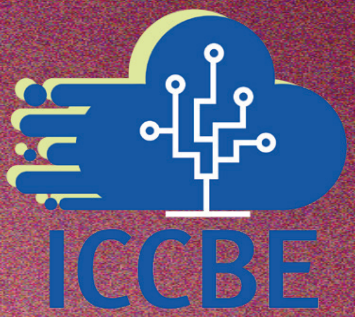


3rd International Conference on Computation, Big-Data and Engineering 2026

*

June 21-23, 2026
University of Guam, Guam

3rd International Conference on Computation, Big-Data and Engineering 2026

(ICCBE 2026)

Guam, USA
June 21-23, 2026

Organized by:

University of Guam, Guam
IEEE Tainan Section Sensors Council
International Institute of Knowledge Innovation and Invention (IIKII)

Welcome

Welcome to the 3rd International Conference on Computation, Big-Data and Engineering 2026 (ICCBE 2026). This conference is a collaboration among the University of Guam, the IEEE Tainan Section Sensors Council, and the International Institute of Knowledge Innovation and Invention (IIKII). It aims to provide an interdisciplinary forum for researchers and technologists in science and engineering.

ICCBE 2026 covers a broad spectrum of topics related to computation, big data, and engineering. The conference topics include Internet and IoT technology, communication science and engineering, computer science and information technology, computational science and engineering, big data applications, electrical and electronic engineering, mechanical and automation engineering, robotics and automation, additive manufacturing technology, smart manufacturing technology for Industry 4.0, applied mathematics and programming, and other related fields. Through these diverse areas, the conference aims to provide an international platform for researchers, engineers, and professionals to exchange scientific, technical, and management perspectives. ICCBE 2026 particularly encourages innovative ideas, emerging technologies, practical applications, and high-quality research outcomes that contribute to academic advancement and industrial collaboration.

ICCBE 2026 received a total of 183 submissions, with 92 papers selected and registered for presentation. Participants represent 12 countries and regions, including Australia, China, Ecuador, India, Japan, South Korea, Malaysia, the Russian Federation, Singapore, Taiwan, the Philippines, and Turkey. The accepted papers are organized into 12 Regular Sessions and 5 Invited Sessions, covering a broad range of topics. We believe this conference will serve as a strong beginning for building international academic and industrial networks in science and engineering.

I would like to express my sincere appreciation to all authors, reviewers, and committee members for their valuable contributions. May ICCBE 2026 bring you insightful discussions, meaningful exchanges, and new professional connections.

Once again, welcome to ICCBE 2026!

Prof. Cheng-Fu Yang, Ph. D.
Department of Chemical and Materials Engineering,
National University of Kaohsiung, Taiwan
Conference Chairman of ICCBE 2026
June 23, 2026

Conference Topics

Regular

A. Internet & IOT technology
B. Communication Science & Engineering
C. Computer Science & Information Technology
D. Computational Science & Engineering
E. Big-data application
F. Electrical & Electronic Engineering
G. Mechanical & Automation Engineering
H. Robotics and Automation
I. Additive Manufacturing Technology
J. Smart Manufacturing Technology for Industry 4.0
K. Applied Mathematics and programing
L. Others

Invited Session

IV1. AIoT and Big Data–Driven ESG Sustainability for Smart Cities and Intelligent Industries
IV2. Human-Centric Artificial Intelligence: Intelligent Systems, Interactive Technologies, and Secure, Sustainable, and Enterprise-Oriented Applications
IV3. Human-Centric Artificial Intelligence: Intelligent Systems, Interactive Technologies, and Secure, Sustainable, and Enterprise-Oriented Applications
IV4. Digital Learning and Innovative Technology Applications
IV5. Multidimensional Fusion and Evolution of AIoT in Digital Life Applications

Content

Organizers

University of Guam, Guam

IEEE Tainan Section Sensors Council

International Institute of Knowledge Innovation and Invention (IIKII)

Sponsors

National Penghu University of Science and Technology, Taiwan

Asia IoT Alliance

Committees

Honorary General Chairs:

Dr. Anita Borja Enriquez, President of University of Guam

Prof. Yo-Ping Huang, President of National Penghu University of Science and Technology, Taiwan

Prof. Li Jin, Director of Scientific Research and Development Office, and Executive Director of Institute of Artificial Intelligence of Guangzhou University GZU), China

Conference Chairs:

Prof. Teen-Hang Meen, National Formosa University, Taiwan
Prof. Cheng-Fu Yang, National University of Kaohsiung, Taiwan
Prof. Dr. Lim Chee Peng, Deakin University, Australia
Prof. Dr. Tan Kim Hua, Nottingham University, United Kingdom
Prof. Dr. Andrew Teoh Beng Jin, Yonsei University, South Korea
Prof. Lawrence Y. Deng, Executive Director of Lanyang Campus, Tamkang University, Taiwan
Dr. Wei Chien, Vice President of Technology, Ningde Qianwei New Energy Group Co., Ltd, China

Program Committees:

Mr. Carlos R. Taitano, Director of Global Learning & Engagement, University of Guam
Prof. Jenn-Kai Tsai, National Formosa University, Taiwan
Prof. Tian-Chiuan Wu, National Formosa University, Taiwan
Prof. Yu-Pin Luo, National Formosa University, Taiwan
Dr. Kuo-Hsien Lee, Chairman of AIoTA, Taiwan
Assoc. Prof. Chun-Yu Hsiao, Tatung university, Taiwan
Prof. Dr. Fathe Jeribi, Jazan University, Saudi Arabia
Prof. Dr. Foued SAADAOUI, Université Internationale de Rabat Technopolis, Morocco
Prof. Dr. Ashish Jani, Navrachana University, India
Assoc. Prof. Dr. Korhan Cengizm, Istinye University, Istanbul, Turkey
Assoc. Prof. Dr. Rubee Singh, GLA University, Delhi India
Assoc. Prof. Dr. Waleed M.Ead, Al Baha university, Saudi Arabia
Prof. Shang-Te Tsai, Taiwan Digital Cultural and Creative Development Association, Taiwan
Mr. Yu-Cheng Chang, Lecturer, Lunghwa University of Science and Technology, Taiwan

International Liaison Committees:

Dr. Farhad Pourpanah, Queen's University, Canada
Reader Dr. Li Zhang, University of London, United Kingdom
Dr. Teo Tee Hui, Singapore University of Technology and Design (SUTD), Singapore
Prof. Dr. Srinivasan Natesan, Indian Institute of Technology (IIT) Guwahati, India
Prof. Dr. Bhupinder Singh, Sharda University, India

Sessions

Regular

A. Internet & IOT technology
B. Communication Science & Engineering
C. Computer Science & Information Technology
D. Computational Science & Engineering
E. Big-data application
F. Electrical & Electronic Engineering
G. Mechanical & Automation Engineering
H. Robotics and Automation
I. Additive Manufacturing Technology
J. Smart Manufacturing Technology for Industry 4.0
K. Applied Mathematics and programing
L. Others

Invited Session

IV1. AIoT and Big Data–Driven ESG Sustainability for Smart Cities and Intelligent Industries
IV2. Human-Centric Artificial Intelligence: Intelligent Systems, Interactive Technologies, and Secure, Sustainable, and Enterprise-Oriented Applications
IV3. Human-Centric Artificial Intelligence: Intelligent Systems, Interactive Technologies, and Secure, Sustainable, and Enterprise-Oriented Applications
IV4. Digital Learning and Innovative Technology Applications
IV5. Multidimensional Fusion and Evolution of AIoT in Digital Life Applications

Executive Committee Members

Honorary Chairman

Dr. Anita Borja Enriquez

President,
University of Guam

Honorary Chairman

Dr. Sharleen Santos-Bamba

Senior Vice President and Provost,
University of Guam

Program Committee

Mr. Carlos R. Taitano

Director,
Global Learning and Engagement,
University of Guam

Executive Committee Members

Support Specialist

Ms. Alyanna Ciarra L. Bantugan

Administrative Support Specialist,
Global Learning and Engagement,
University of Guam

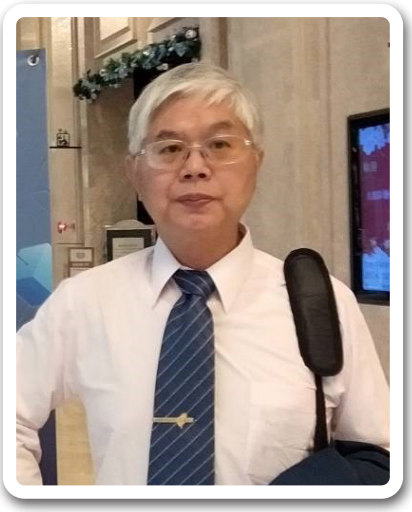
Publication Chairman

Prof. Teen-Hang Meen

Lifetime Distinguished Professor,
Department of Electronic Engineering,
National Formosa University, Taiwan

Chair of IEEE Tainan Section Sensors Council

President,
International Institute of
Knowledge Innovation and Invention (IIKII)



Conference Chairman

Prof. Cheng-Fu Yang

Professor,
Department of Chemical and Materials Engineering,
National University of Kaohsiung, Taiwan

Fellow,
The Institution of Engineering and Technology (IET)

Honorary Chair Professor,
Chaoyang University of Technology, Taiwan

Executive Committee Members

Program Committee

Dr. Kuo-Hsien Lee

Chairman,
AIoTA, Taiwan

Conference Chairman

Dr. Wei Chien

Vice President of Technology,
Ningde Qianwei New Energy Group Co., Ltd, China

Assistant Professor,
Department of Electrical Engineering,
Tatung university, Taiwan

Program Committee

Mr. Yu-Cheng Chang

Lecturer,
Lunghwa University of Science and Technology, Taiwan

Keynote Speaker

Assoc. Prof. Liu Wenting

Head,
Artificial Intelligence for Business Programme
School of Business,
Singapore University of Social Sciences, Singapore

Mining ESG Trajectories: Time-Series Clustering, Big Data Analytics, and the Architecture of Responsible AI-Driven Sustainability Governance

ESG analytics has a measurement problem — and AI is about to make it worse. Corporate sustainability data spanning over 12,000 firm-year observations, 10 ESG sub-categories, and two decades of S&P 1500 records possesses structural properties that engineers recognise immediately: high dimensionality, temporal dependency, label noise from voluntary disclosure, and distribution shift across regulatory regimes. Yet dominant practice collapses all of this into an annual score, discarding nearly all the information that matters. When AI systems are trained on such data, they inherit and amplify its flaws at scale. This keynote argues that the ESG data and AI governance crisis is, at its core, an engineering problem — and that solving it requires the methods and standards of this community.

The talk proceeds in three movements. First, we diagnose the structural failures of current ESG measurement — snapshot bias, proxy-driven scoring, and rating divergence of up to 60% across major providers — and establish why these are data engineering failures, not merely reporting problems. Second, we present empirical evidence from a large-scale time-series clustering study as a worked example of what better computational methods reveal. Applying and benchmarking three algorithmic approaches — Euclidean k-means, Dynamic Time Warping Barycentric Averaging (DBA) k-means, and SoftDTW k-means — to 12,353 firm-year observations across 2003–2022, we identify three archetypal ESG trajectory clusters that static scores cannot detect. The results expose what we term the "ESG trap": under short-term earnings pressure, firms systematically optimise ESG scores rather than ESG outcomes, a distortion amplified by executive pay concentration and moderated by CEO overconfidence. Critically, the choice of clustering algorithm is itself a governance decision — different distance metrics produce different firm classifications, with direct consequences for capital allocation and sustainability

accountability. Third, we examine the engineering implications for Responsible AI deployed in ESG contexts: from data pipeline integrity and model interpretability through decision-system design and downstream impact auditing, including the novel governance risks posed by large foundation models trained on noisy ESG disclosures.

The keynote closes with a call to the computing and engineering community to treat ESG AI infrastructure as safety-critical: building temporal, auditable data pipelines; demanding interpretable and trajectory-aware models; and establishing lifecycle governance standards where measurement integrity, algorithmic accountability, and human oversight are first-class design requirements — not post-hoc additions.

Keywords: Time-series clustering, Dynamic Time Warping, ESG analytics, big data, Responsible AI, sustainability governance, k-means, SoftDTW, CEO overconfidence, algorithmic accountability

Keynote Speaker

Prof. Chi-Fang Huang

Chair Professor,
Tatung University, Taipei, Taiwan

Electrical Characteristics Analysis Technology of High-Speed Interconnects - an Academic Subject Based on Industry

As for interconnection technology for electrical signal transmission, it has been seen as a kind of pure mechanical components, for the purpose of connecting board to board or system to system, etc. Electrical connectors is a broad industry in terms of applications.

Nowadays, the requirement of mechanical connection guarantee of connectors is not being changed at all, yet they have been became to be electrical passive components one way or the other, because the frequencies and data rates through the digital connectors are much, much higher than ever before, and the electromagnetic phenomena have been obviously and dominatively raised.

Actually, electrical connector industry has always been led by industry itself, and seems not so familiar to academics. However, when it comes to be an industry of passive electromagnetic components, especially, a sort one involved in high-frequency/high-speed, industry does need the help from academy. Especially, the techniques and theories of measurement and analysis are needed to be well developed from academy, since they are fully based on the electromagnetics.

In this speech, practical experience of collaboration from Tatung University and Taiwan connector industry is addressed. Detailed results in projects are displayed and explained.

Conference Agenda

Conference schedules are listed in Local Standard Time (GMT+10:00, Guam)

Venue: University of Guam **Language:** English

Pre- Conference		
Sunday, June 21, 2026		
08:30	17:00	Sponsor Showcase
Pre- Conference		
Monday, June 22, 2026		
08:30	17:00	Sponsor Showcase
Main Conference		
Tuesday, June 23, 2026		
08:30	09:00	Welcome Reception& Registration
09:00	09:30	Opening Ceremony
09:30	10:00	Coffee Break
10:00	10:50	Keynote Speech: Associate Professor Liu Wenting
10:55	11:45	Keynote Speech: Prof. Chi-Fang Huang
11:50- 13:20 Lunch Break		
14:00	17:00	Oral Presentation& Poster Presentation (In-person)
14:30	15:30	Coffee Break
14:00	17:00	Virtual Oral Presentation& Poster Presentation (Remote)
18:00	20:00	Conference Banquet & Closing Ceremony

Guidelines

1. Official Languages
   The official language of ICCBE 2026 is English. All presentations including Q&A should be delivered in English.

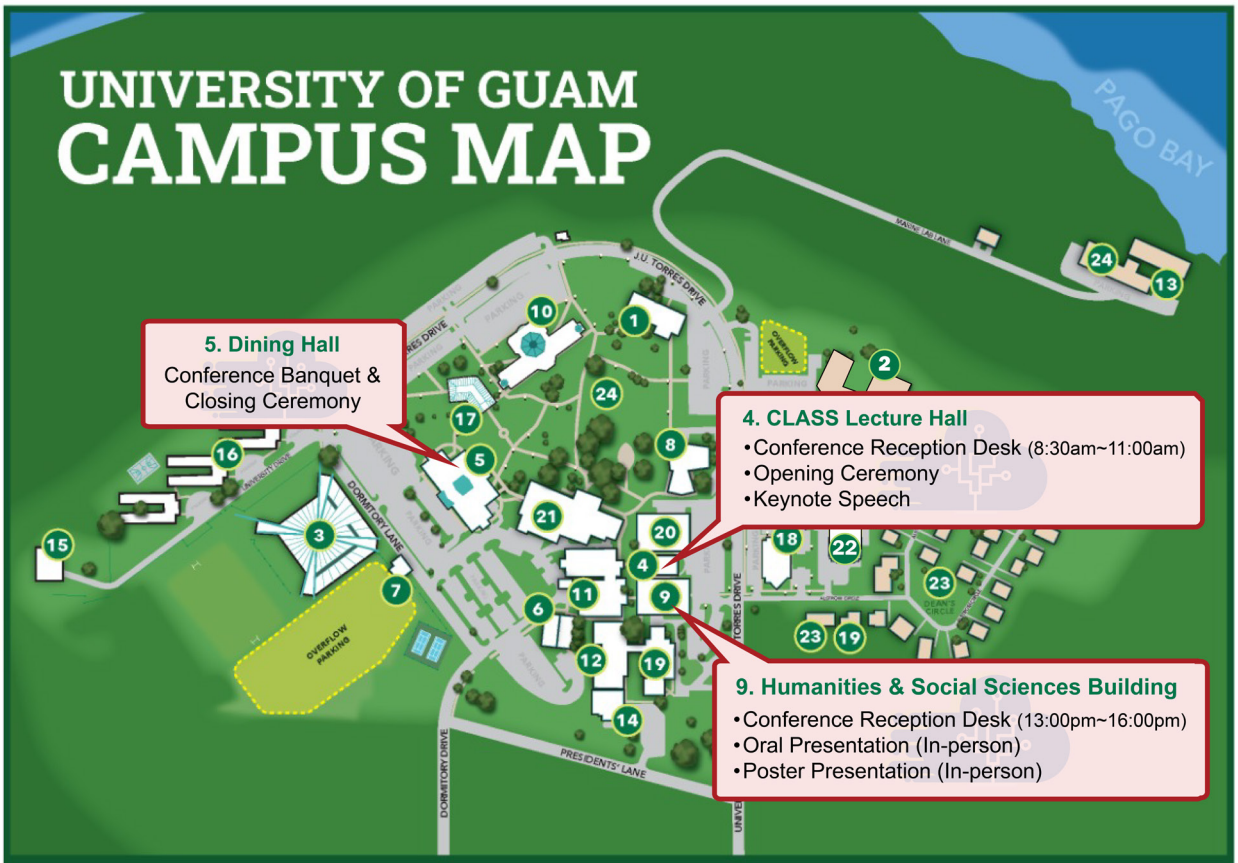
2. Guideline for Participants
   2.1. Conference Venue
   University of Guam, Guam
   (303 University Drive, UOG Station, Mangilao, GU, 96923)
   2.2. Registration
   Time of Registration:
   09:00~ 13:00, June 23, 2026 (UTC/GMT +10)
   2.3. Conference Kit
   Conference kit, which contains final program and name badge, will be provided to participants during check-in at the Registration/Information Desk.

3. Guidelines for Presenters
   3.1. The presenters and session chairs are asked to keep to the paper sequence as shown in the Final Program. By following this predefined schedule, participants can switch between sessions without missing any particular papers of interest.
   3.2. The presentation time for each oral presenter is 15 minutes. The session chairs will allow the presenter 12 minutes for presentation and 3 minutes for discussion. Presentation time for each poster presenter is 60 minutes.
   3.3. It is required that the presentation language of ICCBE 2026 papers is in English.
   3.4. Notebook PCs and LCD projectors will be available in every session room. Presenters are urged to prepare their files in MS PowerPoint format on a USB and copy the Conference into the PC at the session room before the session begins. Our session aids will assist the presenters to copy any relevant files. If you wish to use your own notebook PC, please be prepared to open the file before your presentation time.
   3.5. Please contact the Conference Secretary Desk, the session chairs, or any of the session aids if there are any special requests which might require special and unexpected attention.

