPC UA and Third-Party Protocol Integration

Bodinphat Sirithanawongsa, Suppachai Howimanporn, Sunphong Thanok, Santi Hutamarn and Sasithorn Chookaew

In the current Industry 4.0 era, automation and connectivity between industrial devices are crucial, particularly the use of open platform communication protocols in industrial plants. For vocational certificate programs focused on developing automation skills, students often lack the foundation for setting up third-party communication protocols with OPC UA in industrial plants, including the integration of data into graphical displays that display system data and status for monitoring and controlling the manufacturing process. However, a review of published literature from various sources revealed that research

findings on learning management in this topic remain unclear, resulting in students still lacking the ability to effectively connect and configure communications between devices of different brands. This research developed a learning activity that integrates third-party protocols and problem-solving through open platform communication to enhance problem-solving skills in communication between PLC and SCADA Actuator. The participants are 30 second-year vocational certificate students in mechatronics and robotics engineering at vocational colleges in Thailand. The results revealed a statistically significant difference in pre- and post-test mean scores at the .05 level. Furthermore, students had positive perceptions of the developed learning activities. It can be applied to develop communication connections between protocols in industrial plant systems in the future.

Identifying challenges in predicting L2 dynamic self-confidence using speech features from unbalanced data

Yuga Omori, Mika Tamura and Daisuke Ikeda

Speaking practice for a second language (L2) using an online learning system offers a psychological advantage: L2 learners can repeatedly practice in private, familiar, and uncontrolled environments, thereby mitigating public performance anxiety. Effective feedback for L2 speaking also requires careful consideration of the learner's psychological states. Among these states, dynamic self-confidence is a core predictor of L2 Willingness to Communicate, and its enhancement via individual feedback is highly desirable. However, the critical challenge of directly estimating dynamic confidence from data collected in uncontrolled online learning environments persists. To address this gap, we challenged the binary classification of subjective confidence using only speech features obtained from an online learning system. We established an initial analytical baseline for confidence classification using a deep learning model (Accuracy: 0.745, AUC: 0.813). Crucially, our quantitative analysis identified fundamental limitations inherent in uncontrolled and unbalanced data. t-SNE visualization showed that subjective confidence labels, unlike objective fluency labels, were not separable in the representation space. We further identified structural biases stemming from task difficulty, which contributed to the data imbalance. Future work must address these identified challenges by adopting multimodal approaches and applying integrated debiasing to capture the complexity of dynamic confidence genuinely.

Integrating Augmented Reality to Improve Students' Learning Achievement and Motivation for Stepper Motor Control using PLCs

Wisanukorn Jakkrong, Suppachai Howimanporn, Sunphong Thanok, Sasithorn Chookaew and Santi Hutamarn

Engineering education faces the challenge of moving beyond theory so that students can link what they learn to what actually happens in practice. In the stepping motor concept controlled by a Programmable Logic Controller (PLC), it is part of industrial factory equipment. Most instructors use textbooks as a learning tool, but they often cannot demonstrate how things behave in real time. Many instructors have started using digital technology tools to close that gap. This research aims to develop an Augmented Reality (AR) application to enhance learning of the stepping motor position control concept using a PLC. It is one technology that helps students learn more effectively. It allows them to observe how machines or systems behave and to try simple experiments, turning abstract ideas into something they can see and understand. The participants are 15 vocational students. The results revealed that students who learned through AR-based instructional media had significantly higher post-test achievement scores than their pre-test scores at the 0.05 level. Moreover, learners demonstrated a positive attitude and motivation toward using AR technology for learning. The study suggests that AR technology can be a practical approach for developing instructional media in automation and industrial machinery control.

Internet Fatigue as a Protective Signal in Visibility-Intensive SNS

Chie Kato

We examined “Internet Fatigue” as a “Protective Signal” in visibility-intensive social media. We analyzed 871 free text from young Social Networking Sites (SNS) users in Japan (mean age = 21.9) using an embedding-assisted content analysis. Sentences were encoded with Multilingual E5 (Wang et al., 2022; 2023; 2024) and clustered with k-means. We inspected the elbow curve (k = 2–30) to delimit a candidate range, then selected k by the average silhouette within that range. Overall, 747/871 (85.8%) re-ported at least one fatigue experience. Seventeen interpretable clusters emerged—e.g., Alt-Account Exposure and Conformity Pressure; Problematic Use and Time Dis-placement; Relational Maintenance Pressure—many tied to heightened visibility and inflow. We argue that internet fatigue often functions as a protective signal, prompting boundary-setting and other self-regulatory actions.

Reducing Student Hesitation through a Trial-and-Error Cyber Defense Exercise System for Security Beginners

Ichitoshi Takehara, Yuki Kami, Koji Kida and Keizo Saisho

Cyber defense exercises are important for developing cybersecurity personnel capable of responding to increasingly sophisticated attacks. However, beginners often hesitate to execute commands during exercises because of anxiety about system failures. To address this issue, we developed a cyber defense exercise system that allows students to save and restore exercise states. Trial-and-Error function enables learners to retry operations safely and reflect on the results of their actions. In the evaluation experiment, students who had learned basic Linux commands were divided into two groups: one using the developed function and the other not using it. As a result, the former group tended to execute more commands than the latter. This result suggests that the proposed system reduces hesitation during operations. Interview responses also suggested that the system helped students feel psychologically comfortable and encouraged them to explore different defensive operations. These findings indicate that the proposed system can support learning for beginners by reducing hesitation and promoting reflective practice in cyber defense exercises.

Research on the Automation and Systematization of Learning Support with Generative AI

Kana Sunahara, Haruki Ueno, Hibiki Sato, Ginji Someya, Yasuomi Takano and Hiroshi Komatsugawa

This study develops and evaluates a learning support system that integrates learning data from educational settings with Large Language Models (LLMs) using generative AI. Recent educational policies in Japan emphasize autonomous and self-regulated learning, but teachers face time constraints in providing individualized instruction. To address this, our system automatically analyzes learners' study behaviors and comprehension levels, providing personalized advice on both learning methods and content. The study designs this system and evaluates its effectiveness.

Virtual Laboratory with CNC Simulator to Promote Vocational Students' Competency and Technology Acceptant

Nalinya Phlaiduang, Suppachai Howimanporn, Sunphong Thanok, Santi Hutamarn and Sasithorn Chookaew

Automated industrial manufacturing relies on computer programs to direct its movements and operations. Especially, CNC machining is non-negotiable for anyone pursuing a career in fields such as industrial, mechanical, mechatronics, and manufacturing technology. Therefore, technical colleges attempt to promote CNC skills. Nevertheless, the lack of a workforce with technical skills is crucial; it often struggles with actual machine time. This is usually because they lack sufficient equipment or due to safety hazards and high operating costs. This study proposed blended virtual labs with CNC simulators. This strategy significantly enhances the CNC curriculum, ensuring that students actually acquire the hands-on expertise the industry desperately needs. We focus on assessing students' competency, including knowledge, skills, and attitudes, during the participant learning activity before it begins and then immediately after it concludes. We also used a survey questionnaire to check how enthusiastic and open they were to adopting this new technology. The findings show that the students' competency differences were statistically significant ($p < .05$). This firmly demonstrates that the new technology approach successfully enhanced the students' overall skill development. Additionally, the students themselves demonstrated great enthusiasm and an intense eagerness to continue using the technology within the CNC simulation programming setup.

DSIR 2025-Winter

Analysis of LMS Utilization Based on the Placement of Instructional Materials

Takaaki Ohkawauchi and Eriko Tanaka

The market for Learning Management Systems (LMSs) in higher education has been expanding annually. Previous studies have demonstrated that LMS utilization significantly contributes to edu-cational activities. However, it has also been noted that, despite institutional adoption, LMSs are often not fully employed in actual courses. In this study, the LMS content of all courses was examined via the API. The results revealed that over 40% of courses did not utilize the LMS at all, and factors such as class size were found to influence LMS usage. Furthermore, even in courses where the LMS was used, there were substantial differences between frequently used functions and those that were rarely employed.

Design and Implementation of a Cyclic Dropout Preven-tion Model Using Institutional Research Data

Naruhiko Shiratori

This research proposes a cyclic model for dropout prevention in higher education, integrating data-driven prediction and student support practices. The model connects six key phases—data consolidation, time-series dropout risk prediction, student status monitoring, classification of student trajectories, targeted intervention, and evaluation of support effectiveness—into a continuous improvement cycle. Grounded in institutional research (IR), the model utilizes attendance records, academic performance, and pre-admission data to estimate dropout probabilities and classify students using clus-tering techniques such as X-means. Based on these classifications, tailored interventions including early alert systems and enhanced first-year education programs are imple-mented. The effectiveness of these interventions is evaluated through changes in at-tendance and academic outcomes, enabling feedback into the model for refinement. This framework aims to bridge the gap between predictive analytics and practical student support, offering a scalable and adaptable approach for universities seeking to reduce dropout rates and improve student success.

Effects of Career Change Opportunities for Graduates Af-ter Graduation from an Educational Institute

Yuya Yokoyama, Takaaki Hosoda, Morihiko Ikemizu and Tokuro Matsuo

In modern society, where drastic transformations of social structures are occurring, relearning new knowledge and skills for adults is becoming progressively vital thanks to the widespread proliferation of various educational methods. Under these circum-stances, our study aims to analyze the underlying factors of study motivation of adult learners. To reveal the factors and relationships between before enrollment and after graduation, we performed multivariate analysis on a questionnaire targeted at general adult learners. Based on these observations, we created a questionnaire aimed at the graduate students of our affiliation. Factor analysis has yielded five factors reflecting the curriculum of our institute. Besides the questions analyzed in our previous work, we also posed a question about usefulness for work, which could be an important clue to evaluating the effectiveness of our curriculum. Therefore, in this paper we performed cluster analysis to examine the tendency in the graduates' career changes after gradu-ation. In executing cluster analysis, three sets of feature values were analyzed with four clusters. As a result, it can be suggested that among clusters with high competence, the entire opposite groups can be observed; that is, some graduates stay in the same or-ganizations as before, while others seek new environments.

Generative AI in University Programming Courses - A Survey of Student Practices and Perspectives

Mio Tsubakimoto

This study explores the optimal design and execution of programming courses in the era of generative AI. The study is based on a survey of students enrolled in such courses. Specifically, the research investigated students' actual use of ChatGPT and their per-ceptions of the value of learning programming. The investigation targeted students en-rolled in an applied course in the Mathematical and Data Science Minor at a compre-hensive university. Subsequently, the findings were utilized to examine implications for the design of examinations and assignments. The survey revealed that 80% of re-spondents had experience using ChatGPT, and that the purposes of use varied depending on their prior programming experience. Additionally, students have articulated appre-hensions regarding the fairness of evaluating assignments and examinations when generative AI tools are employed. In response, a series of countermeasures has been proposed, including the implementation of in-person assessments that prioritize not only coding aptitude but also reasoning and comprehension skills. Conversely, a counter-argument posits that programming education should also assess the ability to use AI effectively as a practical tool.

High School Student Sessions at Academic Conferences in Japan: Status and Participant Attributes

Noa Iwai, Haru Ishibiki and Haruki Ono

In Japan, the 2018 revision of the High School Curriculum Guidelines emphasized inquiry-based cross-disciplinary study, encouraging students to engage in substantive research and presentation activities beyond the classroom. This study aims to clarify the current status of high school student sessions at academic conferences in Japan and to investigate the attributes of the presenting schools. A two-part survey was conducted: (1) Analysis of websites of leading Japanese academic societies to identify those holding high school student sessions; (2) Examination of programs and affiliated schools of presenters in these sessions, linking them with official school data to analyze school types, locations, and participation patterns. Results showed that high school sessions mainly exist in natural science fields, with participating high schools including both public and private institutions, and the geographic spread expanding beyond metropolitan Tokyo. Many schools participate only once, while about 20% engage repeatedly, indicating varied continuity. This study offers novel data on Japanese high school students' academic presentations, an area rarely examined in Educational Data Science. It contributes to clarifying high school students' academic communication practices. It provides foundational insights for academic societies and universities hosting academic conferences to consider whether to open their events to high school students.

How Early is Early Enough? A Time-Constrained Analysis of Dynamic Early Warning Systems for Academic Risk Prediction

Shintaro Tajiri, Kunihiko Takamatsu, Naruhiko Shiratori, Kimikazu Sugimori, Sayaka Matsumoto, Shotaro Imai, Tetsuya Oishi, Masao Mori and Masao Murota

Implementing effective academic support for mandatory first-year courses requires precise decision-making about when to intervene, with whom, and with what level of certainty. This study extends our previous static prediction model (AUC=0.878 [1] using enrollment data alone) by addressing its key limitation: the inability to answer operational questions about intervention timing. Using data from a mandatory Information Literacy course at Hokuriku University (N=335, Economics and Management faculty, 2022-2023), we developed machine learning models that incrementally add dynamic formative assessment data from weeks 2-8 to static enrollment information. Under strict time-constraints preventing data leakage, we evaluated models using Re-call@Precision≥0.90—a practical metric balancing intervention resource constraints with student rescue effectiveness. Results demonstrate that minimal behavioral features from weeks 2-3 (non-submission streaks, delay patterns) significantly improve Recall@P≥0.90 from 1.6% to 3.2%, doubling rescue capacity while providing weeks of intervention lead time. Multi-Faceted Rasch Model standardization confirms findings remain robust after controlling for instructor and task effects.