Venue

University of Guam, Guam

303 University Drive, UOG Station, Mangilao, GU, 96923



1. **Administration Building**
   - Bursar's Office
   - Business Office
   - Cashier
   - Human Resources Office
   - Procurement Office
2. **Agriculture & Life Sciences Building**
   - Innovation Research Center
   - Dean's Office, College of Natural & Applied Sciences
   - UOG Land Grant
   - UOG Extension
3. **Calvo Field House**
   - Triton Athletics
   - Triton Athletics Hall of Fame Room
   - Triton Fitness Center
4. **CLASS Lecture Hall**
5. **Dr. Lucio C. Tan Student Success Center** (NEW BUILDING)
   - Admissions & Records
   - Dining Hall
   - Financial Aid Office
   - Graduate Admissions
   - Student Government Association
   - Student Health Services
   - Student Life Center
   - TRIO Programs
   - Tritons Cove
   - Triton Advising Center
   - Triton One-Stop Center
   - Triton Store
   - University Advancement Office
   - Wellness and Counseling Center
6. **GLE Annex A & B**
7. **GLE Deskubre Center**
   - UOG Post Office
8. **Fine Arts Theatre**
9. **Humanities & Social Sciences Building**
   - Dean's Office, College of Liberal Arts & Social Sciences
10. **Jesus & Eugenia Business & Public Administration Building**
    - Café Sirena
    - Center for Entrepreneurship & Innovation
    - Dean's Office, School of Business & Public Administration
    - Guam APEX Accelerator
    - Office of the President
    - Office of the Senior Vice President & Provost
    - Pacific Small Business Development Center Network
    - Regional Center for Public Policy
11. **MARC / Computer Center**
    - Office of Information Technology (OIT)
    - Global Learning & Engagement (GLE)
    - Richard F. Taitano Micronesian Area Research Center (MARC)
    - UOG Press
12. **Margaret Perez Hattori-Uchima School of Health**
13. **Marine Laboratory**
14. **Nursing Annex** (NEW BUILDING)
15. **Plant Maintenance**
    - Facilities Maintenance & Services
16. **Residence Halls**
    - Dorm 1 - *UOG Army ROTC*
    - Dorm 2 - *Iya-Hami Hall*
    - Dorm 3 - *Guma'ta Hall*
    - Residence Halls Office
17. **School of Education**
    - Dean's Office, School of Education
18. **School of Engineering** (NEW BUILDING)
19. **Science Building**
20. **Tan Lam Pek Kim English & Communication Building**
21. **Tan Siu Lin Building**
    - Robert F. Kennedy Memorial Library
22. **Water & Environmental Research Institute (WERI)** (NEW BUILDING)
23. **Dean's Circle**
    - CEDDERS, CIS / Sea Grant, COLL, ORSP, RCUOG
24. **Center Courtyard**

Onsite Paper Schedule

Tuesday, June 23, 2026
(University of Guam, UTC/GMT +10 hours)

Onsite Oral Paper Sessions

	Session A	Session B	Session C
14:00 | 15:00	A1	B1	C1
	P260004-IV5	P260047-G	P260053-E
	P260007-IV5	P260006-H	P260054-E
	P260008-IV5	P260018-J	P260055-E
	P260010-IV5		P260081-E
15:00 | 16:00	A2	B2	C2
	P260011-IV2	P260014-C	P260078-IV1
	P260012-IV2	P260022-C	P260110-IV1
	P260013-IV2	P260048-C	P260111-IV1
	P260030-IV2	P260049-C	
16:00 | 17:00	A3	B3	
	P260117-IV2	P260057-C	
	P260143-IV2	P260051-D	
	P260163-IV4	P260079-D	

Onsite Poster Paper Sessions

14:00—15:00	15:00—16:00	16:00—17:00
P260026-C	P260058-E	P260071-IV3
P260050-C	P260089-F	P260169-IV3
P260186-D	P260177-H	P260159-IV4

Online Paper Schedule

Tuesday, June 23, 2026 (UTC/GMT +10 hours)

Online (Remote) Oral Paper Sessions

(ZOOM Meetings)

14:00—15:00	15:00—16:00	16:00—17:00
Session D		
D1	**D2**	**D3**
P260070-A	P260123-C	P260150-C
P260028-C	P260133-C	P260151-C
P260090-C	P260145-C	P260149-IV1
P260114-C	P260148-C	P260072-J
Session E		
E1	**E2**	**E3**
P260075-D	P260005-IV2	P260041-L
P260120-D	P260155-IV2	P260115-L
P260156-D	P260168-IV2	P260121-F
P260167-D	P260165-IV4	

Online (Remote) Poster Paper Sessions

13:00—14:00	14:00—15:00	15:00—16:00	16:00—17:00
P260176-A	P260180-D	P260062-H	P260073-IV3
P260116-B	P260118-D	P260063-H	P260074-IV3
P260147-B	P260119-D	P260066-IV1	P260184-IV3
P260154-B	P260144-D	P260088-IV1	P260044-IV4
P260031-C	P260153-D	P260100-IV1	P260161-IV4
P260033-C	P260037-E	P260064-IV2	P260009-IV5
P260107-C	P260152-E	P260099-IV2	P260095-L
P260178-C	P260065-G	P260164-L	P260097-L

Paper Abstracts

https://www.iccbe.asia/abstract

Contact Us

Email: office.iccbe@gmail.com

P260004

Research on the Development of E-Government under Artificial Intelligence

Tsai-Hua Kang[1,a], Po-Hsiang Chen[2,b], Wei Chien[3,c] and Tzu-Yin Lin[1,d]

[1]Department of Electronic Engineering, Asia Eastern University of Science and Technology
[2]Department of Electrical and Computer Engineering, Tamkang University
[3]Department of Electrical Engineering, Tatung University

[a]shaka.kang@gmail.com, [b]phchen@mail.tku.edu.tw, [c]air180@seed.net.tw,
[d]114104256@mail.aeust.edu.tw

Corresponding author: Po-Hsiang Chen, phchen@mail.tku.edu.tw

Keywords: E-Government, Artificial Intelligence

Abstract:

Due to the rapid development of artificial intelligence technology, government agencies are actively planning to apply artificial intelligence to various government tasks. As the public's demand for government information and services increases, traditional government organizations and structures can no longer meet the needs of modern people. In the near future, modern governments will use artificial intelligence technology to redefine the role of government and e-government.

P260005

A Human-Centric Intelligent System for Sleep Enhancement: Real-Time EEG-Driven Personalized Aromatherapy

Chien-Yu Lu[1,a], Wei-Zhen Su[1,b], Chin-Wen Liao[1,c] and Yu-Cheng Liao[1,d]

[1]National Changhua University of Education, Taiwan, R. O. C.

[a]lcy@cc.ncue.edu.tw, [b]d1231018@mail.ncue.edu.tw, [c]tcwliao@cc.ncue.edu.tw, [d]tobliao@cisco.com

Corresponding author: Yu-Cheng Liao, tobliao@cisco.com

Keywords: Human-Centric AI, Real-Time EEG, Sleep Quality, Adaptive Aromatherapy, Signal Processing

Abstract:

Conventional interventions for sleep disorders often lack the adaptability required to address individual physiological variability. To address this limitation, this study presents a human-centric intelligent system that leverages real-time biological feedback for personalized sleep enhancement. The proposed closed-loop architecture integrates a wearable single-channel EEG sensor with an IoT-enabled aromatherapy delivery unit. Using a lightweight machine learning algorithm, the system analyzes EEG power spectral density—specifically Alpha and Delta wave activity—to detect the transition from wakefulness to sleep. Based on real-time physiological states, the system dynamically selects and releases specific essential oils, such as Lavender for sedation or Bergamot for stress reduction. Experimental results demonstrate that the system classifies sleep stages with high accuracy and low latency. Comparative user studies further indicate a measurable reduction in sleep onset latency against non-adaptive control groups, validating the efficacy of bio-signal-driven environmental control in promoting sleep hygiene.

P260006

Design of a Mobile Robot Control Method Based on Brainwave Signals

Chun-Chieh Chan[1,a], Chen-Yi Wang[1,b], Dimas Farhan Nugroho[2,c] and Ya-Yun Hsiao[3,d]

[1]Department of Computer Science and Information Engineering, National Formosa University, Yunlin, Taiwan

[2]Department of Mechatronics Engineering, State Polytechnic of Batam, Kepulauan Riau, Indonesia

[3]Department of Medical Imaging and Radiological Sciences, Chung Shan Medical University, Taichung, Taiwan. Department of Medical Imaging Chung Shan Medical University Hospital, Taichung, Taiwan

[a]ccchan@nfu.edu.tw, [b]11263142@nfu.edu.tw, [c]difanu@gmail.com, [d]yhsiao@csmu.edu.tw

Corresponding author: Chun-Chieh Chan, ccchan@nfu.edu.tw

Keywords: EEG, Brain–Computer Interface, Empirical Mode Decomposition, Machine Learning, Mobile Robot Control

Abstract:

This paper explores the potential of developing a mobile robot control method based on human brainwave activity supported by empirical mode decomposition (EMD) and various machine learning techniques. The brainwave signals are acquired using a low-cost single-channel electroencephalogram (EEG) device. Due to the nonstationary and nonlinear characteristics of EEG signals, EMD is employed to decompose raw signals into intrinsic mode functions (IMFs), from which features are then extracted using the Hilbert-Huang transform, the Hjorth parameters, and statistical features. Support vector machine (SVM) and artificial neural network (ANN) classifiers are trained to recognize attention states. Experimental results demonstrate that the ANN achieves an offline classification accuracy of 98.13%, outperforming the SVM model (96.9%) by 1.23%. The classification results are communicated to a mobile robot through a network interface, allowing real-time motion control. The proposed framework verifies the feasibility of integrating low-cost EEG devices, advanced signal processing, and machine learning for brain–computer interface (BCI)-based robotic control.

P260007

Integrating microprocessor and sensing technology in a non-traditional mouse input interface design

Wan-Shing Yang[1,a], Chiung-Liang Chen[1,b] and Shiuan-An Chin[1,c]

[1]Asia Eastern University of Science and Technology

[a]ff044@mail.aeust.edu.tw, [b]clchen@mail.aeust.edu.tw, [c]111104215@mail.aeust.edu.tw

Corresponding author: Wan-Shing Yang, ff044@mail.aeust.edu.tw ; Chiung-Liang Chen, clchen@mail.aeust.edu.tw

Keywords: Mouse Operating Interface, MEMS, Microprocessor Computing Technology, Human-Computer Interaction

Abstract:

With the popularization of information technology, computers have become a core tool in modern life and work. As the primary and most intuitive input device, the mouse, currently available on the market, mostly adopts a fixed shell design, the size and curved structure of which may not conform to the hand characteristics of different users. Prolonged high-frequency operation in an inappropriate grip posture may increase pressure on the median nerve in the wrist, leading to musculoskeletal discomfort related to repetitive movements, affecting work efficiency and health. This paper implements a novel computer mouse operating interface system that uses sensing technology to replace the physical structural limitations of traditional physical mice, constructing a wearable or non-contact input architecture. Users can complete cursor control and clicking operations with a natural and relaxed hand posture. The research method integrates micro-electro mechanical Systems (MEMS) and microprocessor computing technology to establish a motion recognition module to capture hand spatial motion signals. Through data acquisition, real-time signal filtering, and feature value analysis, the raw dynamics are converted into corresponding coordinate displacements and command events, and output as digital signals recognizable by the computer system, thus realizing a human-computer interaction mode that is not based on the traditional mouse. Experimental results show that the system operates stably in a natural posture and effectively reduces wrist load and subjective discomfort. The research findings, combining ergonomic principles with microelectronic sensing technology, aim to reduce occupational injuries caused by repetitive tasks and lay the foundation for the development of next-generation health-oriented input interfaces, possessing potential value for both academic research and practical applications.

P260008

Patient Medical Care System with Two-dimensional barcodes

Sung-Shiou Shen[1,a] and Shih-Wei Lin[2,b]

[1]Department of Electronic Engineering, College of Information and Communication Science, Asia Eastern University of Science and Technology

[2]Department of Computer Science and Information Engineering, College of Engineering, HungKuo Delin University of Technology

[a]3shubert@mail.aeust.edu.tw, [b]shihwei@mail.hdut.edu.tw

Corresponding author: Shih-Wei Lin, shihwei@mail.hdut.edu.tw

Keywords: QR codes, Medical Care System, Telecare, Internet of Things (IoT)

Abstract:

Currently, medical clinics and centers use QR codes printed on patient medication bags to allow pharmacists to verify that the medication matches the prescription. Patients can then take the medication as instructed based on the names and quantities printed on the bag. However, for the elderly, the information on the medication bag alone is insufficient to alleviate difficulties in identifying medications and dosages, let alone clearly conveying medication information. Some patients even lose the ability to clearly remember their medication information after a few days.

To address these medication problems, the existing QR code functionality should be extended to include prescription information for each patient. The system should create a table with photos of the medications and the corresponding dosage and timing noted on the prescription. This table should include the patient's serial number, doctor's information, date of visit, and detailed information and photos of the prescription. This data should be used to create a database and generate a website URL for online access. A QR code should be generated from this data and printed on the patient's medication bag cover. After caregivers return home, they can scan a QR code with their mobile phones. The system will then display the patient's medical bill and the name, photo, and dosage of the medication that must be taken at the current time. This avoids the difficulty of having to confirm the medication and dosage. Caregivers can obtain the relevant information simply by knowing the QR code, which is relatively simple and accurate. On the other hand, the data itself only conveys medication information specific to the patient, and other personal information of the patient is not displayed, which can ensure the protection of privacy.

P260009

Microwave Imaging via Contrast Source Inversion Enhanced by Convolutional Neural Networks

Tsai-Hua Kang[1,a], Tzu-Yin Lin[1,b], Bo-Yu Shi[2,c], Chien-Ching Chiu[2,d] and Po-Hsiang Chen[2,e]

[1]Asia Eastern University of Science and Technology

[2]Tamkang University

[a]ff046@mail.aeust.edu.tw, [b]114104256@mail.aeust.edu.tw, [c]613440212@o365.tku.edu.tw, [d]chiu@mail.tku.edu.tw, [e]phchen@mail.tku.edu.tw

Corresponding author: Po-Hsiang Chen, phchen@mail.tku.edu.tw ; Chien-Ching Chiu, chiu@mail.tku.edu.tw

Keywords: Microwave imaging, Inverse scattering, Contrast source inversion, Convolutional neural networks

Abstract:

This paper presents a novel hybrid approach to microwave imaging reconstruction by integrating Contrast Source Inversion (CSI) with Convolutional Neural Networks (CNN). The proposed method leverages the physical modeling capabilities of CSI to produce an initial estimate of the permittivity distribution from measured scattered field data. This preliminary reconstruction is subsequently refined using a CNN, which improves spatial resolution and suppresses artifacts. By combining the strengths of model-based inversion and data-driven learning, the proposed framework yields superior reconstruction quality compared to traditional methods. Experimental results confirm its effectiveness in generating high-resolution microwave images under challenging conditions.

P260010

Development of an LPWAN-Based Mobile Sensing Network for High-Resolution Air Quality Monitoring in Healthcare Environments

Chiung-Liang Chen[1,a] and Wan-Shing Yang[1,b]

[1]Department of Electronic Engineering, Asia Eastern University of Science and Technology, New Taipei, Taiwan, R.O.C.

[a]clchen@mail.aeust.edu.tw, [b]ff044@mail.aeust.edu.tw

Corresponding author: Chiung-Liang Chen, clchen@mail.aeust.edu.tw

Keywords: LPWAN, Mobile Sensing Network, Air Quality Monitoring (AQM), Environmentally Sensitive Groups, Low-Interference Communication

Abstract:

As PM2.5 has become a leading global health risk factor with strong clinical links to cardiovascular and respiratory exacerbations, medical institutions face significant challenges in environmental protection. Traditional stationary monitoring stations often fail to cover mobile pollution hotspots and monitoring blind spots, leaving healthcare facilities in a passive state when assessing the exposure risks of environmentally sensitive groups. This research implements a high-resolution Mobile Long-Range Air Quality Monitoring System designed to overcome limitations in distance, power, and deployment. Utilizing Low-Power Wide-Area Network (LPWAN) technology, the system leverages high penetration, long-range capabilities, and low-interference characteristics to construct a mobile sensing network. This architecture ensures stable data transmission without disrupting precision medical equipment, allowing environmental data to transition dynamically with patient movement for seamless visibility.

The study integrates microelectronic sensing with wireless communication to establish a comprehensive data workflow. By combining professional-grade sensing modules with microprocessor control boards, multi-parameter pollutants are converted into data packets via serial protocols. The system optimizes long-range transmission to achieve stable, low-interference data flow even under complex architectural shielding. Data is managed through time-series databases and integrated with a real-time visualization interface to provide intuitive analysis for decision-making. Experimental results demonstrate exceptional communication stability in large-scale medical buildings, effectively filling the gaps left by stationary stations. This solution assists hospital management in optimizing environmental quality and HVAC strategies, establishing a precise protection boundary for the public health safety of sensitive populations.

P260011

Edge AI-Enabled Multimodal UAV System with Semantic-Aware Autonomous Navigation

Yu-Cheng Lung[1,a], Shan-Xi Yang[2,b], Chung-Chih Yang[3,c], Yu-Cheng Chang[4,d] and Wei Chien[5,e]

[1]Program in Artificial Intelligence Technology, National Taipei University of Technology
[2]Department of Automation Engineering, National Formosa University
[3]Department of Information Management, National Central University
[4]Department of Computer Science, National Tsing Hua University
[5]Department of Electrical Engineering, Tatung University

[a]0988288034sky@gmail.com, [b]a0976939705@gmail.com, [c]charles@twbts.com,
[d]yucheng208@outlook.com, [e]air180@seed.net.tw

Corresponding author: Yu-Cheng Chang, yucheng208@outlook.com

Keywords: Edge AI, Large Language Models (LLMs), Vision-Based Perception, Multimodal Control, Autonomous Navigation

Abstract:

Uncrewed aerial vehicles (UAVs) are increasingly deployed in inspection, environmental monitoring, and public safety applications; however, conventional control interfaces often require specialized expertise and lack intuitive real-time interaction mechanisms. To address these limitations, this paper presents an edge AI-enabled multimodal UAV system that integrates semantic understanding with vision-based perception to enable intuitive and reliable autonomous navigation.

The proposed framework combines speech recognition, large language model (LLM)-based semantic interpretation, and real-time onboard visual perception to transform natural language commands into structured flight control instructions. To mitigate risks arising from homophones, ambiguous expressions, and misinterpretations in speech recognition, a semantic post-processing module and a rule-based safety verification mechanism are introduced to constrain UAV behavior within predefined operational boundaries.

The entire perception and inference pipeline is deployed on an onboard edge computing platform, eliminating cloud dependency and significantly reducing communication latency. By fusing semantic intent with environmental visual feedback, the UAV performs context-aware operations such as obstacle avoidance, target tracking, and adaptive distance maintenance under dynamic conditions.

Experimental evaluations demonstrate that the proposed system improves operational accessibility while maintaining stable flight control and safety. The modular architecture further enhances scalability and reproducibility, making the system suitable for educational deployment, industrial inspection, environmental monitoring, and public safety scenarios.

P260012

LexRAG-Trace: A Source-Linked Legal Retrieval-Augmented Generation

Jia-Wei Chen[1,a], Yu-Cheng Lung[2,b], Yun-Hao Hu[1,c], Chien-Chen Huang[3,d], Yu-Cheng Chang[4,e] and Hua-Wen Tsai[5,f]

[1]Department of Electronic Engineering, Lunghwa University of Science and Technology
[2]Program in Artificial Intelligence Technology, National Taipei University of Technology
[3]Department of Electrical Engineering, Lunghwa University of Science and Technology
[4]Department of Computer Science, National Tsing Hua University
[5]Department of Computer Information and Network Engineering, Lunghwa University of Science and Technology

[a]chenjiawei887@gmail.com, [b]0988288034sky@gmail.com, [c]frank.hu052490@gmail.com, [d]jusstin925@gmail.com, [e]yucheng208@outlook.com, [f]HWTsai@mail.lhu.edu.tw

Corresponding author: Hua-Wen Tsai, hwtsai@mail.lhu.edu.tw ; Yu-Cheng Chang, yucheng208@outlook.com

Keywords: Retrieval-Augmented Generation (RAG), Legal Information Retrieval, Large Language Models (LLMs), Legal Question Answering, Citation Grounding

Abstract:
Large language models (LLMs) have recently demonstrated strong capabilities in legal question answering and document drafting. However, conventional LLM-based legal assistants often suffer from hallucination, a lack of source attribution, and limited traceability, which greatly limit their effective adoption in real-world legal scenarios. To address these challenges, this paper presents LexLink-RAG, a citation-grounded legal retrieval-augmented generation (RAG) system designed for trustworthy legal consultation and drafting assistance.

The proposed system integrates structured statutory databases and case law corpora into a hybrid retrieval framework that combines sparse keyword search and dense semantic retrieval to increase precision and recall. Retrieved legal sources are explicitly linked and embedded in the generation pipeline, ensuring that every response is grounded in verifiable statutes or court precedents. The system supports legal case searches, statutory interpretation, and the automated generation of basic legal drafting templates, including complaint forms and demand letters. All generated outputs include direct references to external legal sources, enabling transparent verification and reducing the risk of hallucination.

Experimental evaluation shows that the proposed framework significantly improves factual consistency, citation fidelity, and user trust relative to standalone LLM-based baselines. The system provides a practical and deployable LegalTech solution that improves reliability, transparency, and usability in AI-assisted legal services.