Outcomes of Interdisciplinary Graduate Education - A Case Study from a Japanese University-

Ming Li, Michiyo Shimamura, Shunsuke Tao, Naoko Murakami, Linchen Wang and Yusuke Horii

Interdisciplinary graduate education has become increasingly important in addressing complex global challenges that transcend traditional disciplinary boundaries. This study examines the outcomes of such education programs through the lens of Tomlinson's Graduate Capital Model, which encompasses human, social, cultural, identity, and psychological capitals. Focusing on a case study at a Japanese national university, qualitative data were collected through semi-structured interviews and free-form questionnaire with program graduates. Using KH Coder for quantitative text analysis, the results revealed that interdisciplinary education strengthens graduates' academic, social, and personal development. It broadens knowledge and skills by combining ideas and methods from different fields, improving research ability, employability, and adaptability. Collaborative learning across disciplines helps students build professional networks and appreciate diverse academic and workplace cultures. These experiences also shape their professional identity, foster career flexibility, and build confidence and resilience. Overall, interdisciplinary learning fosters well-rounded development by cultivating both expertise and transferable skills essential for lifelong learning and success.

The Dialogic Dual-Instructor Model (DDIM): An Eduinformatics and STEAM-Oriented Approach to Effective University Teaching in Post-COVID-19 Higher Education

Kunihiko Takamatsu, Kenya Bannaka, Sayaka Matsumoto and Yasuo Nakata

This study investigates which instructional formats most effectively promote student understanding and engagement in post-COVID-19 higher education. While the pandemic accelerated diversification in teaching modes including synchronous online classes, on-demand videos, and blended formats, limited empirical evidence exists comparing their effectiveness. Drawing on dialogic pedagogy, STEAM education principles, and the eduinformatics framework, we examine monologic single-instructor lectures, teaching assistant-supported classes, and dialogic co-teaching formats. We introduce the Dialogic Dual-Instructor Model (DDIM), a collaborative teaching approach implemented across statistics courses at Kobe Tokiwa University since 2017. DDIM involves two instructors engaging in structured dialogue during instruction, with one primarily presenting content while the other poses questions, requests clarifications, and offers alternative perspec-tives that mirror student thinking processes. This approach has been successfully adapted across face-to-face, audio-only, and on-demand video formats. Our analysis, synthesizing prior research on tutorial-style videos and dialogic practices in STEAM contexts with our collaborative statistics education practice, suggests that DDIM rep-resents an effective instructional format for fostering student engagement and under-standing in contemporary university education.

SCAI 2025-Winter

A Chess Move Generation Model Based on the Analysis of Human Blunders

Mai Komatsubara, Junji Nishino and Satoshi Takahashi

To create a chess AI that selects human-like moves, we created a model of the cognitive process when humans make bad moves by extracting the situations in which humans make bad moves. We checked each game played by intermediate level players and extracted the situations where mistakes occurred. This study created multiple classification categories based on the situation of the position and the cause of the mistake, categorized the mistakes, and evaluated the characteristics of each. As first approach, we manually considered about few games and determined the mistake type and feature of positions for each situation. Then the mistake type vector and feature vector for whole mistake situations were generated, analyzed, and classified.

A Scalable Reinforcement Learning via Event-Triggered Approach for Railway Systems

Hayato Chujo and Sachiyo Arai

Energy-efficient train operation is a critical challenge in railway systems. Traditionally, dynamic programming has been used to optimize energy efficiency and solve operational control problems. However, its effectiveness is limited by the need to model the operational environment accurately and the scalability issues that arise as the number of variables increase. In contrast, deep reinforcement learning (DRL) offers a model-free approach, eliminating the need for a predefined system model and enabling the derivation of optimal control policies under diverse operating conditions. By leveraging function approximation, DRL mitigates scalability constraints. Nevertheless, when applied to real-world problems like railway systems, challenges such as sparse rewards structures, which limit feedback signals, and control instability caused by sequential decision-making based on gradient methods, remain significant. To address these issues, this study proposes an event-triggered reinforcement learning method and evaluates its effectiveness through computational experiments. The proposed method reduces probability-based selection of actions, improves control stability, and minimizes energy consumption compared to conventional approaches, as demonstrated by the experimental results. Our findings suggest that event-triggered reinforcement learning is a promising approach for achieving both punctuality and energy efficiency in autonomous train operations.

Advancing Responsible AI in Finance: Applications of an Inherently Interpretable Machine Learning Modeling Approach

Annie Wu and Simon Ng

Explainability lies at the heart of Responsible AI in finance, ensuring that AI-driven decision-making processes are transparent, fair, and accountable. Traditional black-box models such as XGBoost offer strong predictive performance but often lack the transparency required for regulated applications like credit underwriting. This research explores a simplified variant of XGBoost that can be represented as an interpretable Generalized Linear Model (GLM), enabling clear decomposition of main and interaction effects. Applied to credit risk use cases, the model achieves comparable accuracy to more complex approaches while greatly enhancing interpretability and regulatory compliance. The findings demonstrate that responsible AI does not require compromising accuracy, and that interpretable modeling architectures can support both performance and trust in high-stakes financial applications.

Approximate Inverse Model Explanations for Metamaterial Design with Scalar-Field-Based Metal Foam Surrogates

Taku Itoh and Takafumi Nakanishi

Approximate inverse model explanations (AIME) and its ridge-regularized variant (RidgeAIME) provide simple linear mappings from model outputs back to input features and thus offer an interpretable tool to analyze black-box regression models. In this paper, we use AIME/RidgeAIME as a design analysis tool for scalar-output surrogate models of cellular metamaterials. As a case study, we consider scalar-field-based modeling of metal foams, where closed-cell-like architectures are generated from a nearest-neighbor-based scalar field and a family of iso-values. Instead of performing full-scale finite

element simulations, we use a density-based proxy for the effective Young's modulus and extract geometric descriptors such as void fraction, specific surface area, and anisotropy. Using AIME and RidgeAIME, we analyze how these descriptors co-vary to achieve a desired effective stiffness under imposed anisotropy controlled by a vertical thinning parameter. Numerical results indicate that the void fraction and specific surface area are the primary descriptors for the surrogate stiffness, whereas anisotropy plays a secondary role whose influence remains modest overall, with slightly more pronounced and occasionally non-monotonic effects in strongly tapered geometries. These results illustrate how approximate inverse explanations can be used both for post-hoc interpretability and for practical design analysis of metamaterial surrogates.

Beyond Frequency: An Entropy Jensen–Shannon Framework for Condition-Specific Word Extraction

Fan Cheng and Takafumi Nakanishi

This study proposes a novel method, Entropy–JS, which extracts condition-specific words and visualizes interclass structures based on an information-theoretic framework utilizing word label entropy H(w)and Jensen–Shannon distance DJS. Conventional methods based on frequency or local weights, such as TF-IDF and PMI, rely on stopword lists and suffer from limitations: generic words tend to remain at the top, and they cannot sufficiently capture relationships between conditions. In contrast, Entropy–JS treats the entire word occurrence distribution as a probability distribution, enabling the extraction of condition-specific words with low entropy while naturally excluding generic words with high entropy. Furthermore, by measuring Jensen–Shannon distances between classes, it visualizes similarities and differences between categories based on distribution shapes. Experiments using the 20 Newsgroups dataset confirmed that the proposed method stably yields interpretable context-specific words. For example, in rec.sport.hockey, terms like nhl and bruins were extracted as low-entropy words with extremely high concentration, p(w |c) 0.98. Furthermore, Mean Spear-man@20 consistently maintained values above 0.9 even when varying subsampling or smoothing parameters, demonstrating ranking stability.

Bridging Real and Virtual Worlds: A Low-Cost MediaPipe-Based Fish Motion System for Educational Cyber-Physical Interaction

Ion Nakagawa, Ryuji Takayama, Manami Masuda, Maria Yokoi, Mizuki Nakashima and Takafumi Nakanishi

This study presents an educational, low-cost cyber-physical system that allows users to animate their own drawings through hand gestures in real time. This study presents a method for realizing virtual swimming interactions with arbitrary fish images using hand-tracking. Currently, various real-time sensing gadgets make it possible to detect real-world events in virtual space in real time. In such environments, it is crucial to realize systems in which real-world objects and virtual objects drawn by any user seamlessly interact and operate together. This study focuses on the "hand" as the user's body. It displays a fish drawn by any user in the virtual space and implements a method to freely animate any image drawn by the user in the virtual space based on real-time hand-tracking in the real world. This enables the virtual space to interact with the user's intent and emotions, which are represented by their physical movements in the real world. Consequently, users can easily achieve movements in virtual spaces that align with their intent and emotions. This work contributes to the democratization of CPS education by enabling students to transform their own drawings into interactive virtual objects, fostering creativity and system-thinking skills.

Cognitive and Sentiment Analysis of Reactions to Insect-Based Foods in Japan on YouTube

Satoshi Fukuda, Emi Ishita and Hidetsugu Nanba

In recent years, although edible insects have been promoted as a sustainable protein source, public acceptance remains limited. This study investigated how insect-based foods are represented and perceived on YouTube, one of the most influential platforms shaping food discourse. We collected 3,534 videos and 108,495 comments written in Japanese, posted between 2018 and 2023, containing the keyword “insect-based food.” Using a large language model-based framework with YouTube video categories, we conducted (1) keyword extraction from video titles to identify content trends, (2) sentiment analysis of viewer comments, and (3) typological classification of positive and negative comments to reveal cognitive and emotional mechanisms. The analysis reveals that content themes and viewer responses differ depending on the video category, highlighting contextual diversity in how insect-based foods are represented and perceived.

Dense Reward Estimation for Decision Transformers Using Adversarial Inverse Reinforcement Learning

Kento Nojiri and Sachiyo Arai

In tasks with delayed rewards where many state–action pairs receive zero feedback, the Decision Transformer (DT) inherits this sparsity, resulting in nearly constant Return-to-Go (RTG) values during training. Such uniform RTG signals hinder accurate action evaluation and lead to unstable policy learning. To address this issue, we propose estimating dense rewards from expert trajectories using Adversarial Inverse Reinforcement Learning (AIRL) and relabeling the Return-to-Go (RTG) of each state–action pair accordingly. This increases the information density of action evaluation and stabilizes DT training. Experiments in the D4RL Hopper environment quantitatively demonstrate that RTG relabeling with AIRL-estimated rewards improves policy performance compared with conventional sparse or delayed reward settings.

Development of an Automated Animation Image Coloring System Based on Inclusion Matching

Tomoya Murata and Naoki Mori

Recent progress in generative AI has broadened the treatment of human-made creative media, including illustration and short animation. Nevertheless, studio pipelines still demand deterministic, segment-level flat coloring that adheres to color design sheets, which current diffusion-based and pixel-wise methods do not guarantee. We propose an automated animation image colorization system based on Inclusion Matching with a multi-reference framework that propagates colors from two reference frames to mitigate occlusion and deformation. The system also accommodates studio conventions by handling color-traced lines. Experiments on the PaintBucket-Character Dataset show improvements in both segment-wise and pixel-wise accuracy over single-reference baselines. A web-based application integrated into a production workflow received positive feedback from professional colorists and reduced manual workload, contributing to the automation of high-quality animation production.

Dynamic Allocation of Ad Slots on Web Pages Using Multi-Agent Negotiation

Md Azizur Rahman and Naoki Fukuta

Online advertising is an integral part of the digital world, yet optimizing it remains a significant challenge. The goal is not merely to display an ad, rather to present the right ad, on the right page, at the right time. However, many existing systems struggle to adapt to real-time market dynamics or to the continuously changing goals of advertisers and publishers. This lack of adaptability often results in missed opportunities, inefficient spending, and advertisements that fail to engage the intended audience. To implement this concept, we outline several key steps. First, we will design both advertiser and publisher agents, defining their objectives, strategies, and decision-making priorities. Next, we will develop a structured communication framework, a negotiation protocol, that ensures that each interaction is transparent, balanced, and efficient. Finally, we will construct a central system that enables agents to discover each other and engage in real-time negotiations. The effectiveness of the proposed approach will then be evaluated through extensive computer-based simulations

Explainable Clustering of Skeleton Time-Series: AIME-Driven Feature Contribution Analysis of Gait Styles

Kanato Murayama and Takafumi Nakanishi

Walking behavior is fundamental to good health, and recognizing one's own walking habits can help lead a healthy life. However, it is becoming increasingly difficult to objectively understand walking habits. However, the development of AI and machine learning models has made it easier to acquire time-series skeletal data in real time by capturing a video of a person using a camera, such as a smartphone. However, compared with acquiring time-series skeletal data by wearing sensors, there are problems of blur and missing values, which must be complemented before analysis. In this study, time-series skeletal data were obtained from walking videos of a group of users, adjusted by spline interpolation to resolve blur and missing values, and clustered by time-series k-means. This allows users to be grouped into similar categories. Furthermore, XAI technology can be used to extract features that contribute to a cluster. In this study, we used approximate inverse model explanations (AIME) to determine which features contributed to each cluster and simultaneously input the features as prompts into the Large Language Model (LLM) to allow the naming of walking styles. This study contributes to the application of explainable time-series clustering.