P260013

MIND: Multimodal Intelligent NLP for Student Stress Understanding in Campus Environments

Zong-Rong Wu[1,a], Saleh Mobayen[1,b], Kuo-Hsien Hsia[2,c], Chao-Yi Huang[3,d], Yu-Cheng Chang[4,e], Hao-En Huang[5,f], Pei-Chen Li[5,g] and Dian-Tsang Tsai[6,h]

[1]Graduate School of Intelligent Data Science, National Yunlin University of Science and Technology
[2]Bachelor Program in Intelligent Robotics, National Yunlin University of Science and Technology
[3]Information Management, National Yunlin University of Science and Technology
[4]Departmant of Computer Science, National Tsing Hua University
[5]Technical and Vocational Program in Artificial Intelligence, National Yunlin University of Science and Technology
[6]Department of Psychology, National Cheng Kung University

[a]jason.jiong.long@gmail.com, [b]mobayens@yuntech.edu.tw, [c]khhsia@yuntech.edu.tw, [d]joyatnet0@gmail.com, [e]yucheng208@outlook.com, [f]yhy930404@gmail.com, [g]paul0966401516@gmail.com, [h]star98271@gmail.com

Corresponding author: Zong-Rong Wu, jason.jiong.long@gmail.com ; Yu-Cheng Chang, yucheng208@outlook.com

Keywords: Multimodal Emotion Perception, Natural Language Processing (NLP), Student Mental Health, Emotion-Aware Dialogue Systems, Human–Computer Interaction (HCI)

Abstract:

In recent years, students have been exposed to social media at increasingly younger ages, which has had a significant impact on their mental health. The phenomenon of peer comparison on social platforms often intensifies pressures related to interpersonal relationships, academic performance, and future career planning. As a result, the demand for psychological counseling services in educational environments has steadily increased. Providing timely emotional understanding and conversational support through technological assistance before students' stress escalates has therefore become an important issue in both educational and mental health domains.

To address this challenge, this study integrates recent advances in natural language processing with multimodal emotion perception to develop an interactive system for understanding students' psychological stress. The proposed system incorporates three modalities of emotional signals, including textual content, vocal tone, and facial expressions, enabling a more comprehensive interpretation of students' emotional states. For multimodal integration, a matrix-based fusion mechanism is employed to combine the results of the three emotion perception modalities with semantic analysis from the language model. This design allows the system to consider both linguistic meaning and emotional context during interaction.

Furthermore, the system is fine-tuned using datasets that include counseling-style conversational responses, enabling the model to generate replies that exhibit empathy and supportive communication. Through this mechanism, the proposed system can engage in early-stage dialogue with students experiencing psychological stress, facilitate the expression of stress-related concerns, and serve as a supportive tool for campus mental health assistance.

P260014

Classification Regression Based Monocular Depth Estimation Neural Networks with High Generalization Capability

Guo-Wei Wu[1,a], Wei-Jong Yang[2,b] and Jar-Ferr Yang[1,c]

[1]National Cheng Kung University, Taiwan

[2]National Kaohsiung Normal University, Taiwan

[a]william900420@gmail.com, [b]wjyang@mail.nknu.edu.tw, [c]jefyang@mail.ncku.edu.tw

Corresponding author: Jar-Ferr Yang, jefyang@mail.ncku.edu.tw

Keywords: Monocular Depth Estimation, Classification Regression, Computer Vision, Zero-Shot Learning, Generalization Ability

Abstract:

In recent years, monocular depth estimation has received increasing attentions in the field of computer vision, particularly in applications of robotics and autonomous driving, where depth perception related to distance estimation plays a critical role. Traditional depth estimation methods rely on multi-view images to infer the depth, whereas monocular depth estimation requires only a single RGB image to estimate the relative distance between objects in a scene. The monocular depth estimation trained by an image-depth database with deep neural networks becomes an active and prevalent technique. However, the generalization ability of existing models is often constrained by the distribution of training data. For instance, the models trained on indoor datasets may perform well in other indoor scenarios but tend to exhibit significant performance degradation when applied to outdoor environments. Therefore, developing a monocular depth estimation model with strong generalization capability across diverse scenes without the need for retraining has become a key challenge. In this paper, we propose a monocular depth estimation model that exhibits high generalizability and is capable of performing effectively across various scenarios without additional fine-tuning. In terms of model designs, we adopt a powerful visual encoder to extract rich features and incorporate a depth prediction head with spatial adaptability, which combines classification and regression strategies for depth estimation. Through carefully designed module integration, architectural refinements, and tailored training strategy, the proposed model achieves a favorable balance between parameter efficiency and inference accuracy, while demonstrating robust cross-domain performance and stability on multiple datasets.

P260018

BOM-Based Similar Product Identification Using Parent-Child Relationship Encoding

Hyeji Jeon[1,a], Hyunbo Cho[2,b], Gi Suk Hong[2,c], Gyuri Choi[1,d], Sihyeon Ann[1,e], Yongkyu Cho[3,f] and Bongjun Ji[1,g]

[1]Pusan National University
[2]Pohang University of Science and Technology
[3]Kyonggi University

[a]jeonhyeji@pusan.ac.kr, [b]hcho@postech.ac.kr, [c]kisuk13577@postech.ac.kr, [d]chlrbfl2000@pusan.ac.kr, [e]dkstlgus28@pusan.ac.kr, [f]yongkyu.cho@kyonggi.ac.kr, [g]bongjun@pusan.ac.kr

Corresponding author: Bongjun Ji, bongjun@pusan.ac.kr

Keywords: product similarity, bill of materials, machine learning, product structure

Abstract:
Manufacturers began developing variations of their products to meet the diverse needs of their customers. However, with complex products, only a small number of experts understand the entire product information, while most are familiar only with specific parts. Therefore, manufacturers rarely take advantage of the opportunity to identify and manage similar products, which can support flexible inventory management through the identification of interchangeable parts and the detection of inaccurate part information by comparing components across similar products. In this paper, we propose a machine learning-based product similarity assessment method. We encode products into vectors using the parent-child relationship of parts constituting each product. After that, high-dimensional vectors of the product are reduced to low-dimensionality vectors by using autoencoders. Product similarity is measured by calculating vector similarity. The proposed method is fully automated and requires no manual intervention. Experts from global home appliance manufacturers validated the results of this study, and similar models could be identified more effectively and efficiently than with existing methods.

P260022

Performance Improvement and Convergence Acceleration for Multiscale Hybrid Detection Transformer-based Neural Networks

Kun-Rong Wu[1,a] and Wei-Jong Yang[2,b]

[1]National Cheng Kung University, Taiwan

[2]National Kaohsiung Normal University, Taiwan

[a]andy2001.02.11@gmail.com, [b]wjyang@mail.nknu.edu.tw

Corresponding author: Wei-Jong Yang, wjyang@mail.nknu.edu.tw

Keywords: Deep Learning, Object Detection, Vision Transformer

Abstract:

For object detection, in this paper, we propose a hybrid detection framework that integrates a multi-scale convolutional neural network (CNN) features and a frozen vision transformer (ViT) to improve convergence inefficiency and small object weakness of transformer-based detectors. Specifically, we combine multi-scale features of the ConvNeXt backbone with the frozen DINOv2 ViT by unifying them via channel alignment and spatial resampling. This new hybrid framework is then passed to a deformable encoder and an enhanced decoder equipped with dynamic query offset, which stabilizes the spatial trajectory of reference points layer-by-layer. In addition, we introduce a group-shared key–value mechanism in the attention module to reduce redundant projections across heads, improving inference speed with minimal performance loss. Experimental results evaluated on the COCO 2017 dataset show that the proposed method achieves faster convergence and better small object AP compared to the original deformable DETR under limited training epochs and batch size. The frozen DINOv2 ViT kernel contributes the rich semantic guidance while the dynamic query offset improves localization stability and the group-shared key-value reduces memory cost. With these effective components, the proposed resource-efficient detection framework achieves competitive accuracy and improved inference efficiency.

P260026

A Lightweight Deep Learning-based Intrusion Detection System for Securing Resource-Constrained UAV Networks

Hyunseok Kim[1,a]

[1]Korea Military Academy

[a]hskim@kma.ac.kr

Corresponding author: Hyunseok Kim, hskim@kma.ac.kr

Keywords: UAV Network Security, Intrusion Detection System (IDS), Lightweight Deep Learning, Cyber-Physical Systems (CPS), Edge Computing

Abstract:

This paper proposes a Lightweight Deep Learning-based Intrusion Detection System (IDS) specifically designed to protect the vulnerable security environments of Unmanned Aerial Vehicle (UAV) networks. While UAVs are widely utilized in both military and civilian sectors, they face significant limitations due to restricted computational power and battery life, making it difficult to implement traditional, heavy security solutions. In particular, network spoofing and replay attacks pose critical threats that can result in the unauthorized takeover of drone control.

In this research, we propose a method to extract features from UAV inter-communication data and analyze them in real-time using a Lightweight Convolutional Neural Network (CNN) model to detect abnormal traffic. The proposed model maintains high detection accuracy while reducing the number of parameters by more than 40% compared to conventional models, optimized to run seamlessly on on-board drone processors. Experimental results demonstrate that the proposed system achieves a detection rate of over 98% across various network attack scenarios and ensures operational longevity by minimizing energy consumption.

P260028

PatchFabric: Grayscale Patch-Based Classification of Biodegradable Fabrics with Intrinsic Uncertainty Estimation from High-Resolution Images

Jhamil Gutierrez[1,a]

[1]National University, Philippines

[a]jggutierrez@nu-fairview.edu.ph

Corresponding author: Jhamil Gutierrez, jggutierrez@nu-fairview.edu.ph

Keywords: patch-based classification, biodegradable fabric, grayscale texture analysis, uncertainty estimation, convolutional neural network

Abstract:

Conventional deep learning pipelines for fabric classification resize high-resolution images to fixed dimensions (e.g., 224×224 pixels), resulting in significant loss of fine-grained texture information. This paper proposes a patch-based classification framework that extracts local regions from grayscale fabric images at native resolution, classifies each patch independently, and aggregates predictions through majority voting. Grayscale conversion was applied to enforce texture-driven feature learning independent of fabric color. Patch-level prediction disagreement was employed as an intrinsic uncertainty signal, enabling the identification of ambiguous classifications without additional computational overhead. The framework was evaluated on a dataset of six biodegradable fabric types (Abaca, Cotton, Hessian, Linen, Silk, and Wool) captured at 2560×1440 resolution under three focal length configurations. Two backbone architectures (MobileNetV2 and EfficientNet-B0) and two patch extraction strategies (uniform grid and random crop) were compared against a standard resize baseline. All four PatchFabric variants achieved 100% classification accuracy with near-zero calibration error (ECE as low as 0.0011), compared to 97.78% and 97.22% accuracy with ECE values of 0.0807 and 0.1227 for the baselines, respectively.

P260030

Continual Learning with OGD and Truncated SVD for Pretrained Model Knowledge Preservation

Kuo-Chung Yu[1,a], Yung- Hsiang Hsu[1,b], Chi-Ju Lai[1,c] and Lawrence Y. Deng[1,d]
[1]Tamkang University

[a]133742@o365.tku.edu.tw, [b]614150018@o365.tku.edu.tw, [c]614150026@o365.tku.edu.tw, [d]114722@mail.tku.edu.tw

Corresponding author: Kuo-Chung Yu, 133742@o365.tku.edu.tw

Keywords: Artificial Intelligence, Continual Learning, Pretrained Knowledge Preservation, Orthogonal Gradient Descent, Low-Rank Adaptation

Abstract:
Most continual learning approaches focus predominantly on mitigating catastrophic forgetting across downstream tasks, while leaving the preservation of pretrained model knowledge largely unaddressed. This work presents Singular Value Decomposition Orthogonal Gradient Descent (SVDOGD), a continual learning framework that integrates Truncated Singular Value Decomposition (TSVD) to identify the pretrained model's knowledge subspace, Orthogonal Gradient Descent (OGD) to explore new task knowledge subspaces, and Low-Rank Adaptation (LoRA) for parameter-efficient fine-tuning. By imposing dual orthogonal constraints on both the LoRA parameter update directions and the pretrained knowledge subspace, the proposed method enables the model to continuously acquire new task knowledge while simultaneously preserving both the pretrained model knowledge and the previously learned task-specific knowledge from prior continual learning stages. To assess the impact of continual learning techniques on pretrained model knowledge, this work further introduces the T5 Pretrained Knowledge Retention Benchmark (T5 PKR Benchmark), a dedicated evaluation protocol for quantifying the degree of knowledge retention in pretrained models. Experimental results demonstrate that SVDOGD achieves accuracy comparable to O-LoRA on the Standard Continual Learning Benchmarks (Standard CL Benchmarks), while exhibiting only marginal performance degradation relative to the original T5-Large on the T5 PKR Benchmark. The primary contributions of this work are twofold: (1) a high-performance continual learning method that simultaneously safeguards pretrained model knowledge; and (2) the T5 PKR Benchmark, enabling systematic measurement of pretrained knowledge retention. SVDOGD delivers strong continual learning performance while providing effective protection of pretrained model knowledge.

P260031

Few-Shot Mental Health Status Classification from Social Media Text Using SetFit with ModernBERT

Jhamil Gutierrez[1,a], Jigo Rafael Catamio[1,b] and Justine Ostraes[1,c]
[1]National University, Philippines

[a]jggutierrez@nu-fairview.edu.ph, [b]jigocatamio@gmail.com, [c]jpostraes@nu-fairview.edu.ph

Corresponding author: Jhamil Gutierrez, jggutierrez@nu-fairview.edu.ph

Keywords: mental health classification, few-shot learning, SetFit, ModernBERT, sentence transformers, social media text analysis

Abstract:
Mental health status classification from social media text has gained increasing attention as a scalable approach to early detection of psychological conditions. However, most existing methods rely on full fine-tuning of pretrained language models, which demand large, labeled datasets that are costly and ethically constrained to collect. This study investigates the data efficiency of SetFit, a parameter-efficient contrastive learning framework, paired with ModernBERT-embed-base for classifying social media posts into seven mental health categories (Anxiety, Bipolar, Depression, Normal, Personality Disorder, Stress, and Suicidal). Experiments were conducted on a publicly available dataset of
52,681 statements across eight data regimes ranging from 8 to 1,000 labeled samples per
class, with SetFit-MiniLM and SetFit-BGE as sentence transformer baselines and finetuned BERT-base and DeBERTaV3-base as conventional baselines. The proposed SetFitModernBERT achieved an F1 (macro) of 0.783 with 1,000 samples per class, outperforming SetFit-MiniLM (0.759), SetFit-BGE (0.778), fine-tuned BERT-base (0.753), and DeBERTaV3- base (0.761) under the same training condition. Under extreme data scarcity at 8 samples per class, SetFit-ModernBERT attained an F1 (macro) of 0.561, exceeding SetFit-MiniLM and SetFit-BGE by 5.3 and 2.8 percentage points, respectively. At 256 samples per class, the proposed model (0.731) surpassed SetFit-MiniLM at 512 samples (0.725), indicating that approximately half the labeled data was sufficient to match the best lightweight baseline. The results suggest that contrastive sentence embedding with ModernBERT offers a viable, data-efficient path toward mental health text classification in low-resource scenarios where annotation budgets are limited.

P260033

Dynamic Epistemic Logic with Neutrosophic Semantics for Language Model Hallucination Detection: Formal Framework, Epistemic Indeterminacy Representation, and Principled Abstention via Chain-of-Thought Reasoning

Maikel Leyva[1,a], Cristian Cornejo Gaete[2,b], Alexis Matheu Pérez[3,c] and Florentin Smarandache[4,d]

[1]Universidad de Guayaquil

[2]Universidad Bernardo O'Higgins,

[3]Alexis Matheu Pérez

[4]University of New Mexico

[a]mleyvaz@gmail.com, [b]cristian.cornejo@ubo.cl, [c]alexis.matheu@ubo.cl, [d]fsmarandache@gmail.com

Corresponding author: Maikel Leyva, mleyvaz@gmail.com ; Florentin Smarandache, fsmarandache@gmail.com

Keywords: dynamic epistemic logic, neutrosophic logic, hallucination detection, confidence calibration, AI safety

Abstract:

Large language models (LLMs) trained via next-token prediction lack explicit mechanisms to represent epistemic indeterminacy—uncertainty arising from incomplete, conflicting, or evolving evidence—which contributes to hallucinations manifested as high-confidence assertions despite unresolved contradictions. We introduce LED (Dynamic Epistemic Logic with Neutrosophic Semantics), a formal framework that models evolving epistemic states as $\sigma(t) = (T(t), I(t), F(t)) \in [0,1]^3$, where T denotes truth, I indeterminacy, and F falsity, governed by three operators: Refinement, Conflict Detection, and Resolution. LED detects three hallucination patterns: Unjustified Confidence (high confidence under high indeterminacy), Unresolved Conflict (coexistence of high T and F), and Indeterminacy Divergence (increasing uncertainty during reasoning). Empirical evaluation on 120 expert-annotated questions across Healthcare, Policy, and Emerging Technologies (inter-rater $\alpha = 0.82$) shows significant improvements over baselines, achieving F1 = 0.8966 vs. 0.7100 ($p < 0.001$, Cohen's $d = 0.66$), ECE = 0.0558 (61.5% improvement), 91.9% justified abstention, and low detection latency (1.29 steps). Performance varies systematically across domains (Healthcare 0.925 > Policy 0.875 > Emerging Tech 0.850), reflecting differences in epistemic structure. These results demonstrate that hallucinations in LLMs stem from failures in representing epistemic uncertainty, and by making uncertainty explicit and actionable—distinguishing justified confidence from principled abstention—LED provides a foundation for trustworthy AI in high-stakes domains.

P260037

Big Data Analysis of Consumer Behavior and Purchase Intention for One Town One Product in Taiwan Attributes

Hui-Ting Hsu[1,a], Wei-Hung Chen[2,b] and Chun-Tai Wang[3,c]

[1]Department of International Trade and Master Program Chihlee University of Technology

[2]Department of Information Management Chihlee University of Technology

[3]Department of Business Administration Minghsin University of Science and Technology

[a]langela@mail.chihlee.edu.tw, [b]wehchen@mail.chihlee.edu.tw, [c]jyuntai@must.edu.tw

Corresponding author: Chun-Tai Wang, jyuntai@must.edu.tw

Keywords: Consumer Behavior, Purchase Intention, Brand Image, Brand Identification, Product Attributes

Abstract:

This study investigates consumer preferences for local specialty products in Taiwan, using "One Town One Product" (OTOP) retail channels as the empirical context. As Taiwan increasingly emphasizes regional revitalization and sustainable development, understanding consumer decision-making mechanisms has become critical. Drawing on consumer behavior and brand-related theories, this study develops an integrated framework to examine how brand image, brand identification, and perceived product attributes influence purchase intention across multiple retail channels. Brand image is conceptualized as a multidimensional construct comprising functional, symbolic, and experiential attributes, while product attributes include both tangible and intangible characteristics such as quality, price, packaging, and brand reputation. Brand identification reflects the alignment between consumers' self-concept and brand values. A questionnaire survey was conducted, yielding 354 responses, of which 211 were valid. The data demonstrate acceptable reliability and validity. The results indicate that both brand image and product attributes have significant positive effects on purchase intention. Brand image enhances perceived quality and reduces perceived risk, while product attributes provide evaluative criteria that strengthen perceived value. Brand identification further reinforces repurchase intention and word-of-mouth, contributing to customer loyalty. In addition, demographic differences are observed, with younger consumers being more influenced by brand image and social media, whereas middle-aged consumers place greater emphasis on product quality and value. From a managerial perspective, enhancing brand image and strengthening product information transparency are essential strategies for promoting local specialty products. From a theoretical perspective, this study contributes by integrating affective and cognitive decision-making pathways within a multi-channel retail context, highlighting the joint role of psychological and perceptual factors in shaping consumer purchase intention.