Find Your Story: Novel Retrieval through Imaginative Summary Embeddings

Futa Tajima, Yuto Funatsu, Runa Takeuchi, Kei Kimura, Kouta Kameoka and Takafumi Nakanishi

This study introduces Find Your Story, a novel retrieval framework that transforms readers' imaginative summaries into semantic vectors to discover both similar and contrasting literary works. The key feature of the proposed method is that the source data for the novel embeddings used in the search are not the novel text itself but rather reader reviews and summaries. This allows the user's natural language and emotional expressions to be mapped more directly in the vector space. Technically, we constructed a novel embedding database by automatically generating review-style summaries of Aozora Bunko works using an LLM and then performing embeddings via BERT. When a user inputs a summary of the novel they envision, we embed it and present nearby and opposite novels using similarity calculations. Compared to traditional keyword matching or full-text embedding methods, leveraging review-derived features enables the capture of emotional and structural similarities beyond mere lexical matches. In the experiments, because obtaining user reviews for each novel was impossible, we used text generated by a Large Language Model for verification. This approach excels at handling ambiguous user imaginings and emotional expressions and addressing "similarities in writing style and atmosphere" which are difficult for conventional novel search methods.

From Safety to Guidance: CBF-Augmented Reinforcement Learning with Guiding Barrier Function

Kento Nagata and Sachiyo Arai

This paper presents a framework that integrates Reinforcement Learning (RL) with Control Barrier Function (CBF) for autonomous navigation and extends it with a Guiding Barrier Function (GBF) to encode desirable regions. While CBF is often viewed as trading optimality for safety, we show that appropriately designed constraints can also accelerate learning. GBF complements CBF by actively guiding trajectories toward human-intent regions, thereby relaxing conservativeness without compromising safety. During training, RL+CBF+GBF reduces collisions and shortens the time to reach a target

success rate compared with RL alone or RL+CBF. During execution, GBF enables flexible selection among multiple safe trajectories (e.g., clockwise vs counterclockwise obstacle avoidance) using a single learned policy. Simulations on a unicycle obstacle-avoidance task demonstrate that the proposed method maintains safety while improving learning efficiency and enabling intent-aligned trajectory selection.

Hacking the Black Box: Prompt Injection for Visualizing LLM Reasoning as Graphs

Takumi Sugimoto, Hiryu Kimura, Yuhei Yamada, Tomoki Akiyama, Minato Hojo and Takafumi Nakanishi

Large Language Models (LLMs) have demonstrated remarkable versatility across diverse natural language processing tasks, including translation, summarization, dialogue generation, and reasoning. However, their internal inference mechanisms remain largely opaque, preventing users from understanding how conclusions are derived and undermining trust in critical domains such as education, healthcare, and decision support, where interpretability and accountability are essential. To address this transparency challenge, we propose a lightweight yet powerful framework that employs prompt injection to induce LLMs to explicitly output their own reasoning traces. These traces, comprising assumptions, intermediate deductions, and dependencies, are parsed and visualized as directed graphs, enabling step-by-step observation of the reasoning process. Unlike traditional explainable AI methods such as LIME or SHAP, which focus on feature attribution, our approach captures the sequential reasoning flow characteristic of generative models. By obtaining multiple reasoning traces for identical prompts and comparing their structural similarities, the framework enables quantitative assessment of reasoning stability and reproducibility. Experiments using Gemini 2.5 Flash Lite demonstrate successful externalization of reasoning paths and robustness against irrelevant information. This research advances AI interpretability, visual auditing, and educational understanding, ultimately bridging human and machine cognition for enhanced transparency and safety evaluation.

Improving Learning Performance of Decision Transformer via Attention-Based Reward Shaping

Yuta Ohno and Sachiyo Arai

Decision Transformer (DT) has emerged as a promising approach in offline reinforcement learning by reformulating sequential decision-making as a sequence modeling task. However, DT faces challenges in credit assignment, which involves determining which actions contribute to the final outcome. In such environments, the Return-to-Go (RTG) signal provides limited guidance for action selection at each time step, hindering the agent's ability to identify critical action sequences. This paper proposes a novel framework that integrates attention-based reward shaping into DT by estimating the contribution of each time step using the attention mechanism and generating dense reward signals. Specifically, we train a Transformer to predict sequence rewards and extract attention weights representing the contribution of each state-action pair. These contributions are used to construct dense reward signals through normalization, enabling more effective policy learning. We evaluate the proposed method on D4RL benchmark tasks under sparse reward settings and compare its performance with conventional DT approaches. The results demonstrate that attention mechanism-based reward shaping can effectively address credit assignment problems in sparse reward environments.

Interactive XAI through Dialogue: Leveraging Approximate Inverse Model Explanations and LLM Agents

Takafumi Nakanishi

Artificial intelligence (AI) models are extensively used in high-stakes decision-making; however, many operate as black boxes. Explainable AI (XAI), which ensures the reliability and fairness of these models, has become indispensable. Existing methods, including local interpretable model-agnostic explanations and Shapley Additive exPlanations, provide only static explanations, limiting user engagement and requiring expert intervention for deeper analysis. This study proposes a new XAI framework that enables “full interactivity” through natural language dialogue, allowing AI models to be explored from multiple perspectives and in depth. The framework combines approximate inverse model explanations (AIME), which can generate diverse explanations from a single infrastructure, with large language model agents that interpret user queries and autonomously invoke AIME functions as tools. This system supports a seamless analytical flow: from “confirming forecast results (What?)” to “asking questions about the basis for the forecast (Why?)” and “exploring remedial measures (What if?).” This study contributes to the democratization of XAI by enabling non-experts to achieve deep model understanding without requiring specialized AI knowledge. Consequently, the proposed framework can unlock interactive, domain-specific insights in contexts such as clinical decision support, financial risk assessment, and real-time autonomous control—areas where static post-hoc explanations have thus far fallen short.

Learning-Based Scene Selection for Autonomous Multi-Camera Video Editing

Yoshiharu Tanabe and Takafumi Nakanishi

In recent years, the ability to easily shoot multi-camera videos has become possible, and creators are burdened by the large amount of time spent editing these data. This study proposes a learning-based scene-selection framework for autonomous multicamera video editing. This method learns the editor's "selection from an extremely limited training dataset (33 scenes). Our framework consists of three stages: (1) extracting semantic features from video frames using OpenAI CLIP, (2) learning the editor's binary "Adopt/Reject" preferences using a Support Vector Machine (SVM), and (3) implementing a novel editing logic that applies this scene-level score to a frame-level selection process. As a result of the experiment, when the video work autonomously

generated by this framework was evaluated by a human, 79.66% of the scenes were judged as "Usable" (Usable Scene Ratio). Furthermore, this AI selection was statistically significant ($p < 0.0001$) compared to random selection. This research demonstrates that, even with extremely limited data, it is possible to autonomously generate practical-quality video edits that reflect human sensibilities.

Listening with Confidence: Bayesian Explainable AI for Understanding Musical Preferences

Yuki Kato and Takafumi Nakanishi

This study proposes a Bayesian explainable AI framework for analyzing individual musical preferences from acoustic features of cover songs. Building upon the Approximate Inverse Model Explanation (AIME), the proposed Bayesian-AIME introduces a probabilistic interpretation of feature importance by estimating posterior distributions and 95% credible intervals, thereby quantifying the reliability of explanations. A listener-annotated dataset of YouTube cover songs (liked/disliked) was analyzed using descriptors of loudness dynamics, spectral shape, and cepstral coefficients extracted using Essentia. The results revealed that the dynamic range and spectral shape moments (kurtosis and skewness) were consistently credible across posterior intervals, indicating that listeners prefer sounds with organized temporal and spectral variations rather than excessive loudness or irregular changes. Features such as spectral centroid (brightness) and MFCC/BFCC first coefficients showed coherent directions across feature families, suggesting a consistent dislike of harsh or peaky timbral changes. By integrating Bayesian inference with explainable inverse modeling, this approach not only improves explanation stability but also provides confidence-aware interpretability of musical preferences. This method demonstrates how credible intervals bridge quantitative audio descriptors and perceptual impressions, enabling more trustworthy and personalized music analyses.

Loss-Decoupled Training in Deep Image Classification: Co-optimization of Encoder and Classifier with Gaussian Mixture Model

Kataru Hara and Hironori Nakajo

This study proposes a new end-to-end learning framework for deep image classification, assuming that latent representations follow a Gaussian mixture distribution. In the proposed framework, the mean and variance of each class are directly optimized using stochastic gradient descent (SGD) while being aligned with the empirical statistics of the features. Conventional Gaussian mixture–based methods often require recalculating feature statistics after each SGD update or rely on two-stage optimization such as the expectation–maximization (EM) algorithm, making the training process complex. The proposed method, called Loss-Decoupled Training (LDT), divides the model into an encoder and a GMM classifier and assigns separate loss functions to each, thereby achieving both the formation of GMM-consistent feature distributions and statistical consistency. This enables the mean and variance parameters of the GMM classifier to be jointly optimized through SGD alone. Experiments on MNIST and Fashion-MNIST demonstrate that the proposed method achieves performance comparable to Softmax crossentropy on MNIST (98.78% vs. 98.82%) and maintains high classification accuracy on Fashion-MNIST (86.80% vs. 91.99%). The proposed framework provides a simple and easily implementable SGD-based foundation for deep classification models that explicitly incorporate Gaussian mixture modeling.

Mapping to Vector Representations Based on Distributed Semantics for Waka

Keigo Saito and Sanggyu Shin

This study presents a framework for mapping waka poems from the Japanese imperial anthologies known as the Nijūichidaishū (Twenty-One Anthologies) into vector representations based on distributional semantics, in order to evaluate the cultural proximity between anthologies at a macroscopic level. The original texts were first normalized and segmented while preserving phrase boundaries, and both tokenized and kana-based sequences were constructed. I compare three types of embeddings: (i) fastText pretrained on general-domain Japanese text, (ii) fastText retrained on the present waka corpus, and (iii) a shallow encoder model that applies residual intra-phrase convolution and inter-phrase self-attention over five layers to kana embeddings. Each poem is aggregated into a vector via the simple average of word (or character) embeddings, and anthology-level representations are defined as the centroid of poem vectors belonging to the respective source. Geometric structures among anthologies are analyzed through cosine similarity matrices and two-dimensional projections.

Multi-Agent Voltage Control for Efficient Regenerative Power Utilization in Railway Systems

Yuki Sano and Sachiyo Arai

The utilization of regenerative power for energy conservation in DC-electrified railway systems has attracted considerable attention. Generally, the catenary voltage is maintained within a specified range to prevent excessive increases caused by regenerative power. Although energy storage systems can be used to absorb excess energy, their installation is limited due to high costs. To address these issues, this study proposes a substation voltage control method in which multiple substations learn cooperative control strategies to jointly optimize their output voltages and the overall voltage distribution among trains, thereby effectively utilizing regenerative power according to train positions. The problem is formulated as a multi-agent system, where designing feedback mechanisms based on observations and rewards is a key challenge. The energy-saving effectiveness of the proposed method is verified through experiments under multiple reward design conditions.

Persona-Conditioned Online Firestorm Risk Detection　A Similarity-Based Approach with Switchable OUT/SAFE Exemplars

Ren Yamauchi, Yuki Fujimatsu, Jinyu Toida, Haruto Miyakawa, Haruto Ichikawa, Rei Oshima and Takafumi Nakanishi

Online firestorm risks on social networking services and online platforms often lead to severe reputational and economic damage to both organizations and individuals. Conventional toxicity classifiers detect inappropriate expressions through supervised training on annotated corpora but implicitly assume a universal definition of toxicity. However, the threshold for what constitutes an online firestorm-inducing statement varies significantly across communities, organizations, and even individuals, making a one-size-fits-all solution inadequate. Moreover, black-box classifiers usually provide binary predictions without clear explanations or actionable guidance. This study proposes a similarity-based online firestorm risk detection framework that enables a persona-conditioned evaluation. Specifically, we maintain two exemplar databases: an OUT database of online firestorm-inducing examples and a SAFE database of acceptable examples for the training data. Given an input, the system compares its embedding similarity to both databases and derives a margin-based risk score for the input. By switching or mixing the exemplar databases, the same text can be evaluated under different personas or organizational norms, providing a flexible and adaptive assessment. In addition, nearest-neighbor exemplars are presented as explanations, offering users transparent grounds for the decision and potential rewrite suggestions that can be made.