P260041

Edge-Based Teeline Shorthand Handwriting Recognition: A Comparative Study of SVM and ResNet-50

Aaron John C. Alegre[1,a], Dionis A. Padilla[1,b] and Aaron John C. Alegre[2,c]

[1]Mapua University

[2]National University

[a]ajcalegre@mymail.mapua.edu.ph, [b]dapadilla@mapua.edu.ph, [c]acalegre@nu-clark.edu.ph

Corresponding author: Aaron John Alegre, ajcalegre@mymail.mapua.edu.ph ; Aaron John Alegre, acalegre@nu-clark.edu.ph

Keywords: Teeline Shorthand, ResNet-50, Edge-based System, Handwriting Recognition, Deep Learning

Abstract:

Teeline shorthand remains an important tool for rapid information writing in journalism; however, its manual transcription presents significant limitation in terms of speed, scalability and integration to modern digital systems. Existing handwriting recognition largely focusses on character level interpretation, which fails to interpret contextual meaning and reduces the effectiveness in real world transcription. This study addresses the problem by proposing a word-level Teeline shorthand recognition system capable of translating complete handwritten inputs into English word. A total of 1,000 handcrafted handwritten Teeline words across ten commonly used terms in flash news report were collected. Results indicate that the ResNet-50 model significantly outperformed SVM, achieving 98.00% accuracy compared to 89.50%. The deep learning model demonstrated superior capability in capturing complex stroke patterns and generalizing across handwriting variations. These findings validate the effectiveness of word-level recognition and edge deployment, offering a practical solution for automated shorthand transcription in time-critical communication environments.

P260044

Enhancing Student Learning Motivation in Color Theory Course through the Integration of Color Picker App in STEAM Education

LI CHIH HSUAN[1,a], FENG LI CHUAN[1,b], Yu Cheng Wang[1,c] and Kai-Chun Hou[1,d]
[1]National Taipei University of Education.

[a]hsuan106@mail.ntue.edu.tw, [b]jua520@mail.ntue.edu.tw, [c]starckwang@mail.ntue.edu.tw, [d]kghou@tea.ntue.edu.tw

Corresponding author: LI CHIH HSUAN, hsuan106@mail.ntue.edu.tw

Keywords: STEAM Education, Motivated Learning Strategies Questionnaire (MSLQ), Color Picker App

Abstract:
STEAM education cultivates students' creativity and problem-solving skills. In university color theory courses, student motivation is heavily influenced by teaching methods. This study explores the integration of a Color Picker App—a digital tool that instantly captures and analyzes real-world color schemes—to bridge the gap between theory and practice and enhance engagement.

To evaluate its impact, this study adopted an experimental design using the Motivated Learning Strategies Questionnaire (MSLQ) to quantitatively assess learning motivation. Students were divided into an experimental group, using the Color Picker App for practical color exploration, and a control group, relying on traditional methods like printed color wheels and textbooks.

Post-course MSLQ results revealed that the experimental group exhibited significantly higher learning motivation than the control group. The findings indicate that integrating the Color Picker App effectively stimulates students' interest, enhances learning efficiency, and positively impacts their overall engagement in color theory education.

P260047

Taiwan Safety-Aware Fuzzy Path Planning for ROV-Based Port Inspection

Jhe-Wei Liang[1,a], Sheng-Long Kao[2,b] and Taih-Cherng Lirn[3,c]

[1]Department of Shipping and Transportation Management, Intelligent Maritime Research Center, National Taiwan Ocean University, 2, Pei-Ning Road, Keelung, Taiwan, R.O.C.

[2]Department of Transportation Science, Intelligent Maritime Research Center, National Taiwan Ocean University, 2, Pei-Ning Road, Keelung, Taiwan, R.O.C.

[3]Department of Shipping and Transportation Management, National Taiwan Ocean University, 2, Pei-Ning Road, Keelung, Taiwan, R.O.C.

[a]leojwliang@gmail.com, [b]slkao@email.ntou.edu.tw, [c]tedlirn@email.ntou.edu.tw

Corresponding author: Sheng-Long Kao, slkao@email.ntou.edu.tw

Keywords: Remotely Operated Vehicle (ROV), Fuzzy Logic Control (FLC), port inspection, fuzzy path planning, acoustic-satellite positioning

Abstract:

Safe inspection with remotely operated vehicles (ROVs) in complex port waters is hindered by low visibility, unstable currents and densely distributed underwater structures, leading to collision risk, path deviation, and operational inefficiency. Existing inspection approaches, including manual diving and predefined ROV routes display limited adaptability to environmental uncertainty in real-time navigation. To bridge this gap, this study suggests a safety-aware path-planning framework for ROV inspection in Bisha Fishing Port, Taiwan, with Fuzzy Logic Control (FLC) serving as the core decision-support layer. The designed fuzzy inference system actively transforms uncertain navigational inputs, such as obstacle proximity, current-induced disturbances, and heading deviations into adaptive trajectory corrections and contingency maneuvers to increases the ease of navigation and operation of ROV-operators in complex harbor environments. To ensure reliable real-world deployment, a hybrid acoustic-satellite positioning architecture to maintain robust estimation under noisy conditions is integrated to the FLC framework. Additionally, a high-fidelity digital twin of the port is further established and coupled with Hardware-In-the-Loop (HIL) experiments to assess system performance under realistic operational disturbances. The performance of framework is assessed by comparing it to operator-created trajectories, utilizing mission success rate, minimum safety clearance, safety violations, travel time, and energy consumption as key evaluation metrics. The findings indicate that the FLC-based controller enhances navigation reliability within dynamic port settings, diminishes safety violations and path oscillations, and improves mission completion outcomes while preserving operational efficiency.

P260048

Assessment of Unmanned Aerial Vehicles (UAVs) No-fly Zones by Spatial Decision Approaches

Min-Xuan Li[1,a] and Sheng-Long Kao[1,b]

[1]Department of Transportation Science, Intelligent Maritime Research Center, National Taiwan Ocean University, 2, Pei-Ning Road, Keelung, Taiwan, R.O.C.

[a]mindy30169@gmail.com, [b]slkao@email.ntou.edu.tw

Corresponding author: Sheng-Long Kao, slkao@email.ntou.edu.tw

Keywords: Unmanned Aerial Vehicle, Geographic Information System, Spatial Decision Support System, No-fly Zone, System Tool Kit

Abstract:

The rapid proliferation of Unmanned Aerial Vehicles (UAVs) has introduced unprecedented flexibility across various industries. However, unauthorized UAV incursions near airports pose a significant challenge to aviation safety and operational continuity. Despite established regulatory frameworks, the increasing frequency of violations suggests that the current prohibited zones may not adequately encompass the actual risk hotspots. While existing literature mainly focuses on legal frameworks and static flight control zones, a critical research gap remains in a critical research gap remains in integrating geospatial data on historical UAV violations to optimize no-fly zones (NFZs). To address this gap, the present study proposes a comprehensive geospatial decision-making framework for evaluating and optimizing no-fly zones, demonstrated through a case study of Taipei Songshan Airport (TSA). The integration of Geographic Information Systems (GIS) and a Spatial Decision Support System (SDSS) enabled the development of a multi-criteria Risk Index, quantifying the spatial relationship between illegal event coordinates and critical flight routes. To ensure operational validity, high-fidelity dynamic flight simulations were conducted by using the Systems Tool Kit (STK). Empirical findings indicate that unauthorized UAV activities are primarily concentrated in the southern sector of the airport's controlled airspace. The spatial distance between recorded UAV violations and the NFZ boundary is ranging from 0.115 km to 2.129 km. The result proposes expanding the no-fly zones based on a geospatial optimization model, increasing the no-fly zone area by 9.67 km² and the perimeter by 0.452 km. Furthermore, STK simulation results demonstrate that the reconfiguration of the airspace leads to a significant enhancement in proactive early-warning and response times, improving by 63 to 91 seconds. This research provides a constructive suggestion on the adjustment of NFZs and UAV risk management strategies.

P260049

The Novel Fuzzy Spatial Risk Index for Navigational Safety Assessment

Ying-Ping Liu[1,a] and Sheng-Long Kao[1,b]

[1]Department of Transportation Science, Intelligent Maritime Research Center, National Taiwan Ocean University, 2, Pei-Ning Road, Keelung, Taiwan, R.O.C.

[a]deletion625@gmail.com, [b]slkao@email.ntou.edu.tw

Corresponding author: Sheng-Long Kao, slkao@email.ntou.edu.tw

Keywords: Fuzzy Logic Control (FLC), Automatic Identification System (AIS), Marine Geographic Information System (MGIS), Maritime Risk, Spatial Risk Assessment

Abstract:

With the increasing convenience of maritime transportation, more and more activities are taking place around ports, including cargo handling, fishing operations, and tourism-related uses. However, potential risks exist. If captains can identify high-risk areas in advance, it can also support more informed decision-making during navigation and enhance operational flexibility. To reduce the frequency of maritime accidents, this study aims to identify areas that captains consider dangerous. A system is developed by combining various factors to assess the level of navigational risk. Finally, a ranked list is produced. Previous studies often evaluate risk based on shore-based monitoring or the overall situation, which makes the model lack consideration of real-time operational pressure. This study adopts the captain's perspective to make a spatial-dimensional indicator, which represents the core contribution of this research. Ship data from the Automatic Identification System (AIS) are gathered and integrated with marine meteorological and environmental data. Then, the Marine Geographic Information System (MGIS) is used for visualization, and finally Fuzzy Logic Contro (FLC) is developed to assess area-based risk. The analysis is divided into four stages. Sensitivity analysis is conducted after defuzzification to examine the influence of each factor on the risk indicator. Traffic density has a significant impact. This study develops a method to assess maritime risk from the captain's perspective, ensuring that the results are close to actual conditions. It serves as a reference for navigation safety and port management.

P260050

An IMU-based Toothbrushing Monitoring and Management System

Chia-Yeh Hsieh[1,a], Yi-Lun Chen[1,b], Bang-Yu Wang[1,c] and Wan-Xin Zhang[1,d]

[1]Bachelor's Program in Medical Informatics and Innovative Applications, Fu Jen Catholic University

[a]152369@mail.fju.edu.tw, [b]fjumi111ilun@gmail.com, [c]BangYu1103@gmail.com, [d]zhangwanxin911@gmail.com

Corresponding author: Chia-Yeh Hsieh, 152369@mail.fju.edu.tw

Keywords: inertial measurement unit, toothbrushing monitoring, brushing region recognition, mobile health

Abstract:

Oral health is an important part of overall health and quality of life, and improper toothbrushing may result in inadequate plaque removal and an increased risk of oral diseases. However, objectively monitoring brushing behavior and providing effective feedback in daily life remain challenging. This study developed an IMU-based toothbrushing monitoring and management system for brushing behavior analysis, brushing region recognition, and personalized feedback.

Inertial signals were collected during toothbrushing using three IMU devices placed on the head, wrist, and toothbrush holder. For assessment, the tooth surfaces were divided into 18 brushing regions. Synchronized video recordings were used to annotate the start time of brushing in each region and establish the ground truth labels. Continuous accelerometer and gyroscope signals were processed by calculating resultant and planar magnitudes and segmented using a sliding window approach. Eight statistical time-domain features were extracted from each window, and a Random Forest classifier was used for brushing region recognition with leave-one-out cross-validation.

Among the tested window sizes, 210 data points yielded the best performance, with an accuracy of 72.09%, recall of 71.00%, precision of 75.49%, and F1-score of 73.17%. The framework was further implemented as a mobile application with four modules, namely Home, Measure, Report, and History, to support data management, brushing performance review, personalized feedback, and longitudinal tracking. These findings demonstrate the feasibility of applying IMU-based motion analysis to toothbrushing monitoring and management. Future work will focus on expanding the dataset, improving recognition algorithms, and enhancing system robustness in real-world applications.

P260051

Design of an Edge-Assisted and Fitness-Aware Personalized Bicycle Route Planning System

Shih-Wei Lin[1,a], Sung-Shiou Shen[2,b] and Tsai-Hua Kang[2,c]

[1]Department of Computer Science and Engineering Hungkuo Delin University of Technology, New Taipei, Taiwan, R.O.C.

[2]Department of Electronic Engineering Asia Eastern University of Science and Technology, New Taipei, Taiwan, R.O.C.

[a]shihwei@mail.hdut.edu.tw, [b]3shubert@mail.aeust.edu.tw, [c]shaka.kang@gmail.com

Corresponding author: Shih-Wei Lin, shihwei@mail.hdut.edu.tw

Keywords: personalized bicycle navigation, exercise-aware routing, edge-assisted computing

Abstract:

Bicycles have increasingly become an important platform for integrating leisure activities with personalized fitness in the development of smart sports technologies. However, most existing navigation systems optimize primarily for travel time or distance and do not adequately account for gradient-induced workload, individual fitness variation, or fatigue accumulation during cycling. This study presents a pre-implementation framework for a personalized bicycle route planning application that formulates navigation as an exercise-aware routing problem rather than a conventional shortest-path task. The proposed framework integrates open street network data, elevation information, user riding history, and real-time sensing signals to estimate variations in the rider's physical state and adapt route recommendations accordingly. The system consists of four modules: three-dimensional road network construction, lightweight physical-state prediction, fatigue-aware weighted A* route planning, and a mobile interface for route visualization and risk alerts. This paper focuses on the research motivation, system architecture, and evaluation design for future validation. The planned evaluation includes predictive accuracy, route-planning efficiency, physiological stability, and user experience. The main contribution is a research-oriented design blueprint for a fitness-aware bicycle navigation system with edge-assisted computing support, providing a foundation for subsequent prototype development and empirical validation.

P260053

Estimating Peak Age in Data-Poor Sports from Data-Rich Sport Texts: An Olympic LOSO Benchmark and Local Case Study

Sihyeon Ann[1,a] and Bongjun Ji[1,b]

[1]Graduate School of Data Science, Pusan National University

[a]dkstlgus28@pusan.ac.kr, [b]bongjun@pusan.ac.kr

Corresponding author: Bongjun Ji, bongjun@pusan.ac.kr

Keywords: Peak Age Estimation, Sport Similarity Graph, Text Embedding, Zero-Label Transfer Learning, Sports Analytics

Abstract:

Peak age, the age at which athletes reach peak performance, reflects how sport-specific physical, technical, and tactical demands evolve across a career. Yet many understudied or data-poor sports lack sufficient observations to estimate peak age directly. We propose a zero-label transfer framework that uses data-rich sport descriptions to infer peak age for local sports. Descriptions of Olympic sports were converted into text embeddings and used to construct a sport-similarity graph. We evaluated the framework in an Olympic leave-one-sport-out benchmark, withholding all peak-age information for each target sport, and then applied it to Ssireum, a traditional Korean combat sport with a limited sport-science database. A lightweight hybrid model combining the Graph-scalar prior with a global baseline achieved the best overall performance, while the Graph-scalar model remained competitive with text-only transfer and outperformed a manual taxonomy. For Ssireum, estimated peak ages ranged from 22.8 to 29.5 years across women's classes and from 25.6 to 28.0 years across men's classes, with super-heavy classes estimated at 27.4 years by the hybrid model. Wrestling and Taekwondo emerged as the most similar sports. Publicly available sport descriptions therefore offer a practical transfer prior for estimating peak age in held-out or data-poor sports and may serve as a useful first-pass screening tool for extending sport-science evidence to understudied, region-specific, or traditional sports. More broadly, this framework may lay the groundwork for leveraging evidence from data-rich sports to support the development of local sports.

P260054

A Hybrid XGBoost-SARIMAX Framework for LPG Demand Forecasting

Tsumugi Mimiura[1,a], Takuya JInno[1,b] and Yuukou Horita[1,c]

[1]Uinversity of Toyama

[a]m25d1002@ems.u-toyama.ac.jp, [b]jinno@sus.u-toyama.ac.jp, [c]horita@sus.u-toyama.ac.jp

Corresponding author: Yuukou Horita, horita@sus.u-toyama.ac.jp

Keywords: LPG, demand forecasting, XGBoost,, SARIMAX, data reconstruction

Abstract:

Japan's energy security faces particularly acute energy security challenges with respect to Liquefied Petroleum Gas (LPG), as the country depends on imports for approximately 85% of its total LP gas consumption. Accurate demand forecasting is therefore essential to prevent critical supply shortages while enabling providers to optimize inventory levels and reduce logistical overhead.

Historically, the LPG meter readings were collected manually on a monthly basis, making it impossible to capture high-frequency daily demand fluctuations caused by sudden weather changes or shifting consumer behavior.

The proliferation of smart meters has initiated a paradigm shift, enabling daily or even hourly data collection. However, many suppliers face a "cold start" problem, as they possess decades of monthly data but only limited granular daily records insufficient for training robust predictive models. This study addresses that gap through a data-driven, hybrid forecasting framework that bridges legacy monthly data with modern smart meter data.

The proposed model operates in two steps. First, an XGBoost-based machine learning regressor disaggregates coarse monthly data into daily increments, using the smart meter acquisition period as the training reference. Reconstructed values are then calibrated against actual monthly totals to ensure physical consistency. Second, a SARIMAX time series model incorporates exogenous meteorological variables including air temperature, estimated water temperature, and Heating Degree Days to capture nonlinear seasonal consumption patterns.

The hybrid XGBoost-SARIMAX framework achieved a 40% improvement in forecasting accuracy ove conventional models, demonstrating particular strength in reproducing sharp demand spikes during peak winter periods. These results confirm that intelligently leveraging coarse historical data can yield superior predictive performance even under conditions of limited high resolution data availability, contributing directly to the development of resilient, data driven LPG supply planning systems.

P260055

Improving LPG Demand Forecasting Accuracy Through Cluster-Based SARIMAX Modeling: A Bottom-Up Approach Using Smart Meter Data

Ayane Matsuzaki[1,a], Hikaru Suzuki[1,b], Takuya Jinno[1,c] and Yuukou Horita[1,d]
[1]University of Toyama

[a]yuukou.horita@gmail.com, [b]m26d1004@ems.u-toyama.ac.jp, [c]jinno@sus.u-toyama.ac.jp, [d]horita@sus.u-toyama.ac.jp

Corresponding author: Yuukou Horita, horita@sus.u-toyama.ac.jp

Keywords: LPG Demand Forecasting, Cluster-Based SARIMAX, Smart Meter Data

Abstract:
Highly accurate demand forecasting is essential for ensuring a stable energy supply. Residential LPG demand is strongly influenced by meteorological conditions and household behavioral patterns —particularly for water heating and space heating- which results in substantial consumption variability throughout the year. The proliferation of smart meters has made it possible to acquire daily consumption data at the individual household level. This study applies cluster analysis to smart meter data to classify households by consumption pattern, then constructs cluster-specific SARIMAX forecasting models, to evaluate the effectiveness of this bottom-up approach in improving residential LPG demand forecasting accuracy.
The dataset comprised daily LPG consumption records from 651 detached households in Takaoka City, Toyama Prefecture (November 2024–May 2025). Installed appliances were classified into four categories based on contract information, and exogenous variables included daily average air temperature and estimated water temperature. Households were clustered using k-means++ applied to z-score normalized consumption time series, with k=4 selected based on SSE and silhouette scores. The SARIMAX mode incorporated a fixed weekly seasonal period (s=7) and a calendar dummy variable alongside the meteorological variables, with orders automatically selected via auto_arima.
Two configurations were compared: an aggregate model and a bottom-up cluster-based model. With a 90-day training period and forecast horizons of up to 120 days, the cluster-based model outperformed the aggregate model across all horizons and metrics. At 120 days, MAPE improved from 10.49% to 8.45%, confirming that cluster-specific modeling yields superior accuracy and stability in medium-to-long-term LPG demand forecasting.

P260057

A Fuzzy Logic-Based Approach for Abnormal Vessel Behavior Analysis

Wen-Ding Yong[1,a], Chien-Min Su[1,b] and Sheng-Long Kao[1,c]

[1]Department of Transportation Science, Intelligent Maritime Research Center, National Taiwan Ocean University, 2, Pei-Ning Road, Keelung, Taiwan, R.O.C.