Predicting Groundwater Level Anomalies under Data Scarcity with LSTMs and Transfer Learning

Sarp Profeta, Ali Alsahag and Seyed Sahan Ziabari

Groundwater in Zuid-Holland faces increasing pressure from climate change and urbanization, exposing limits of traditional monitoring. Despite an extensive network, sparse and uneven observations hinder assessment of groundwater dynamics. We develop and validate an AI framework that combines Long Short-Term Memory (LSTM) networks with Transfer Learning (TL) to predict groundwater table depth anomalies (¥(wtd_a¥)) and quantify predictive uncertainty for operations. The approach partially freezes layers to transfer European-scale knowledge to local wells; integrates multi-source hydrometeorological predictors with systematic lag analysis; and employs Monte Carlo dropout and bootstrapped ensembles for uncertainty quantification. A 9-month input window is optimal, reflecting regional response times. Across wells, LSTM--TL outperforms baselines, achieving a statistically significant 5.96¥% RMSE reduction versus a standard LSTM (0.667 vs.¥ 0.710, ¥(p<0.05¥)) and substantially exceeding traditional models (ARIMA ¥(R^2=-0.451¥); Random Forest ¥(R^2=0.094¥)). Permutation analysis identifies regional groundwater anomalies and precipitation as the most informative predictors, and prediction intervals are well calibrated (95.7¥% coverage). The framework leverages data-rich European regions while preserving local sensitivity, provides 3--9 month lead times for proactive drought response, and addresses sparse-monitoring constraints in groundwater management.

Public Opinion Main Factors Extraction Method by Using Sentimental Analysis and Explainable AI and Its Application to Review Text Data for Star Wars

Akane Kikuchi and Takafumi Nakanishi

Generally, review comments on work contain both positive and negative opinions, and it is important to separate and analyze these opinions using sentiment analysis, which has been realized using machine learning techniques. However, if we can analyze why review comments are positive or negative, we can derive the global feature importance of positive opinions to identify the aspects of the movie that users find appealing and the global feature importance of negative opinions to identify the aspects that users find unappealing. This contributes to the aggregation of public opinions. In this study, we demonstrate a method that utilizes sentiment analysis and explainable AI to extract the main factors of public opinion and apply it to Star Wars review text data. Sentiment Analysis, Explainable AI, Approximate Inverse Model Explanations(AIME), Star Wars' Review Comments, Public Opinion Factor Extraction

Quantifying Function Simplicity by Arc Length: A Geometric Foundation for Explainable AI

Aimi Tozawa, Kei Murayama, Ryunosuke Oda, Nagi Yamaguchi and Takafumi Nakanishi

Human understanding of functions is inherently tied to geometric simplicity; linear or smoothly varying functions are intuitively easier to interpret, whereas highly　oscillatory or irregular functions appear complex and opaque. Modern AI models, however, often correspond to extremely nonlinear functions whose inner mechanisms are difficult to explain, giving rise to the so-called “black-box problem.” This study proposes a geometric approach to explainability, hypothesizing that functions with　shorter arc lengths are inherently more interpretable to humans. By generating 50,000 nonlinear functions and analyzing their arc-length distributions, we establish a robust threshold for distinguishing “simple” from “complex” functions. The results demonstrate a 14× median difference between the two groups, validating arc length as a quantitative indicator of human-understandable simplicity. This framework provides a theoretical foundation for developing explainable AI models that approximate black-box functions with geometrically simple surrogates. This study contributes to bridging mathematical geometry and human cognition, providing a new direction for designing inherently interpretable AI systems.

Real-Time Animation of User-Drawn Images via Smoothed Skeleton Time-Series Data

Yuhei Yamada and Takafumi Nakanishi

In recent years, there have been active efforts to map physical movements in the real world to a virtual space in real time and achieve seamless action

sharing. However, time-series skeleton data obtained using commercially available cameras and simple skeleton estimation algorithms often contain measurement noise and missing data points. When directly applied to a virtual space, this results in avatars or arbitrary images exhibiting unintended movement. In this study, we propose a method for driving arbitrary 2D images prepared in advance by the user in a virtual space while maintaining natural movement. This is achieved by smoothing and restoring the blur and missing values in the skeleton data acquisition stage using weighted moving averages and time-series interpolation, followed by bone mapping. The proposed method consists of four stages: (1) real-time skeleton acquisition using a monocular RGB camera, (2) missing value interpolation (linear interpolation), (3) adaptive smoothing, and (4) mapping to virtual space bones. This method enables users to freely move illustrations or character images prepared in advance in a virtual space synchronized with their own body movements, opening up a wide range of applications such as VR/VTuber streaming, remote communication, and physical rehabilitation support.

Reflective Feedforward for Trustworthy Human–AI Dialogue: Internal and Perceptual Alignment

Takashi Matsuura and Seiko Shirasaka

Large language models (LLMs) have often exhibited overconfidence and poor calibration between perceived and actual performance. In this study, the human evaluative input provided to the AI system was referred to as feedback, and the AI's reflective process of integrating that feedback into its subsequent responses was referred to as feedforward. Building upon a prior experimental study that compared feedforward and non-feedforward conditions, the question of how feedforward enhances the internal and perceptual alignment of AI self-evaluation was investigated. Qualitative self-reflection comments from the AI were coded into three categories—Reflection/Improvement, Collaboration/Contribution, and Conviction/Achievement—based on a feedback model of learning processes. Correlation analysis revealed that feedforward strengthened the internal coherence between the AI's linguistic and numerical self-evaluations, as well as their alignment with human evaluative descriptions. These findings suggest that feedforward supports the emergence of trustworthy AI behavior by fostering reflective synchronization between self-perception and human feedback.

Research on Pain Detection for Japanese by multimodal AI using basic devices

Shota Ando, Haruki Ueno, Yoko Tsukamoto and Hiroshi Komatsugawa

This paper proposes a multimodal AI model that detects pain in Japanese individual by using digitally acquired time-series data such as facial expressions and electrocardiograms (ECG). While pain is a critical indicator in clinical diagnosis, limited research to detect pain exists in Japan compared to other countries. This is probably due to the cultural background where Japanese tend to suppress facial expression of pain when feeling pain. In this study, we perform binary classification of pain, specifically focusing on a cluster of participants who exhibit minimal facial expressions of pain.