[a]wending82111126@gmail.com, [b]cmsu@mail.ntou.edu.tw, [c]slkao@mail.ntou.edu.tw

Corresponding author: Sheng-Long Kao, slkao@mail.ntou.edu.tw

Keywords: Automatic Identification System (AIS), Fuzzy Logic Control (FLC), Marine Geographic Information System (MGIS), Vessel Traffic Services (VTS), Abnormal Vessel

Abstract:

With the ongoing development of the global economy and the rapid growth of the marine industry, the number of vessels and the frequency of navigation have increased significantly, resulting in higher traffic density in major shipping routes and port waters and, consequently, a greater risk of maritime accidents. Traditional Vessel Traffic Services (VTS) mainly rely on fixed safety-distance thresholds or static traffic hotspots for risk control, which are often insufficient for capturing rapid changes in vessel maneuverability under varying traffic and environmental conditions. To address this limitation, this study develops a fuzzy-logic-based risk assessment model that integrates dynamic Automatic Identification System (AIS) data with environmental parameters to evaluate vessel navigation behavior in complex maritime settings. The study focuses on vessel navigation activities within a 20-nautical-mile radius of the Taichung Port VTS tower during November to December 2024, during the northeast monsoon season in Taiwanese waters, with oil product tankers selected as the target vessel type. The proposed model adopts a four-stage Fuzzy Logic Control (FLC) framework composed of eight fuzzy sub-criteria. Each sub-criterion follows a two-input, single-output structure, combining the Vessel Navigation Capability Index (VNCI) and the Vessel Navigation Environment Index (VNEI), ultimately generating the Vessel Behavior Risk Index (VBRI). In addition, this study compares one potentially abnormal vessel with ten normal vessels of similar characteristics during the same period. The results indicate that, by integrating VBRI and the Marine Geographic Information System (MGIS) for spatial validation, the framework can readily distinguish anomaly behaviors caused by traffic density and environmental conditions. Overall, the proposed model provides a more effective mechanism for evaluating unusual vessel behavior and offers reliable decision support for navigation risk management in dynamic maritime conditions.

P260058

Reconstruction-Based Anomaly Detection Approach for Vessel Scrubber Operational Data in Label-Scarce Environments

Sihyeon Ann[1,a], Yerim Yang[1,b], Gyuri Choi[2,c], Donghwi Kim[2,d], Hyeji Jeon[2,e] and Bongjun Ji[2,f]

[1]Pusan National University

[2]Graduate School of Data Science, Pusan National University

[a]dkstlgus28@pusan.ac.kr, [b]202689715@pusan.ac.kr, [c]chlrbfl2000@pusan.ac.kr, [d]heeduru@pusan.ac.kr, [e]jeonhyeji@pusan.ac.kr, [f]bongjun@pusan.ac.kr

Corresponding author: Bongjun Ji, bongjun@pusan.ac.kr

Keywords: Anomaly Detection, Vessel Scrubber, Time-Series Data, LSTM autoencoder, Unsupervised Learning

Abstract:

This study proposes an LSTM autoencoder-based anomaly detection framework for vessel scrubber operational data to address the limitations of rule-based approaches and the scarcity of labeled anomaly data in the maintenance of large-scale marine equipment. In real-world operating environments, anomalous events are rare, and sufficient labeled data are difficult to obtain, which limits the applicability of supervised classification models. Moreover, scrubber sensor time-series data exhibit strong temporal dependencies and nonlinear patterns, making it difficult for simple statistical methods and traditional machine learning approaches to capture complex operational behaviors and early signs of anomalies. To address these challenges, we develop an LSTM autoencoder that learns the temporal characteristics of normal operating data and reconstructs input sequences from latent representations of normal patterns. The proposed model identifies anomalous patterns through increased reconstruction error, thereby enabling unsupervised anomaly detection even when labeled data are scarce. The framework also provides a basis for the integrated interpretation of scrubber operational data and can be extended to real-time monitoring, control dashboard integration, spare-part replacement planning, and operator decision-support systems.

P260062

Swarm Robotics for Adaptive and Scalable Irrigation in Distributed Plantation Fields

Wai Yie Leong[1,a]

[1]INTI International University

[a]waiyie@gmail.com

Corresponding author: Wai Yie Leong, waiyie@gmail.com

Keywords: Swarm robotic, Artificial Intelligence, Irrigation

Abstract:

This study proposes a swarm robotics framework for adaptive and scalable irrigation in distributed plantation fields, addressing the limitations of centralized irrigation systems under spatial heterogeneity and climate variability. The system comprises multiple low-cost autonomous robots equipped with soil moisture sensors, environmental monitoring modules, and wireless communication capabilities. A decentralized coordination algorithm based on bio-inspired swarm intelligence enables robots to collaboratively allocate irrigation tasks, dynamically adjust water distribution, and respond to localized crop water requirements. The proposed approach integrates edge computing and lightweight machine learning models to support real-time decision-making, minimizing latency and dependence on cloud infrastructure. Simulation and field-scale evaluations demonstrate that the swarm-based irrigation system achieves improved water-use efficiency, reduced energy consumption, and enhanced crop yield consistency compared to conventional and single-robot systems. Furthermore, the system exhibits strong scalability and fault tolerance, maintaining operational performance under node failures and varying plantation sizes. The findings highlight the potential of swarm robotics to transform precision irrigation practices in plantation agriculture, contributing to sustainable water resource management and climate-resilient farming systems.

P260063

Robotic Process Automation (RPA) for Academic Administration and Intelligent Workflow Management in Universities

Wai Yie Leong[1,a]

[1]INTI International University

[a]waiyie@gmail.com

Corresponding author: Wai Yie Leong, waiyie@gmail.com

Keywords: Robotic, Artificial Intelligence, Academic Administration

Abstract:

Robotic Process Automation (RPA) is transforming academic administration by automating repetitive, rule-based tasks and enabling intelligent workflow management in universities. Administrative functions such as student admissions processing, course registration, timetable scheduling, examination management, and financial record handling often involve high volumes of structured data and manual intervention. RPA systems, integrated with artificial intelligence and machine learning, can streamline these processes by extracting, validating, and processing data across multiple institutional platforms with high accuracy and speed. The adoption of RPA reduces operational costs, minimizes human errors, and enhances service delivery efficiency. Moreover, intelligent workflow orchestration allows universities to dynamically manage task allocation, prioritize critical operations, and ensure compliance with institutional policies and accreditation requirements. When combined with analytics, RPA can provide actionable insights for decision-making, such as enrollment trends and resource utilization. This approach supports digital transformation in higher education by freeing administrative staff to focus on strategic and student-centric activities. Ultimately, RPA-driven academic administration improves institutional agility, operational transparency, and the overall student experience in increasingly complex educational ecosystems.

P260064

Multimodal Human–Computer Interaction Using Gesture, Voice, and Eye-Tracking in Smart Environments

Yuan Zhi Leong[1,a] and Wai Yie Leong[1,b]

[1]INTI International University

[a]lwaiyie@gmail.com, [b]waiyie@gmail.com

Corresponding author: Yuan Zhi Leong, lwaiyie@gmail.com ; Wai Yie Leong, waiyie@gmail.com

Keywords: Human–Computer Interaction (HCI), Artificial Intelligence, Computer Vision

Abstract:

This study presents a multimodal Human–Computer Interaction (HCI) framework that integrates gesture recognition, voice commands, and eye-tracking to enable seamless and natural interaction within smart environments. Traditional single-mode interfaces often struggle with usability limitations, especially in dynamic or hands-busy contexts. To address this, the proposed system combines computer vision-based gesture detection, speech recognition, and gaze estimation to create a context-aware and adaptive interaction model. The framework leverages deep learning techniques for real-time multimodal fusion, allowing the system to interpret user intent more accurately by correlating multiple input signals. An edge computing architecture is employed to minimize latency and ensure privacy-preserving data processing, making it suitable for applications in smart homes, healthcare, and industrial environments. Experimental evaluations demonstrate that the multimodal approach significantly improves interaction accuracy, reduces user cognitive load, and enhances task completion efficiency compared to unimodal systems. Furthermore, the system supports personalized interaction by learning user preferences and behavioral patterns over time. The results highlight the potential of multimodal HCI systems to deliver intuitive, efficient, and inclusive user experiences in next-generation smart environments.

P260065

Human–Robot Interaction (HRI) Models for Collaborative and Safe Autonomous Systems

Yuan Zhi Leong[1,a] and Wai Yie Leong[1,b]

[1]INTI International University

[a]lwaiyie@gmail.com, [b]waiyie@gmail.com

Corresponding author: Wai Yie Leong, lwaiyie@gmail.com ; Wai Yie Leong, waiyie@gmail.com

Keywords: Human–Robot Interaction (HRI), Safe Autonomous Systems, Artificial Intelligence

Abstract:

This study proposes advanced Human–Robot Interaction (HRI) models to enable collaborative and safe operation in autonomous systems across industrial, healthcare, and service environments. As robots increasingly work alongside humans, ensuring intuitive communication, trust, and safety becomes critical. The proposed framework integrates multimodal interaction channels, including speech, gesture, and proximity sensing, to facilitate seamless human–robot collaboration.

The HRI model incorporates machine learning and intent recognition algorithms to interpret human actions and predict user intentions in real time. A safety-aware control mechanism is embedded using dynamic risk assessment, collision avoidance, and compliance control strategies, ensuring safe physical interaction. Additionally, explainable AI components are introduced to improve system transparency and user trust by providing interpretable feedback on robotic decisions and actions.

Experimental validation demonstrates that the proposed HRI framework enhances task efficiency, reduces human workload, and significantly improves safety metrics compared to conventional interaction models. The system also adapts to user behavior through continuous learning, enabling personalized interaction experiences. Overall, this research highlights the importance of intelligent, adaptive, and human-centered HRI models in advancing the deployment of collaborative autonomous systems in complex real-world environments.

P260066

Artificial Intelligence Application and Firms' Green Innovation Performance: The Moderating Roles of Environmental Investment and Research and Development Expenditure

Jiayu LU[1,a] and Yue WU[1,b]

[1]Faculty of Business and Management (FBM) Beijing Normal - Hong Kong Baptist University (BNBU)

[a]t330024156@mail.bnbu.edu.cn, [b]yuewu@bnbu.edu.cn

Corresponding author: Jiayu LU, t330024156@mail.bnbu.edu.cn

Keywords: Keywords—artificial intelligence, green innovation, environmental investment, research and development expenditure, panel data

Abstract:

Abstract—Artificial intelligence is increasingly regarded as a strategic resource for sustainable transformation, yet evidence remains limited on whether artificial intelligence application improves firms' green innovation and how complementary investments shape this effect. Drawing on the resource-based view, this study investigates the direct impact of artificial intelligence application on green innovation and the moderating roles of environmental investment and research and development expenditure. Using 33,549 firm-year observations of Chinese listed companies from 2008 to 2023, we estimate two-way fixed effects models with robust standard errors. The results show that artificial intelligence application significantly enhances green patent output. Environmental investment and research and development expenditure further strengthen this positive effect, indicating that digital capability, sustainability commitment, and innovation resources operate as complementary assets. These findings extend research on artificial intelligence enabled sustainable innovation and provide practical guidance for aligning artificial intelligence deployment with environmental and innovation investment.

P260070

An Autonomous Patrol Vehicle for Safety and Personnel Identification using Deep Learning

Chin-Chih Chang[1,a], Chien-Lung Li[2,b], Yin-Hsuan Peng[1,c], Chyuan-Huei Thomas Yang[3,d] and Sean Hsiao[4,e]

[1]Department of Computer Science and Information Engineering, Chung Hua University

[2]College of Computer Science and Electrical Engineering, Chung Hua University

[3]School of Information Engineering, Shandong Vocational and Technical University of International Studies

[4]Department of Computer Science and Information Engineering, Ming Chuan University

[a]changc@chu.edu.tw, [b]d11424002@chu.edu.tw, [c]e11202003@chu.edu.tw, [d]chyang@swut.edu.cn, [e]sean.hsiao@mail.mcu.edu.tw

Corresponding author: Chin-Chih Chang, changc@chu.edu.tw ; Sean Hsiao, sean.hsiao@mail.mcu.edu.tw

Keywords: Bluetooth Beacon, Deep Learning, Fire Detection, Indoor Positioning, Raspberry Pi

Abstract:

In contemporary industrial and residential environments, sudden accidents—particularly fires—remain a significant concern due to their potential for catastrophic consequences. While fire inspection systems are essential, high-end patrol robots are often financially inaccessible for small-scale factories. This study develops a low-cost autonomous patrol vehicle using a Raspberry Pi 5B to perform automated inspections in unmanned or hazardous environments.

The system integrates high-efficiency indoor positioning, deep learning-based recognition, and real-time environmental sensing. For navigation, the vehicle utilizes Bluetooth Beacon technology combined with an Adaptive Ratio-Based Positioning (ARBP) algorithm and the A* path planning method. To overcome the instability of Received Signal Strength Indication (RSSI) caused by environmental interference, a Mean-Biased Filter was implemented, demonstrating superior stability and efficiency compared to Kalman filtering in this hardware context.

The system uses a tiered deep learning architecture for hazard detection. Initial fire detection combines YOLOv8 with HSV color transformation and binary masking to filter out non-fire light sources. To optimize performance on resource-constrained hardware, a hybrid YOLO+LeNet model was implemented. Experimental results show this hybrid model achieved a 100% F1-score in both bright and dark environments, outperforming standalone YOLO and YOLO+ResNet in speed and accuracy. Additionally, the system utilizes FaceNet and Triplet Loss for personnel identification, reaching an 80% accuracy rate for frontal recognition and 70% for profiles. Real-time environmental monitoring is further bolstered by an MQ-2 gas sensor and Arduino Nano to detect smoke and combustible gases.

All sensory data and visual alerts are integrated into a Flask-based web monitoring interface. This platform provides supervisors with real-time fire alerts and live camera feeds, enabling immediate response to emergencies. By combining cost-effective hardware with optimized models, this research provides a viable solution for reducing manual inspection labor and ensuring the safety of personnel and property.

P260071

An AI-Assisted Semiconductor Fundamentals Learning System with Knowledge Graph Visualization

Chih-Chiang Cho[1,a], Jiann-Jong Chiu[2,b] and Chin-Yu Chang[1,c]

[1]Department of Electrical Engineering, Tatung University, Taipei City, Taiwan

[2]Ansforce Inc., Taipei City, Taiwan

[a]A098139767300@gmail.com, [b]jeff@ansforce.com, [c]cyc@gm.ttu.edu.tw

Corresponding author: Chin-Yu Chang, cyc@gm.ttu.edu.tw

Keywords: Semiconductor fundamentals, Generative AI, Educational technology, Knowledge graph visualization, Interactive learning system

Abstract:

As the semiconductor industry continues to grow, the extensive range of specialized terminology in the field poses considerable challenges for learners attempting to establish a systematic knowledge framework. Existing learning tools are largely limited to static resources, lacking effective mechanisms for illustrating conceptual relationships and delivering personalized explanatory support.

This study designs and implements a semiconductor fundamentals learning assistance system that integrates generative artificial intelligence and knowledge graph technologies. The system backend is constructed using the ASP.NET Core framework with a SQL Server database, incorporating 155 core semiconductor terms spanning 15 categories, including fundamental semiconductor theory, P-N junction characteristics, device operating principles, and materials science. The Google Gemini API is integrated to generate concise summaries and extended explanations for individual terms, while D3.js is employed to build an interactive knowledge graph that visually presents 85 relational connections among terms. The system further provides personalized learning progress tracking, popular term recommendations, and real-time semiconductor industry news updates.

The proposed system is expected to effectively support learners in acquiring foundational semiconductor knowledge. By combining knowledge graph visualization with AI-generated explanations, the system aims to help users develop a structured and comprehensive knowledge network, offering a practical and innovative digital learning solution for the field of engineering education.

P260072

An Edge–Cloud Platform for Data and Model Management in Smart Manufacturing with a Large Language Model-Based Agent

Chun Chung Chang[1,a], Jian Wen Chen[2,b], Meng Shiun Tsai[3,c] and Che Lun Hung[1,d]

[1]National Yang Ming Chiao Tung University

[2]National Tsing Hua University

[3]National Taiwan University

[a]hank0209.md13@nycu.edu.tw, [b]vito9580@gapp.nthu.edu.tw, [c]mstsai0126@ntu.edu.tw, [d]clhung@nycu.edu.tw

Corresponding author: Che Lun Hung, clhung@nycu.edu.tw

Keywords: Edge–Cloud Computing, Smart Manufacturing, Large Language Model, Industrial Internet of Things

Abstract:

Smart manufacturing systems are essential for improving productivity and decision-making in industrial environments. However, their increasing complexity introduces challenges in data integration and scalable artificial intelligence (AI) deployment due to heterogeneous data formats, communication protocols, and hardware architectures. To address these challenges, this paper proposes an edge–cloud platform for data and model management in smart manufacturing. The platform consists of three main components. The first is a Large Language Model (LLM)-based edge AI agent, which supports natural language interaction and decision-making. The second is a model management module that enables model deployment and version control. The third is a monitoring and data analytics module that provides real-time visualization and analysis. Together, these components enable unified data integration, efficient model management, and intelligent process control. The system is implemented on an edge device and validated in a CNC machining environment. The results demonstrate improved system flexibility, real-time monitoring capability, and enhanced decision-making efficiency for smart manufacturing applications.

P260073

SECOED: A Comparative Machine Learning Approach for Teacher Training Course Recommendation

Elsy Rodriguez-Revelo[1,a], Lorenzo Cevallos-Torres[1,b], Vallardo Villegas-Ricauter[1,c] and Lilia Santos-Díaz[2,d]

[1]Universidad Bolivariana del Ecuador
[2]Universidad de Guayaquil

[a]erodriguezr@ube.edu.ec, [b]ljcevallost@ube.edu.ec, [c]vvvillegasr@ube.edu.ec, [d]lilia.santosd@ug.edu.ec

Corresponding author: Lorenzo Cevallos-Torres, ljcevallost@ube.edu.ec ; Elsy Rodriguez-Revelo, erodriguezr@ube.edu.ec

Keywords: Educational recommender systems, Machine Learning, teacher training, higher education, Random Forest

Abstract:
Teacher training management in higher education often relies on manual decisions derived from teacher performance evaluations, which can be slow, subjective, and difficult to personalize. This paper presents a comparative machine learning approach for recommending training courses in SECOED V3, a platform intended to support teacher evaluation and training management at the University of Guayaquil. The proposal combines an applied research design, waterfall-oriented software development, and a Knowledge Discovery in Databases pipeline to transform institutional evaluation records into predictive inputs for course recommendation. A dataset was built from teacher evaluation variables related to pedagogical, didactic, and information and communication technology performance, together with contextual academic attributes and engineered grouped-score variables. Three supervised learning models were evaluated: K-Nearest Neighbors, Decision Tree, and Random Forest. Four experimental scenarios were designed to compare the effect of raw scores, contextual features, and grouped variables on classification performance. The evaluation process included label encoding, standardization of quantitative variables, filtering of underrepresented classes, and an 80/20 stratified split for training and testing. Results showed that Random Forest achieved the best overall performance, with a maximum accuracy of 60.81% in the second scenario, while Decision Tree achieved 57.43% and K-Nearest Neighbors 37.83% under the same configuration. A one-sided proportion test against an expected performance threshold of 80% rejected the null hypothesis in all scenarios and for all models. Although predictive performance did not reach the expected target, the study demonstrates the feasibility of integrating computational intelligence into institutional teacher training management and identifies feature design and data quality as key directions for future improvement

P260074

An Intelligent Content Assignment Model for Teacher Professional Development in Virtual Learning Environments

Elsy Rodriguez-Revelo[1,a], Vallardo Villegas-Ricauter[1,b], Juan Cedeño-Rodriguez[2,c] and Lorenzo Cevallos-Torres[1,d]

[1]Universidad Bolivariana del Ecuador
[2]Universidad de Guayaquil

[a]erodriguezr@ube.edu.ec, [b]vvvillegasr@ube.edu.ec, [c]juan.cedenor@ug.edu.ec, [d]ljcevallost@ube.edu.ec

Corresponding author: Lorenzo Cevallos-Torres, ljcevallost@ube.edu.ec ; Elsy Rodriguez-Revelo, erodriguezr@ube.edu.ec

Keywords: computational intelligence, recommender systems, teacher professional development, virtual learning environments, ersonalized recommendation

Abstract:
The growing use of virtual learning environments in higher education has increased the need for intelligent mechanisms capable of assigning training resources according to the actual needs of teachers. This paper presents an intelligent content assignment model designed to support teacher professional development through personalized recommendations. The proposal addresses the problem of improving the precision of content allocation across pedagogical, didactic, and information and communication technology dimensions. Methodologically, the study followed an applied research approach supported by bibliographic analysis, functional observation, expert-based validation, and agile prototyping. The system was implemented using a three-layer architecture composed of a presentation layer, a business logic layer, and a data layer. The recommendation engine was structured as a content-based model using textual profiling, TF-IDF weighting, and cosine similarity to match training needs with available learning resources. Development was organized through six Scrum sprints, allowing iterative implementation and validation. The prototype was evaluated by expert judgment under criteria of clarity, objectivity, sufficiency, consistency, methodology, and applicability, obtaining an overall compliance score of 88.95%. The results indicate that the proposed model is operationally feasible and relevant for improving teacher training processes in institutional digital environments. The main contribution of this work is the reframing of training-content allocation as a computational intelligence problem rather than merely a software integration task

P260075

A Production-Oriented RAG Architecture for Occupational Safety and Health Question Answering over Regulatory Documents

Alexander Suleykin[1,a], Peter Panfilov[1,b], Tsydenov Saian[1,c], Anastasiya Radaeva[2,d], Valery Pyatetsky[2,e] and Alexander Zinin[2,f]

[1]HSE University

[2]The National University of Science and Technology MISIS

[a]aless.sull@mail.ru, [b]ppanfilov@hse.ru, [c]tsydenovsayan@gmail.com, [d]av.radaeva@misis.ru, [e]7621496@gmail.com, [f]zinin.aa@misis.ru

Corresponding author: Anastasiya Radaeva, av.radaeva@misis.ru ; Peter Panfilov, ppanfilov@hse.ru

Keywords: Retrieval-Augmented Generation (RAG), Occupational Safety and Health (OSH), Hybrid Retrieval, Cross-Encoder Reranking, Domain-Specific Question Answering

Abstract:

This paper presents a production-oriented retrieval-augmented generation (RAG) architecture for domain-specific question answering over large regulatory document collections. We study the occupational safety and health (OSH) domain, where the system assists labour protection experts and responses must be grounded in formal regulatory and procedural texts. We show that a baseline RAG pipeline that performs adequately on small corpora degrades as the knowledge base scales to thousands of files, resulting in noisier retrieval and less reliable grounding; additionally, LLM-based reranking becomes a major latency and cost driver in production settings. To address these issues, we redesign the system across the retrieval stack: structured ingestion with hierarchy-aware chunk construction and embedding-level deduplication, a client–server vector backend with metadata retention to support filtering and exact-match discovery, hybrid retrieval combining dense vector search with BM25 and query expansion, cross-encoder reranking for efficient candidate selection, and graph-based orchestration that enables iterative retrieval, filtering, and recovery in empty-result cases via query-reformulation loops. We evaluate staged improvements using Context Precision, Context Recall, and an LLM-based answer score. Experiments on a real-world safety-regulation corpus indicate that data-centric changes—especially hierarchical and semantic chunking—deliver the largest end-to-end gains, with the final configuration achieving an answer score of 0.9218. Overall, the results suggest that scalable domain RAG depends primarily on structured data preparation and retrieval design rather than prompt engineering alone.

P260078

Perceptions and Attitudes Toward Quiet Quitting Among Generation Z: An Empirical Investigation

Yu-Tzu Sun[1,a] and Yu-Jing Chiu[2,b]

[1]Department of Business Administration Chung Yuan Christian University

[2]Department of Business Administration Chung Yuan Christian University

[a]g11304105@cycu.edu.tw, [b]yujing@cycu.edu.tw

Corresponding author: Yu-Tzu Sun, g11304105@cycu.edu.tw ; Yu-Jing Chiu, yujing@cycu.edu.tw

Keywords: Generation Z, Quiet Quitting, AI Anxiety, Job Insecurity, Segmentation Preference, Turnover Intention, Conservation of Resources Theory, PLS-SEM

Abstract:

This study applies Conservation of Resources Theory (COR Theory; Hobfoll, 1989) to examine Generation Z employees' attitudes toward five constructs: AI Anxiety, Job Insecurity, Segmentation Preference (preference for clear work-life boundaries), Quiet Quitting, and Turnover Intention. When resources are threatened, individuals adopt defensive behaviors. This study explores how AI anxiety, job insecurity, and reluctance to blur work-life boundaries drive quiet quitting and turnover.

Given the research design, the target population consists of individuals willing to disclose sensitive reasons underlying their intention to leave. Such participants are difficult to recruit, resulting in a small sample size. Considering non-normal data distribution and small sample constraints, PLS-SEM was selected to examine relationships among the constructs.

COR Theory has predominantly been applied to stress and burnout. This study extends it to AI-induced anxiety and turnover behavior, broadening the theory's scope. While prior research focused on Baby Boomers and Millennials, this study targets Generation Z, filling a generational gap and offering theoretical insight into this cohort's workplace attitudes in the AI era.

From a practical perspective, this study reconceptualizes employees as organizational resources within the COR framework. It underscores the importance of acknowledging the psychological impact of AI adoption on employees, and advocates for the proactive development of organizational intervention strategies targeting quietly disengaged employees. Enhancing employee retention not only reflects an organization's commitment to its workforce but also serves as evidence of its capacity to safeguard and sustain existing organizational resources. As organizations accelerate the deployment of AI tools and automated workflows, it is imperative that they simultaneously establish mechanisms for employees' psychological adaptation. By identifying early indicators of declining work engagement, organizations are better positioned to implement preventive measures before turnover intentions solidify, thereby reducing voluntary employee attrition.

P260079

SPH-Based Fluid Interaction with Selective SDF Boundaries in XR environment

Hamin Lee[1,a], Jaehyoun Kim[2,b] and Min Hong[1,c]

[1]Soonchunhyang University

[2]Sungkyunkwan University

[a]haminprotoss@gmail.com, [b]jaekim@skku.edu, [c]mhong@sch.ac.kr

Corresponding author: Min Hong, mhong@sch.ac.kr

Keywords: XR, fluid simulation, SPH, SDF, spatial interaction

Abstract:

Particle-based fluid simulation is an important component for enhancing realism in XR environments. However, achieving stable physical interaction with real-world geometry remains challenging because of complex mesh structures, collision instability, and high computational cost. In this paper, we present an SPH-based fluid interaction framework that employs selective Signed Distance Field (SDF) boundaries for both a container and partial real-space geometry in an XR pass-through environment, where a pre-scanned indoor room mesh is aligned with the physical environment in Unity3D. The container is represented as an SDF boundary, allowing fluid particles to remain stably confined according to the container shape while responding to user manipulation. As the user grasps, shakes, and tilts the container to pour fluid, the fluid interacts with the dynamically updated container boundary. In addition, instead of colliding with the entire scanned room mesh, spilled fluid particles interact only with a predefined local region of a table surface. To this end, only the fluid interaction region is extracted from the full room mesh of 165,714 vertices and reduced to a sub-mesh of 7,326 vertices and 2,442 triangles, from which an SDF is generated for collision computation. This approach reduces the computational cost compared with using the entire space as a boundary condition while enabling localized fluid interaction aligned with the real environment. The proposed framework was implemented in a PC-based XR pass-through setup and maintained an average performance of approximately 48 FPS with about 40,000 fluid particles, while reproducing fluid behavior inside the container as well as collision and flow changes against selected spatial boundaries in real time. The proposed framework provides a practical approach for integrating fluid simulation with selective spatial collision in XR and can serve as a foundation for real-space fluid interaction, immersive simulation, and educational or visualization applications.

P260081

Context-Dependent Effects of Lung Segmentation Preprocessing on CXR Pneumonia Classification: A Comparative Study Across Acquisition Settings and Backbone Architectures

Jihong Min[1,a], JungWan Park[2,b], Sungyeup Kim[1,c] and Min Hong[1,d]

[1]Soonchunhyang University

[2]Soonchunhyang University Cheonan Hospital

[a]wlghd5524@sch.ac.kr, [b]splendidmagic@schmc.ac.kr, [c]sungyeupkim@sch.ac.kr, [d]mhong@sch.ac.kr

Corresponding author: Min Hong, mhong@sch.ac.kr ; JungWan Park, splendidmagic@schmc.ac.kr

Keywords: Chest X-ray, Lung Segmentation Preprocessing, Pneumonia Classification, Acquisition-Dependent Preprocessing

Abstract:

Chest X-ray (CXR) imaging is one of the most widely used diagnostic tools in clinical practice, yet the conditions under which lung segmentation-based preprocessing provides meaningful benefit remain insufficiently understood, particularly across different acquisition settings and backbone pretraining characteristics. In this study, we conduct a comparative evaluation of lung segmentation-based preprocessing strategies for pneumonia classification using the MIMIC-CXR-JPG dataset, spanning both PA and AP views multiple backbone architectures, and two segmentation methods. We compare five preprocessing conditions: original images, lung-masked and lung-cropped images derived from CheXmask (HybridGNet-based, expert-validated), and lung-masked and lung-cropped images generated by MedSAM3, a text-promptable segmentation foundation model. Experiments span CNN and ViT backbones, including general-purpose pretrained models and a CXR-specific foundation model. Results reveal that preprocessing effects are strongly dependent on acquisition noise level and backbone pretraining domain. In high-quality PA views, preprocessing yields minimal benefit, with raw images achieving competitive performance (AUROC up to 0.817). In AP views reflecting noisy ICU conditions, preprocessing consistently improves performance, with notable gains in ResNet50 (AUROC 0.674 to 0.725) and DINOv3, a general-purpose ViT pretrained on non-medical data (AUROC 0.713 to 0.757). In contrast, EVA-X, a CXR-specific foundation model pretrained exclusively on chest radiographs, shows low preprocessing sensitivity under both views, suggesting that domain-specific pretraining implicitly encodes lung localization. Cropping consistently outperforms masking across all settings, and performance differences between MedSAM3 and CheXmask remain small, indicating that segmentation tool choice has limited impact beyond sufficient segmentation quality. These findings offer practical guidelines suggesting that lung segmentation preprocessing is most beneficial in noisy acquisition settings or with general-purpose backbones, and may be omitted when using high-quality images or CXR-specific foundation models.

P260088

Construction and Application Practice of Public Participation Platform Based on PPGIS--A Case Study of the Renewal of Micro Public Spaces in Jimei Dashe, Xiamen City, China

Sihan Liu(co-first author)[1,a], Mingshuo Li(co-first author)[1,b] and Yinglu Huang(co-first author)[1,c]
[1]Huaqiao University

[a]2916160756@qq.com, [b]1114172801@qq.com, [c]lilghost19971016@gmail.com

Corresponding author: Yinglu Huang, lilghost19971016@gmail.com

Keywords: PPGIS, Public Participation Platform, Micro Public Space, Community Renewal

Abstract:
At present, the renewal of urban micro public spaces in China is generally plagued by problems such as limited channels for public participation and difficulties in effectively integrating residents' opinions into the planning process. To enhance public participation in community micro-renewal, this study takes Public Participation Geographic Information System (PPGIS) as the technical support to construct a public participation platform for urban micro public space renewal. Taking Jimei Dashe in Xiamen as a case area, the paper explores the construction method and application effect of the platform. This research integrates the PPGIS workshop, LSV (LocaSpace Viewer) 3D geographic information software, and WeChat official account to establish a comprehensive participation platform integrating information acquisition, planning participation, scheme voting, and decision publicity, realizing a combination of online and offline public participation. In the practice of micro public space renewal in Jimei Dashe, the platform effectively supports the whole process including status quo investigation, public opinion collection, scheme visualization display, and online voting evaluation, which improves residents' enthusiasm for participation and enhances the scientificity and rationality of planning schemes. The results show that the PPGIS public participation platform can effectively lower the threshold for public participation, promote the in-depth integration of local knowledge and professional planning, and provide a simple and feasible technical path and practical paradigm for public participation in the renewal of urban community micro public spaces.
The first two authors contributed equally to this work and are co-first authors.

P260089

Deep Learning-Based Gait Analysis and Fall Detection with MediaPipe Pose

Pu-Sheng Tsai[1,a] and Ter-Feng Wu[2,b]

[1]Department of Electrical Engineering, Ming Chuan University, Taoyuan, Taiwan, ROC
[2]Department of Electrical Engineering, National Ilan University, Yilan, Taiwan, ROC

[a]pusheng@mail.mcu.edu.tw, [b]tfwu@niu.edu.tw

Corresponding author: Ter-Feng Wu, tfwu@niu.edu.tw

Keywords: skeleton-based human activity recognition, convolutional neural network (CNN), fall detection, gait identification, Internet of Things (IoT)

Abstract:

This study proposes a skeleton-based human activity recognition framework that integrates MediaPipe Pose–based feature extraction with deep learning for intelligent healthcare applications, including gait analysis and fall detection. Skeletal time-series data from 33 keypoints are extracted from video streams and transformed into angle-based temporal features to characterize human motion patterns. Experimental results demonstrate that the proposed method effectively captures gait characteristics and achieves stable performance in both binary and multi-class fall detection tasks. In addition, an Internet of Things (IoT) architecture based on Raspberry Pi and ESP32 is developed to enable real-time fall detection and remote monitoring. The proposed system exhibits high computational efficiency and strong integration capability, making it suitable for smart home care and real-time safety monitoring applications.

P260090

Towards Green Edge Computing: Energy-Efficient Virtual Switching via DPU Hardware Offloading

Pang-Wei, Tsai[1,a] and Chih-Yuan, Cheng[1,b]
[1]National Cheng Kung University

[a]pwtsai@ee.ncku.edu.tw, [b]nq6134031@gs.ncku.edu.tw

Corresponding author: Cheng, Chih-Yuan, nq6134031@gs.ncku.edu.tw

Keywords: Green Computing, DPU, Offload, Virtual Switch

Abstract:
As edge computing rapidly expand, hyperconverged infrastructure (HCI) at the edge faces severe resource and energy constraints. In these environments, software-based virtual switches (e.g., Open vSwitch) are heavily utilized to manage East-West and North-South traffic among multi-tenant microservices. However, operating software vSwitches at high-speed network rates (e.g., 25Gbps to 100Gbps) consumes a disproportionate amount of host CPU cycles, leading to significant thermal output, increased power consumption, and degraded performance for critical user applications. This reasearch aims to propose an energy-inefficient architecture fundamentally contradicts the goals of green computing at the edge.

P260095

An Interpretable Computational Intelligence Approach for Atrial Fibrillation Biomarker Identification from ECG-Derived Features under Uncertainty

Lorenzo Cevallos-Torres[1,a], Rosangela Caicedo-Quiroz[1,b], Rafael Sorhegui-Ortega[1,c] and Dayron Rumbaut-Rangel[1,d]

[1]Universidad Bolivariana del Ecuador

[a]ljcevallost@ube.edu.ec, [b]rcaicedoq@ube.edu.ec, [c]rasorheguio@ube.edu.ec, [d]drumbautr@ube.edu.ec

Corresponding author: Lorenzo Cevallos-Torres, ljcevallost@ube.edu.ec ; Dayron Rumbaut-Rangel, drumbautr@ube.edu.ec

Keywords: Atrial fibrillation, computational intelligence, interpretability, uncertainty modeling, Knowledge Discovery in Databases

Abstract:

Atrial fibrillation (AF) is a significant cardiac arrhythmia, as its delayed identification heightens the risk of stroke, heart failure, and other serious cardiovascular consequences. This research in-troduces an interpretable computational intelligence method for discovering ECG-derived bi-omarkers linked to atrial fibrillation in the presence of ambiguity. The methodology was orga-nized according to a Knowledge Discovery in Databases (KDD) workflow, encompassing data organization, preprocessing, feature transformation, supervised learning, evaluation, and de-ployment. A dataset including 42,168 records and 11 features was utilized to predict atrial fibril-lation-oriented patterns from ECG-derived variables, including mean heart rate, RR-interval variability metrics, and representative waveform statistics. Two classifiers were evaluated: mul-tinomial logistic regression and Gaussian Naive Bayes. Multinomial logistic regression had su-perior overall performance, achieving 94.51% accuracy, an AUC of 0.98, and an MCC of 0.89, surpassing Gaussian Naive Bayes. Model transparency was enhanced by SHAP and LIME expla-nations underscoring the significance of pnn50, nn50, sdnn, rmssd, average heart rate, and median ECG peaks in atrial fibrillation prediction. A lightweight web prototype and a neutrosophic evaluation layer were integrated to facilitate uncertainty-aware decision support

P260097

Hybrid Fuzzy AHP and Single-Valued Neutrosophic Decision Support for Emotional Impact Assessment in Adolescents Affected by Family Migration

Lorenzo Cevallos-Torres[1,a], Julio Barzola-Monteses[1,b], Roberto Tolozano-Benites[1,c], Dayron Rumbaut-Rangel[1,d] and Franklin Parrales-Bravo[1,e]

[1]Universidad Bolivariana del Ecuador

[a]ljcevallost@ube.edu.ec, [b]jjbarzolam@ube.edu.ec, [c]rtolozano@ube.edu.ec, [d]drumbautr@ube.edu.ec, [e]frparralesb@ube.edu.ec

Corresponding author: Lorenzo Cevallos-Torres, ljcevallost@ube.edu.ec ; Dayron Rumbaut-Rangel, drumbautr@ube.edu.ec

Keywords: fuzzy AHP, fuzzy inference system, neutrosophic logic, adolescent emotional assessment, decision support

Abstract:

This paper presents a compact computational intelligence framework for emotional impact assessment in adolescents affected by the migration of close relatives. The proposal integrates Fuzzy Analytic Hierarchy Process (Fuzzy AHP), Mamdani fuzzy inference, and single-valued neutrosophic representation into a unified decision-support workflow. The model was built from a pilot dataset of 30 adolescents aged 15–17 in Guayaquil, Ecuador, and organizes the problem into three evaluation blocks: migration factors, migration effects, and emotional development. Fuzzy AHP is used to derive criterion weights from pairwise comparisons, fuzzy inference transforms qualitative assessments into interpretable outputs, and the neutrosophic layer supports prioritization under indeterminacy. The framework is finally deployed in a lightweight web-based prototype for result visualization. The reported pilot outputs were 0.12 for migration factors, 0.37 for migration effects, and 0.45 for emotional development, yielding an overall affectation score of 0.21, interpreted as a low compromised emotional state. The main contribution is not the web interface itself, but the hybrid uncertainty-aware decision methodology, which is suitable for small-sample, weakly structured, and human-centered assessment scenarios. This reformulation positions the work within the Computational Intelligence track by emphasizing explainable reasoning, structured uncertainty handling, and practical decision support

P260099

Beyond Technical Performance: Data Governance, Public Trust, and the Effectiveness of AI-Based Smart Mobility Systems

GuoHanXiang[1,a] and LeongWaiYie[1,b]

[1]INTI International Unversity

[a]i25034188@student.newinti.edu.my, [b]waiyie.leong@newinti.edu.my

Corresponding author: Guo Hanxiang, i25034188@student.newinti.edu.my

Keywords: Smart Mobility, AI-Based Transport Systems, Data Governance, Public Trust, Urban Governance, Comparative Case Study

Abstract:

Artificial intelligence now plays a central role in smart mobility, helping cities manage traffic flow, improve public transport reliability, and respond to incidents more effectively. Yet technical capacity alone does not determine whether these systems work well over time. Their performance is also shaped by the quality of governance, the clarity of data rules, and the level of public trust they are able to sustain. This paper examines the ways in which data governance arrangements influence the effectiveness and transferability of AI-based mobility systems. It adopts a qualitative comparative approach and focuses on three Asian cases: Hangzhou's City Brain, Singapore's Land Transport Authority, and Kuala Lumpur's smart mobility initiatives. Through these cases, the study explores differences in institutional design, inter-agency coordination, accountability structures, and citizen-facing service models. The analysis shows that governance choices affect not only how AI systems are introduced, but also how they are accepted, managed, and expanded. Centralized models tend to provide stronger consistency and administrative control. Public–private platforms often move faster, yet they raise sharper concerns over transparency and data ownership. Multi-agency arrangements can appear more flexible, though they are often slowed by coordination problems. Smart mobility, in practice, depends on more than algorithms, sensors, and predictive tools. It also depends on trusted institutions, clearly defined data responsibilities, and continued public engagement. For cities seeking to build AI-enabled transport systems, the issue is not only efficiency, but also social legitimacy and long-term institutional durability.