Simplification Principle for Adding Complexity in Multi-Layered Neural Networks

Ryotaro Kamimura

The present paper aims to demonstrate the existence of a simplification principle in neural networks as a simplified extension of our cognitive system. The simplification force cannot be easily detected, because some complexity in connection weights is necessary to make learning possible. However, we suppose that there are various types of simplification, and the combination of certain simplification forces can seemingly produce additional complexity. As a first approximation, we assume two types of simplification: collective and individual. The collective force aims to represent inputs across as many different components as possible, while the individual force aims to represent inputs as locally as possible. These two forces are typical examples of simplification forces, but they can be combined to produce complex effects. The proposed method was applied to artificial data containing both linear and non-linear inputs to explicitly demonstrate these different types of simplification. The results show that the collective and individual forces were effective in introducing some complexity. This combination revealed that input information was initially compressed and later decompressed. The seemingly complex behaviors of compression and decompression can thus be traced back to the existence of two fundamental simplification procedures: collective and individual.

Smart Edge-AI Framework for Finger Motion-Based Cognitive–Motor Assessment in Web Browsers

Sinan Chen, Atsuko Hyashi and Masahide Nakamura

The early detection of cognitive decline requires non-invasive and accessible tools that can quantitatively evaluate fine motor and cognitive–motor coordination in daily environments. Conventional finger-tapping tests often depend on dedicated sensors or manual observation, limiting their scalability and practicality. This study proposes a fully browser-native, privacy-preserving system for finger motion measurement that operates entirely on built-in cameras of personal computers and smartphones, without any external devices or cloud services. The system integrates a real-time hand landmark detection framework (MediaPipe Hands) with a lightweight JavaScript-based processing pipeline to capture and analyze both hands' movements during a tapping task presented within the browser. By combining real-time motion recognition, random stimulus presentation, and automatic CSV data export, the system enables immediate and reproducible evaluation of cognitive–motor performance. All computations, rendering, and data management are executed locally on the client side, ensuring full privacy protection and cross-platform operability. Experimental implementation confirms real-time performance (25–30~fps) and usability across multiple devices, establishing a foundation for scalable cognitive assessment and home-based healthcare applications. The

proposed framework represents a significant step toward ubiquitous, low-cost, and ethically responsible digital health technologies for cognitive screening and rehabilitation.

The Breath of Music: Quantifying How Pianists' Respiration Aligns with the Score

Ayako Minematsu and Takafumi Nakanishi

Breathing is often regarded as irrelevant to piano performance; however, it is where the expression begins. In this study, we reveal that even in a non-wind instrument, pianists unconsciously "breathe with the score." To make this hidden dimension visible and explainable, we digitized manually annotated respiration data from seven pianists performing four Chopin excerpts and aligned every inhalation, exhalation, and hold with score landmarks, such as slur boundaries and dynamic markings. Through enrichment analysis, multivariable logistic regression, and peri-event time histograms, we found that inhalation consistently peaked within ±1 beat of slur boundaries across performers, whereas dynamic cues showed weaker and highly individual effects. These findings expose a physiological trace of musical phrasing—two timing phenotypes, immediate and delayed inhalation—that characterize each performer's expressive fingerprint. Beyond revealing "where music breathes," this study establishes respiration as an interpretable and quantifiable feature of performance style, opening a new frontier for explainable performance analysis and pedagogy.

Towards Intelligent Document Processing: A Hybrid Generative Question Answering System with BERT-NER and Ontology-Based Context Enrichment

Muhammad Asri Safi'Ie, Nurul Firdaus and Andy Supriyadi

We built a Hybrid Generative Question Answering (RAG) system to get precise, reliable answers from unstructured PDF documents. Our approach combines deep semantic search with high-precision factual lookup, avoiding the pitfalls of a single retrieval method. First, our pipeline pulls text from PDFs using PyMuPDF. We then process this text in two ways: (1) using a BERT-NER model and regex to extract entities like persons and job history into an RDFLib Knowledge Graph (KG); and (2) indexing text chunks into a FAISS vector store using SentenceTransformers. At query time, the system retrieves context from both sources simultaneously, running SPARQL queries for facts and FAISS searches for context. We fuse these results and feed them to a generative Large Language Model (LLM), which synthesizes a single, coherent answer. We tested the system using an "LLM-as-a-Judge" on a question set generated from the extracted entities. The results showed our Hybrid QA System achieved 100% accuracy, confirming the RAG architecture successfully grounds the LLM to provide reliable answers based on the source document.

Towards Personalized Career Path Guidance: Integrating Personality Diagnosis with RAG-based Recommendation

Hiroto Tanaka, Toshihito Ikeya, Hiroki Takahashi, Yuzuki Okada and Takafumi Nakanishi

This study introduces an innovative AI-driven approach for recommending optimal undergraduate programs based on individual personality assessments. Traditional career guidance often depends mainly on academic performance or motivation, failing to fully consider students' personality traits and lifestyle preferences. Such limitations can lead to mismatches in program selection, decreased motivation, and even dropouts. To address this, the proposed system employs the Myers-Briggs Type Indicator (MBTI) framework in combination with Retrieval-Augmented Generation (RAG) technology. By analyzing responses to four core MBTI-based questions, the system identifies a student's personality tendencies and retrieves relevant university department information from a structured RAG database. This enables personalized and flexible recommendations aligned with each student's values and aspirations. A case study conducted across multiple faculties demonstrated the system's effectiveness in promoting satisfaction, learning engagement, and retention. The study highlights the societal significance of AI-based personality-oriented education, suggesting that such systems can contribute to more fulfilling academic and career paths. Furthermore, the proposed methodology has potential applications beyond university admissions, extending to career development and employment matching in future professional contexts.

Unpaired Image-to-Image Translation Problem via Epoch-by-Epoch Comparative using CycleGAN at Monet's Cataract Stage

Yuuki Oishi and Sanggyu Shin

This study tackles unpaired image-to-image translation, converting Claude Monet's late-period works created after the onset of cataracts back to the motifs and styles of his pre-onset phase. Using PyTorch's CycleGAN and pix2pix frameworks, we carefully selected 1,072 pre-onset works and 44 post-onset works, applying resolution normalization and preprocessing. We conducted loss-based evaluations on all fully processed works and compared both the outputs at different training iterations and the corresponding training-curve plots. Extending training improved color-gamut stability, compositional coherence, and readability; however, under a discriminator-dominant regime it also amplified side effects such as repetitive patterns, over-smoothing, and slight hue biases.