P260100

From Predictive Analytics to Reinforcement Learning: Future Directions for Intelligent Urban Traffic Control

GuoHanXiang[1,a] and LeongWaiYie[1,b]

[1]INTI International Unversity

[a]i25034188@student.newinti.edu.my, [b]waiyie.leong@newinti.edu.my

Corresponding author: Guo Hanxiang, i25034188@student.newinti.edu.my

Keywords: Predictive Analytics, Reinforcement Learning, Smart Mobility, Urban Traffic Control, Multi-Agent Coordination, Spatio-Temporal Modelling, Governance Accountability

Abstract:

Current smart mobility systems rely heavily on predictive analytics, real-time sensing, and centralized data platforms to improve the operation of urban traffic networks. These arrangements have produced clear gains in congestion management, demand forecasting, and incident response. Even so, most of them still work within a predictive logic rather than a truly adaptive one. This paper examines the next step in intelligent urban traffic control by looking at the shift from predictive artificial intelligence to reinforcement learning-based decision systems. It draws on smart mobility cases in Hangzhou, Singapore, and Kuala Lumpur, and it also reviews recent studies on reinforcement learning, multi-agent coordination, and spatio-temporal traffic modelling to assess what this shift may offer and where its limits remain. Reinforcement learning is found to have strong value for real-time adaptive control, especially in signal optimization, network-wide coordination, and responses to uncertain traffic conditions that do not fit stable forecast patterns. At the same time, its practical use is constrained by several unresolved issues, including the sim-to-real gap, large-scale deployment, safety requirements, limited interpretability, and questions of governance accountability. The study therefore treats reinforcement learning not as a simple technical upgrade, but as a broader change in how urban traffic systems sense conditions, make decisions, and respond in practice. It argues that the future of smart mobility will depend on linking predictive infrastructure with adaptive learning while keeping public safety, institutional capacity, and responsible governance at the center of system design.

P260107

Comparative Analysis of MobileNetV3 and MobileViT for Lightweight Tomato Leaf Disease Classification

Jhamil G. Gutierrez[1,a], Jamil Allen G. Fortaleza[1,b] and Cedie B. Macasaling[1,c]
[1]National University

[a]jggutierrez@nu-fairview.edu.ph, [b]fortaleza.jamil06@gmail.com, [c]cbmacasaling@nu-fairview.edu.ph

Corresponding author: Jamil Allen G. Fortaleza, fortaleza.jamil06@gmail.com

Keywords: plant disease, tomato leaf classification, precision agriculture, MobileNetV3, MobileViT

Abstract:
Timely and accurate diagnosis of tomato plant diseases is essential for ensuring food security and sustaining agricultural productivity. Although deep learning models have demonstrated high accuracy in plant pathology, conventional convolutional neural networks (CNNs) often exhibit limitations in capturing long-range dependencies within complex leaf lesion patterns. However, deployment-oriented comparisons between lightweight CNN and hybrid transformer architectures remain limited. This study presents a comparative benchmarking of MobileViT, a hybrid vision transformer–CNN model, and MobileNetV3 using the PlantVillage Tomato dataset. Both architectures were evaluated across RGB, grayscale, and segmented inputs using accuracy, precision, recall, F1-score, and inference latency to assess classification performance alongside operational feasibility. Results show that MobileNetV3-Large achieved the highest RGB testing ac-curacy (96.86%), while MobileViT-S delivered comparable performance (95.71%) with substantially lower inference latency (~0.0026 s per image versus 0.040 s). Performance degradation under grayscale inputs highlights the importance of chromatic information, whereas segmentation partially restored accuracy by emphasizing lesion-specific fea-tures. These findings reveal a fundamental performance–efficiency trade-off: Mo-bileNetV3 prioritizes maximum diagnostic accuracy, whereas MobileViT provides a more favorable balance of speed and accuracy for real-time, resource-constrained edge de-ployment. This work offers an evidence-based foundation for selecting lightweight ar-chitectures tailored to practical agricultural AI applications

P260110

Forecasting Quantum Technology Convergence Through Citation Network Dynamics and Probabilistic Topic Modeling of Triadic Patent Families

Ancheng Zhan[1,a]

[1]Independent Student Researcher

[a]anchengzhan27@gmail.com

Corresponding author: Ancheng Zhan, anchengzhan27@gmail.com ; Ancheng Zhan, anchengzhan27@gmail.com

Keywords: quantum technology, patent citation networks, technology convergence, topic modeling, triadic patent families

Abstract:

Quantum technologies are moving from lab research to commercially oriented innovation, yet the global patterns of cross-disciplinary convergence remain unclear. Prior studies have mapped national patent landscapes or broad thematic clusters, but few have analyzed inter-technology citation flows across quantum sub-fields.

This study addresses that gap by examining citation network dynamics and topic evolution within triadic patent families—those filed in at least two of the United States Patent and Trademark Office, European Patent Office, and Japan Patent Office—between 2010 and 2025. These families are used to capture inventions with clear international commercial intent.

Directed citation networks are constructed at the IPC subclass level to measure knowledge spillovers among quantum computing, communication, and sensing. Temporal segmentation across three five-year periods reveals shifts in cross-field citation intensity. In parallel, dynamic topic modeling using time-sliced Latent Dirichlet Allocation is applied to patent claims to trace thematic evolution and identify emerging hybrid topics.

This approach enables the identification of convergence hotspots where cross-disciplinary knowledge flows are intensifying, offering insights for future R&D prioritization.

P260111

Cross-Domain Knowledge Transfer in Global Robotics Patents Through Assignee Co-Classification and Collaborative Filing Network Analysis

Yuqiao Zhang[1,a]

[1]Independent Student Researcher

[a]zyuqiao989@gmail.com

Corresponding author: Yuqiao Zhang, zyuqiao989@gmail.com ; Yuqiao Zhang, zyuqiao989@gmail.com

Keywords: robotics patents, technology convergence, diversity indices, cross-domain innovation

Abstract:

The robotics sector increasingly draws on advances in adjacent fields such as artificial intelligence, advanced materials, and biomedical engineering, yet the extent to which individual robotics inventions are becoming more technologically cross-domain over time has not been systematically quantified. This study addresses that gap by analyzing the technology breadth of robotics patent families using Derwent Manual Codes — expert-assigned, hierarchical classification codes unique to the Derwent World Patents Index (DWPI). A dataset of robotics-related patent families filed at the USPTO, EPO, JPO, MOIP, and CNIPA between 2016 and 2025 was retrieved from DWPI using DWPI Class Code. For each patent family, the full set of assigned Derwent Manual Codes was extracted, and technology breadth was operationalized through Shannon entropy and Herfindahl diversity indices calculated at the individual patent level. These indices capture whether a given invention draws narrowly from a single technical domain or spans multiple domains simultaneously. Temporal trends in mean diversity scores are examined to assess whether robotics inventions are becoming more cross-domain over the study period. Diversity profiles are further disaggregated by assignee type — firms, universities, and public research organizations — and by filing jurisdiction to identify where and by whom the most technologically integrative inventions originate. This approach offers a continuous, quantitative measure of technology convergence that complements classification-frequency and text-based mapping methods, providing researchers and policymakers with an empirically grounded lens for tracking the broadening scope of robotics innovation.

P260114

YOLOv10-based Driver Drowsiness Detection through Facial Feature and Head Pose Estimation

Ice Marcux B. Canda[1,a], Eleazar A. Collamat[1,b] and Analyn N. Yumang[1,c]
[1]Mapua University

[a]imbcanda@mymail.mapua.edu.ph, [b]eacollamat@mymail.mapua.edu.ph, [c]anyumang@mapua.edu.ph

Corresponding author: Ice Marcux B. Canda, imbcanda@mymail.mapua.edu.ph ; Eleazar A. Collamat, eacollamat@mymail.mapua.edu.ph

Keywords: Driver Drowsiness Detection, YOLOv10, Computer Vision, Edge Computing, Raspberry Pi 5

Abstract:
Drowsy driving is a major issue contributing to a significant portion of global road traffic accidents, endangering drivers, passengers, and pedestrians. This study presents a driver drowsiness detection system that utilizes the You Only Look Once Version 10 (YOLOv10) to identify physical signs of drowsiness, targeting prolonged eye closure, yawning, head tilting, and nodding. To overcome the limitations of instantaneous frame analysis, the proposed framework processes a continuous video feed to evaluate dynamic behavioral patterns over consecutive frames. The edge computing hardware architecture is composed of a Raspberry Pi 5 equipped with a Raspberry Pi AI HAT+, Raspberry Pi Camera Module 2, and a buzzer module designed to emit an immediate acoustic alert upon the positive verification of sustained drowsiness. The model was trained and tested on a rigorously structured dataset of 2,000 annotated images. The data is evenly distributed with 500 images per class, which are further partitioned into 400 images for training, 40 for validation, and 60 for testing. The system performance was evaluated using a confusion matrix, revealing that the integrated prototype achieved an overall detection accuracy of 85%. Furthermore, the model demonstrated an overall precision of 0.916, a recall of 0.900, and a mAP50 of 0.937. These results validate that the developed system is highly proficient in capturing driver drowsiness cues, offering a robust, and computationally efficient safety mechanism for real time drowsiness monitoring.

P260115

Effectiveness of Implementing Digital Transformation

Deepa Thirumanancheri Justus[1,a] and Arumugam Seetharaman[1,b]

[1]SP Jain Global Scjhool of Management. Sydney, Australia

[a]deepa.dm21DBA014@spjain.org, [b]Seetha.raman@spjain.org

Corresponding author: Arumugam Seetharaman, Seetha.raman@spjain.org

Keywords: Digital Transformation (including Banking, Financial Services, BFSI),, Organisation Processes (including Organisation Structure, Business Model), Innovative collaboration (including Fintech, Innovation, Collaboration, Disruption), Sustainability (including Sustainability), Automation (including Internet of Things (IoT), Robotics, Big Data(BD), Artificial Intelligence (AI), Machine Learning (ML), Cloud Computing(CC))

Abstract:

Abstract— Digital transformation is a crucial process for the success of companies in the current digital landscape. The primary aim of this paper is to investigate what is known and what is still needed to be learned about Digital Transformation (DT). This paper presents a conceptual model to investigate the role of Collaborative innovation, Organisational processes, automation and sustainability expectation as key antecedents for effective implementation of Digital Transformation

The suggested investigation is qualitative in nature with a structured literature review to identify existing research gaps. The methodology involves including four independent variables that could contribute to the effectiveness of implementing Digital transformation

Research questions were formulated from the Gaps identified, and four research propositions were formed and tested. The propositions were supported by the literature review and proven as key factors that have resulted in a conceptual model for the effective implementation of Digital Transformation. The study has additionally emphasized the constraints and identified gaps for future research.

P260116

OBE-Oriented Teaching Reform for Communication Electronic Circuits Integrating AI-Supported Learning and Virtual–Physical Experimental Teaching

CHEN YIN[1,a], Leong Waiyie[2,b], Yang Dan[3,c] and YU Chengbo[3,d]

[1]Chongqing Institute of Engineering; INTI International University

[2]INTI International University

[3]Chongqing Institute of Engineering

[a]i25035482@student.newinti.edu.my, [b]waiyie.leong@newinti.edu.my, [c]283900413@qq.com, [d]yuchengbo@cqut.edu.cn

Corresponding author: Leong Waiyie, waiyie.leong@newinti.edu.my

Keywords: Outcome-Based Education (OBE), Communication Electronic Circuits, AI-supported learning, virtual–physical integrated experimental teaching, STEM interdisciplinary learning

Abstract:

Communication Electronic Circuits (CEC) is a core course in Communication Engineering, yet students often struggle to apply abstract theoretical knowledge to engineering practice. To address this issue, this study explores an Outcome-Based Education (OBE)–oriented teaching reform integrating AI-supported learning, STEM interdisciplinary learning, and a virtual–physical experimental model.

A quasi-experimental comparative design was conducted at Chongqing Institute of Engineering, involving 456 undergraduate students from three cohorts (2021–2023). The 2023 cohort (n = 162) experienced the fully implemented reform, while the 2021–2022 cohorts served as comparison groups. Instructional effectiveness was evaluated through CLO attainment, grade distribution analysis, learning analytics, and statistical methods including ANOVA, chi-square tests, and effect size estimation.

Results show that the 2023 cohort achieved an overall CLO attainment of 0.74, exceeding the benchmark of 0.70. Although the overall course score slightly declined due to competency-oriented assessment, laboratory performance improved significantly ($F = 10.76$, $p < 0.001$), with mean scores increasing from 85.84 to 89.61 and a moderate effect size ($d \approx 0.41$). Learning analytics further indicate strong engagement, with over 54,000 learning activities and 306,000 platform accesses.

These findings suggest that AI-supported learning primarily enhances engagement and learning support, while the virtual–physical model more directly improves practical engineering competence. However, due to the single-institution setting and lack of a randomized control group, the results should be interpreted as evidence of feasibility rather than causal proof. Future studies should adopt controlled designs to further examine the impact of AI-supported engineering education.

P260117

Developing a Cardiovascular Calcification Prediction Model from Chest X-rays via Attention-Enhanced Deep Learning

Lawrence Y. Deng[1,a], Xiang-Yann Lim[1,b], Zih-Yong Fan[1,c], Ting-Wei Wen[1,d], Yu-Hsuan Yen[1,e] and Yu-Cheng Chang[2,f]

[1]Tamkang University

[2]Department of Computer Science, National Tsing Hua University

[a]114722@mail.tku.edu.tw, [b]811415016@o365.tku.edu.tw, [c]412770660@o365.tku.edu.tw, [d]412770249@o365.tku.edu.tw, [e]412770454@o365.tku.edu.tw, [f]yucheng208@outlook.com

Corresponding author: Xiang-Yann Lim, 811415016@o365.tku.edu.tw

Keywords: Cardiovascular Calcification, Deep Learning, X-ray Imaging, Attention Mechanism

Abstract:

According to the 2024 statistics released by the Ministry of Health and Welfare in Taiwan, heart disease remains the second leading cause of death, highlighting the substantial impact of cardiovascular diseases on public health. In current clinical practice, computed tomography (CT) is commonly employed for calcification assessment owing to its high diagnostic accuracy; however, its high cost and relatively high radiation dose limit its suitability for large-scale screening and longitudinal follow-up. In contrast, chest X-ray imaging is more cost-effective and readily accessible. Nevertheless, its two-dimensional projection and the presence of anatomical overlap make calcification features difficult to identify. This study proposes a deep learning-based approach for automated analysis of cardiovascular calcification using chest X-ray images. Multiple deep learning models are evaluated to assess their performance in calcification prediction tasks. The best-performing model is further enhanced by incorporating an attention mechanism to improve feature extraction in critical regions. Experimental results demonstrate that the proposed method achieves an accuracy of 72.5% in cardiovascular calcification prediction tasks. Therefore, we believe that the integration of deep learning with attention mechanisms can effectively improve the identification of calcification features in chest X-ray images. This approach has the potential to serve as a clinical decision support tool, enhancing screening efficiency while reducing healthcare costs.

P260118

Requirements Engineering Reimagined: A Micro-Credential Framework for Competency-Based Learning

Darwin Castillo-Malla[1,a], Franklin Parrales-Bravo[2,b], Roberto Tolozano-Benites[3,c] and Leonel Vasquez-Cevallos[4,d]

[1]Universidad Técnica Particular de Loja
[2]Universidad de Guayaquil
[3]Universidad Bolivariana del Ecuador
[4]Universidad ECOTEC

[a]dpcastillo@utpl.edu.ec, [b]franklin.parralesb@ug.edu.ec, [c]rtolozano@ube.edu.ec, [d]lvasquez@ecotec.edu.ec

Corresponding author: Franklin Parrales-Bravo, franklin.parralesb@ug.edu.ec ; Leonel Vasquez-Cevallos, lvasquez@ecotec.edu.ec

Keywords: Requirements engineering, Micro-credentials, Competency-based learning, Performance-based assessment, Software engineering education

Abstract:
Requirements engineering remains one of the most challenging subjects to teach effectively in software engineering programs. Students often master declarative knowledge about elicitation techniques and specification formats yet struggle to apply this knowledge in the ambiguous, conflict-ridden contexts of real projects. This paper proposes a targeted micro-credential framework specifically designed for a semester-long requirements engineering course. Drawing on design science methodology and grounded in the competency specifications from our previous work, we present two stackable micro-credentials: Requirements Elicitation and Negotiation, and Writing Effective User Stories and Acceptance Criteria. For each credential, we detail content structure, performance-based assessment design, and integration strategies within existing course formats. The framework addresses persistent pedagogical challenges including the scalability of authentic assessment, the development of professional judgment under ambiguity, and the recognition of partial competency achievement. This course-specific application demonstrates how micro-credentials can transform a traditionally theory-heavy subject into a competency-driven learning experience that better prepares students for the human-centered realities of professional requirements practice.

P260119

Putting Theory into Practice: Lessons Learned from Implementing Micro-Credentials in a Requirements Engineering Course

Darwin Castillo-Malla[1,a], Franklin Parrales-Bravo[2,b], Dayron Rumbaut-Rangel[3,c] and Leonel Vasquez-Cevallos[4,d]

[1]Universidad Técnica Particular de Loja
[2]Universidad de Guayaquil
[3]Universidad Bolivariana del Ecuador
[4]Universidad ECOTEC

[a]dpcastillo@utpl.edu.ec, [b]franklin.parralesb@ug.edu.ec, [c]drumbautr@ube.edu.ec, [d]lvasquez@ecotec.edu.ec

Corresponding author: Franklin Parrales-Bravo, franklin.parralesb@ug.edu.ec ; Leonel Vasquez-Cevallos, lvasquez@ecotec.edu.ec

Keywords: Implementation study, Micro-credentials, Requirements engineering education, Peer assessment, Lessons learned

Abstract:
While the theoretical benefits of micro-credentials for software engineering education have been extensively discussed, empirical accounts of their practical implementation remain scarce. This paper addresses this gap by presenting a case study of implementing two stackable micro-credentials—Requirements Elicitation and Negotiation, and Writing Effective User Stories and Acceptance Criteria—within a fifteen-week undergraduate requirements engineering course. Drawing on implementation logs, student performance data, and post-course surveys from a cohort of forty-two students, we document the practical realities of translating credential blueprints into classroom practice. Our findings address three key areas: the scalability of authentic assessment through calibrated peer evaluation, the challenges students face when transitioning from declarative knowledge to performance-based demonstration, and the institutional adaptations required for credential issuance and recognition. The paper contributes actionable insights for educators seeking to implement micro-credentials, including specific recommendations for assessment design, student preparation, and faculty support. These lessons learned, while situated in a specific course context, offer transferable guidance for competency-based transformation across software engineering education.

P260120

Wood Type Classification Through Image Processing Using YOLOv9 with OpenCV

Sean Gabriel J. Cruz[1,a], Emmanuel D. Lorenzo[1,b] and Cyrel O. Manlises[1,c]
[1]Mapua University

[a]sgjcruz@mymail.mapua.edu.ph, [b]edlorenzo@mymail.mapua.edu.ph, [c]ccontimare@mapua.edu.ph

Corresponding author: Cyrel O. Manlises, ccontimare@mapua.edu.ph

Keywords: YOLOv9, Image Processing, OpenCV, Wood Classification, Linear Discriminant Analysis

Abstract:
This research paper presents the development of an image-processing tool using Linear Discriminant Analysis (LDA) and OpenCV to classify different types of wood. The study addresses the challenge of wood species identification, which is vital for the Philippine wood sector. A prototype system was designed using a Raspberry Pi camera to capture images of wood samples and extract key features such as color, texture, and grain patterns. Four wood species—Acacia, Agoho, Kamagong, and Sampalok—were examined, with 100 images collected per species, 80 for training and 20 for verification. The system demonstrated the capability to detect up to four samples simultaneously in real time, providing bounding boxes and labels for each identified species. Results showed that the model achieved 96.25% performance, with Acacia at 90% and Sampalok at 95%. This research may be applied in forestry management, the local wood industry, and research institutions for practical wood classification.

P260121

Near-Infrared Based Handheld Device for Authentication of Philippine Traditional Weaves

David James B. Leus[1,a], Seth Ryan S. Manuel[1,b], Noel B. Linsangan[1,c] and Rey Eliseo C. Torrejos[2,d]

[1]Mapúa University
[2]DOST

[a]djbleus@mymail.mapua.edu.ph, [b]srsmanuel@mymail.mapua.edu.ph, [c]nblinsangan@mapua.edu.ph, [d]rectorrejos@dost.gov.ph

Corresponding author: Seth Ryan S. Manuel, srsmanuel@mymail.mapua.edu.ph

Keywords: Near-infrared, Fiber Authentication, Philippine Traditional Weaves, Raspberry Pi, Handheld Device

Abstract:
Because of the increasing number of imitations, verifying the authenticity of traditional Philippine weaves has become a challenge despite their cultural significance. This study presents the development of a portable handheld device based on near-infrared (NIR) spectroscopy for textile authentication. The system analyzes spectral fingerprints of woven fabrics to determine fiber composition and classify authenticity. A Raspberry Pi is used for data processing, while classification performance is evaluated using a confusion matrix. The study focuses on four weave types: Coco, Pandan, Saguran, and Romblon. Experimental results from 80 trials achieved an overall accuracy of 85%, demonstrating the system's capability to reliably distinguish authentic from counterfeit weaves. The proposed device offers a fast, non-destructive, and portable solution that supports the preservation and protection of Philippine traditional weaving practices.

P260123

Transfer Learning for Edible Flower Classification: A Comparative Study of CNN Architectures

Jhamil G. Gutierrez[1,a], Jamil Allen G. Fortaleza[2,b], Aaron John Alegre[1,c] and Corazon B. Rebong[1,d]

[1]National University

[2]National Unversity

[a]jggutierrez@nu-fairview.edu.ph, [b]fortaleza.jamil06@gmail.com, [c]acalegre@nu-clark.edu.ph, [d]cbrebong@nu-fairview.edu.ph

Corresponding author: Jamil Allen G. Fortaleza, fortaleza.jamil06@gmail.com

Keywords: edible flower, flower classification, convolutional neural network, transfer learning

Abstract:

Edible flowers have gained global recognition for their nutritional value, therapeutic properties, and culinary applications, where accurate identification has become increasingly important in food technology and agriculture due to growing consumer de-mand for natural ingredients and functional botanicals. However, accurate identification remains challenging due to morphological similarities between species, posing food safety risks when toxic varieties are mistaken for edible ones. This paper presents an automated classification system for identifying edible flowers using deep learning and transfer learning techniques. A custom dataset comprising 1,200 images of eight edible flower species; Marigold, Moringa Flower, Periwinkle, Butter Daisy, Begonia, Wishbone, Cosmos, and Squash Blooms was developed under controlled imaging conditions with consistent backgrounds and lighting. The study systematically compares four distinct CNN architectures representing classic (VGG19), established (ResNet50), and modern efficient (MobileNetV3, EfficientNetB0) designs, all pre-trained on ImageNet. Data augmentation techniques including rotation, zoom variations, brightness adjustments, and horizontal and vertical flips were applied to enhance model generalization. The models achieved testing accuracies of 98.89%, 100%, 100% and 100% respectively, with MobileNetV3 representing optimal overall choice with its superior performance in both classification accuracy and computational efficiency. This work demonstrates the feasibility of CNN-based transfer learning for fine-grained edible flower classification and offers a practical, scalable approach for food safety applications, culinary identification systems, and agricultural monitoring within sustainable food production frameworks.

P260133

Image-Based Detection and Classification of Aflatoxin-Contaminated Corn Kernels Using EfficientDet

Ross Abraham Morales[1,a], Gian Lex Maverick D. Trinidad[1,b] and Analyn N. Yumang[1,c]
[1]Mapua University

[a]ramorales@mymail.mapua.edu.ph, [b]glmdtrinidad@mymail.mapua.edu.ph, [c]ANYumang@mapua.edu.ph

Corresponding author: Ross Abraham Morales, ramorales@mymail.mapua.edu.ph ; Gian Lex Maverick D. Trinidad, glmdtrinidad@mymail.mapua.edu.ph

Keywords: Aflatoxin Detection, Corn Kernel Classification, EfficientDet-Lite0, Ultraviolet Imaging, Computer Vision

Abstract:
Aflatoxin contamination of corn kernels is a critical food safety concern that poses serious health risks and economic losses to the agricultural industry. Traditional detection methods rely on laboratory-based analysis, which is often time-consuming, costly, and unsuitable for field applications. This study presents a computer vision-based aflatoxin detection system utilizing ultraviolet (UV) imaging and the EfficientDet-Lite0 object detection model to classify corn kernels into three categories: aflatoxin-contaminated, healthy, and non-aflatoxin-contaminated. The proposed system is designed for embedded deployment on a Raspberry Pi 4 (4GB), providing a portable solution for field use. The system operates through a capture and process workflow, wherein images are manually acquired by the user and subsequently analyzed by the model to determine contamination. The model was trained and evaluated on a custom dataset of over 1,500 UV-illuminated corn kernel samples with bounding-box annotations across three classes. Experimental results demonstrate that the proposed system achieved an overall accuracy of 91.10%, precision of 85.26%, recall of 89.86%, and an F1-score of 87.50%. Additionally, the model obtained a mean Average Precision (mAP@0.5) of 86.47%, indicating strong object detection and localization performance. These results validate the effectiveness of the developed approach as a reliable, efficient, and scalable solution for aflatoxin detection, with potential applications in agricultural quality control and food safety monitoring.

P260134

ICCBE 2026

Queenie Pan[1,a]
[1]IIKII

[a]anlin83918@gmail.com

Corresponding author: Queenie Pan, anlin83918@gmail.com

Keywords: test

Abstract:
test

P260143

Multimodal Cardiovascular Calcification Fusion Model Combining MedSigLIP and TabNet

Xiang-Yann Lim[1,a], Lawrence Y. Deng[1,b], Ting-Wei Wen[1,c], Zih-Yong Fan[1,d] and Yu-Hsuan Yen[1,e]
[1]Tamkang University

[a]811415016@o365.tku.edu.tw, [b]114722@mail.tku.edu.tw, [c]412770249@o365.tku.edu.tw, [d]412770660@o365.tku.edu.tw, [e]412770454@o365.tku.edu.tw

Corresponding author: Xiang-Yann Lim, 811415016@o365.tku.edu.tw

Keywords: Cardiovascular calcification, Chest X-ray, MedSigLIP, Multimodality, TabNet

Abstract:
Clinical assessment of cardiovascular calcification currently relies on Computed Tomography (CT) as the go-to standard. However, its high radiation dose and significant costs limit its accessibility for large-scale screening. Although chest X-ray imaging is more accessible, the overlap of bones and organs complicates the interpretation of cardiovascular calcification. To address this, this study proposes a multimodal architecture integrating the MedSigLIP Visual Encoder with TabNet, fusing Imaging Features with Clinical Variables for Deep Learning. Experimental results demonstrate that in binary classification tasks, the strategy using only image features is the most accurate method, achieving an accuracy of 68.2%. In the Heartpart region and multiclass tasks, the Multimodal Fusion mechanism exhibits a complementary effect, reaching an accuracy of 66.1% and 39.2% respectively, outperforming Single-Modality models. Notably, while using prediction followed by classification reduces binary classification accuracy to 56.8%, the Recall rate significantly increases to 99.4%. This characteristic effectively reduces the false negative rate in clinical settings, validating the feasibility and potential of this architecture for cardiovascular calcification screening.

P260144

A Computer Vision-Based Estimation of Right-Handed Dart Trajectories Under Complex Background Conditions

Angelica Anne D. Santos[1,a], Ma. Catherina N. Facal[1,b] and Cyrel O. Manlises[1,c]
[1]Mapua University

[a]aadsantos@mymail.mapua.edu.ph, [b]mcnfacal@mymail.mapua.edu.ph, [c]ccontimare@mapua.edu.ph

Corresponding author: Cyrel O. Manlises, ccontimare@mapua.edu.ph

Keywords: Darts, Computer Vision, Lucas-Kanade Optical Flow, Kalman Filter, Complex Background

Abstract:
This study presents a computer vision–based system for dart trajectory prediction and hand position classification designed to operate under complex background conditions. The proposed framework integrates YOLOv9 for dart detection, Lucas–Kanade Optical Flow for motion tracking, and a Kalman Filter for trajectory estimation within a Raspberry Pi–based dual-camera setup. Unlike existing dart analytics systems that focus primarily on score recognition, the proposed approach models the dart's in-flight motion from release to impact, enabling predictive performance analysis. Experimental results show that prediction accuracy improves as the dart stabilizes during flight, achieving a Global Root Mean Squared Error (RMSE) of 303.24 pixels and a normalized accuracy of 74.65%. Ad-ditionally, a Support Vector Machine (SVM) classifier achieved 74.73% accuracy in cate-gorizing hand positions, with minor misclassifications between adjacent classes. Despite challenges given by visually cluttered and dynamic backgrounds, the system maintained stable detection and tracking performance under embedded hardware constraints. The findings demonstrate the feasibility of integrating detection, motion estimation, and filtering techniques for dart trajectory analytics, supporting the foundation for more advanced sports performance monitoring applications.

P260145

Macrolitter Identification using U-net Semantic Segmentation

Ulramsses S. Layam[1,a], Jonor Robert A. Vargas[1,b] and John Paul T. Cruz[1,c]

[1]Mapua University

[a]uslayam@mymail.mapua.edu.ph, [b]jravargas@mymail.mapua.edu.ph, [c]jptcruz@mapua.edu.ph

Corresponding author: Ulramsses S. Layam, uslayam@mymail.mapua.edu.ph ; Jonor Robert A. Vargas, jravargas@mymail.mapua.edu.ph

Keywords: Macrolitter, Semantic Segmentation, U-Net, MobileNetV2, Raspberry Pi

Abstract:

The increasing accumulation of macrolitter presents a critical environmental challenge, often managed inefficiently through manual sorting at Material Recovery Facilities (MRFs). While automated waste sorting solutions exist, many are computationally expensive and difficult to deploy in resource-constrained environments. This study proposes a lightweight, automated macrolitter identification system optimized for edge computing. The proposed system utilizes a U-Net semantic segmentation architecture integrated with a pre-trained MobileNetV2 backbone, trained to identify six common macrolitter categories: straws, cutlery, bottles, cardboard packaging, food containers, and cups. By employing MobileNetV2 as the feature encoder using transfer learning, the model achieves high-efficiency feature extraction, while the U-Net decoder constructs precise pixel-level masks for isolating and identifying the waste. To evaluate its viability in real-world scenarios, the system is deployed on a Raspberry Pi 5 edge device. Experimental results validate the model's effectiveness, achieving a litter-specific accuracy of 87%, and a Mean Intersection over Union (mIoU) of 0.76. These findings demonstrate that the integration of U-Net and MobileNetV2 provides a highly accurate, computationally efficient, and scalable solution for automated macrolitter monitoring on low-power edge devices.

P260147

Research and Simulation of a Deep Reinforcement Learning-Based Dynamic Resource Allocation Algorithm for 5G-V2X Networks

Zheng Chengfeng[1,a], Leong Waiyie[2,b], Chen Yin[3,c] and YU Chengbo[1,d]

[1]Chongqing Institute of Engineering

[2]INTI International University

[3]Chongqing Institute of Engineering, INTI International University

[a]3439902859@qq.com, [b]waiyie.leong@newinti.edu.my, [c]i25035482@student.newinti.edu.my, [d]yuchengbo@cqut.edu.cn

Corresponding author: CHEN YIN, i25035482@student.newinti.edu.my

Keywords: 5G-V2X, Deep Reinforcement Learning, DQN, Vehicular Networks, Resource Allocation, Rayleigh Fading

Abstract:

Efficient resource allocation in 5G-V2X (Vehicle-to-Everything) networks is critical for ensuring reliable, low-latency communication in highly dynamic vehicular environments. Traditional static or rule-based scheduling methods, such as heuristic greedy search, struggle to adapt to rapidly changing channel conditions caused by high mobility (60–120 km/h), multipath propagation, and non-linear fading. This paper proposes a deep reinforcement learning (DRL)-driven framework for adaptive resource scheduling under non-stationary wireless conditions. A realistic physical-layer simulation platform is first developed in an Ubuntu environment to model large-scale path loss (based on 3GPP TR 37.885 at 5.9 GHz) and small-scale Rayleigh fading. Based on this environment, a Deep Q-Network (DQN) is trained using GPU acceleration on Google Colab to learn optimal allocation policies. The state space includes SNR estimates, vehicle positions, previous allocations, and queue lengths; the action space selects resource blocks (RBs) from a pool of 10. Experimental results show that the proposed approach achieves stable convergence within 125 episodes, with the loss function decreasing from 0.5 to approximately 0.0001 over 300 training steps — a drop of four orders of magnitude. Compared with conventional greedy and random strategies, the proposed method demonstrates superior robustness, improved long-term throughput stability (average 8.2 Gbps normalized throughput after convergence), and better adaptability to fast-changing channel conditions. The results confirm the effectiveness of DRL in addressing complex decision-making problems in vehicular communications.

P260148

CipherLink: Biometric-Gated Encrypted Messaging and Secure Hardware Logging

Brian Matthew E. Clemente[1,a], Vance David G. Samia[1,b] and Analyn N. Yumang[1,c]
[1]Mapua University

[a]bmeclemente@mymail.mapua.edu.ph, [b]vdgsamia@mymail.mapua.edu.ph,
[c]ANYumang@mapua.edu.ph

Corresponding author: Brian Matthew E. Clemente, bmeclemente@mymail.mapua.edu.ph ; Vance David G. Samia, vdgsamia@mymail.mapua.edu.ph

Keywords: AES-128, Arduino Uno, Biometric Authentication, Hardware Logging, Secure Messaging

Abstract:
Mobile messaging security often relies on cloud-based encryption, leaving data vulnerable to Operating System (OS)-level exploits and unauthorized physical access. This paper presents CipherLink, a hardware-centric security architecture that offloads cryptographic operations and message logging to an external 8-bit hardware vault. The system utilizes an Arduino Uno integrated with an AS608 optical biometric sensor to gate access to a local MicroSD-based encrypted log. Messaging is facilitated through a dual-channel routing system utilizing Radio Frequency Communication (RFCOMM) and Firebase. Empirical results demonstrate a 0.00% False Acceptance Rate and a mean processing latency of 228.40 ms, which is significantly faster than existing Arduino-based benchmarks. Statistical evaluations utilizing two-sample t-tests ($p < 0.001$, $\alpha = 0.05$) and repeated measures Analysis of Variance ($p > 0.05$) validate the scalability and thermal stability of the resource-constrained hardware. This research confirms the feasibility of providing a verifiable and auditable secure messaging history on 8-bit microcontrollers.

P260149

Level Classification of Late Blight Disease in Potato Leaves Using YOLOv10

Rudy Gerro V. San Juan III[1,a], Edward Neo C. Cruz[1,b] and John Paul T. Cruz[1,c]

[1]Mapua University

[a]rvsanjuan@mymail.mapua.edu.ph, [b]enccruz@mymail.mapua.edu.ph, [c]jptcruz@mapua.edu.ph

Corresponding author: John Paul T. Cruz, jptcruz@mapua.edu.ph ; Rudy Gerro V. San Juan III, rvsanjuan@mymail.mapua.edu.ph

Keywords: Smart Agriculture, AIot(Artificial Intelligence of Things), Disease Severity Classification, YOLOv10, Object Detection

Abstract:

Potatoes are a vital crop in the Philippines, supporting food security and local farmer income, yet production remains highly vulnerable to Late Blight, a destructive disease caused by Phytophthora infestans that can lead to total tissue collapse if not detected early. While previous deep learning studies have achieved success in binary classification, few have addressed automated disease severity grading in field-like environments, leading this study to propose a detection and classification system utilizing the YOLOv10 object detection algorithm. Deployed on a portable Raspberry Pi-based prototype, the system identifies late blight lesions and categorizes severity into Healthy, Mild, Moderate, and Severe based on the percentage of leaf area affected. Experimental results demonstrate that the model achieved an overall mean Average Precision mAP50 of 81%, with per-class analysis revealing peak effectiveness in identifying Healthy leaves (99.5% accuracy) and Severe infections (83.9%), while classification performance for Mild (68.8%) and Moderate (72.0%) categories was comparatively lower due to overlapping lesion patterns and the gradual transition between severity levels. Despite these challenges, the system provides a low-cost, portable monitoring tool for early intervention, enabling farmers to make timely crop management decisions and reduce potential losses.

P260150

Detection and Classification of Urinary Crystals in Feline Urine Samples Using AlexNet CNN Architecture

Michaella Louise A. Llopis[1,a], Alaisa C. Magueriano[1,b], Carlos C. Hortinela IV[1,c], Nielsen B. Donato[2,d], Kenneth Jack Ablazo[2,e] and Orlan Paz[2,f]

[1]Mapúa University

[2]Vets In Practice Animal Hospital The Fort

[a]mlallopis@mymail.mapua.edu.ph, [b]acmagueriano@mymail.mapua.edu.ph, [c]cchortinela@mapua.edu.ph, [d]nielvet@yahoo.com, [e]kjmablazo92@gmail.com, [f]orlanpaz20@gmail.com

Corresponding author: Michaella Louise A. Llopis, mlallopis@mymail.mapua.edu.ph ; Alaisa C. Magueriano, acmagueriano@mymail.mapua.edu.ph

Keywords: Convolutional Neural Network, AlexNet, Raspberry Pi, Edge Computing, Feline Lower Urinary Tract Disease

Abstract:

Feline lower urinary tract disease (FLUTD) poses significant health risks to domestic cats, with the presence of struvite and calcium oxalate crystals serving as key diagnostic indicators. Traditional microscopic evaluation of these crystals remains a manual, subjective, and time-consuming process that often leads to diagnostic inconsistencies. To address this limitation, this study presents an automated diagnostic system utilizing the AlexNet Convolutional Neural Network (CNN) architecture to detect and classify urinary crystals. The edge-computing hardware setup integrates a Raspberry Pi 4 Model B and a Raspberry Pi Camera Module V2, which are enclosed in a casing and mounted directly on the eyepiece of a monocular microscope. Furthermore, the data acquisition methodology strictly adheres to ethical veterinary protocols; all feline urine samples are extracted and prepared exclusively by licensed veterinarians who actively assist in the data gathering process. Treating the problem as a multiclass classification task, the model categorizes samples into three states: struvite crystals, calcium oxalate crystals, or no visible crystals. Preliminary testing of the localized dataset yielded a baseline classification accuracy of 82%. The prototype is currently undergoing expanded deployment at a partner veterinary clinic to gather a larger, more robust image dataset, which is expected to further optimize the model's accuracy for the final evaluation. This system aims to provide a faster, more objective diagnostic tool to support veterinarians in resource-limited clinical environments.

P260151

A Centralized Document Verification System using Blockchain: A Raspberry Pi and Proof of Authority Blockchain-Based QR Code Scanning Approach

Nigel C. Uy Cana[1,a], Nikhil M. Sahijwani[1,b] and Meo Vincent Caya[1,c]
[1]Mapúa University

[a]ncuycana@mymail.mapua.edu.ph, [b]nmsahijwani@mymail.mapua.edu.ph, [c]mvccaya@mapua.edu.ph

Corresponding author: Nikhil M. Sahijwani, nmsahijwani@mymail.mapua.edu.ph ; Nigel C. Uy Cana, ncuycana@mymail.mapua.edu.ph

Keywords: Blockchain, Hyperledger Fabric, Document Security, Proof of Authority, Raspberry Pi

Abstract:
Diploma forgery and identity theft remain significant challenges due to the lack of synchronization between physical and digital records. To verify diplomas, the study uses Hyperledger Fabric to create a permissioned, proof-of-authority blockchain verification system deployed on a Raspberry Pi 5. Administrators can add, update, and search diplomas while users can only verify diplomas. Each diploma includes a QR code containing the transaction hash generated by the blockchain. Evaluation using the confusion matrix resulted in 100% accuracy and precision across 50 sample diplomas. Additionally, a Common Vulnerability Scoring System (CVSS) yielded a medium risk level. However, this can be remedied by increasing the number of ordering nodes for improved fault tolerance.

P260152

Inferring Uncollected Attributes in Infrastructure Data Systems Using Controlled Large Language Model Inference

LEONG WAI SAN[1,a], LEONG WAI YIE[1,b] and Leong Yuan Zhi[2,c]
[1]INTI INTERNATIONAL UNIVERSITY
[2]Queensland University of Technology

[a]berniceleong2000@gmail.com, [b]waiyie.leong@newinti.edu.my, [c]zhi.leong@ymail.com

Corresponding author: LEONG WAI SAN, berniceleong2000@gmail.com ; LEONG WAI YIE, waiyie.leong@newinti.edu.my

Keywords: Large language models, data enrichment, uncollected data, schema-constrained inference, business intelligence, process innovation

Abstract:
Data-driven infrastructure and urban systems rely on structured datasets to support analytics and decision-making. However, many real-world registries exclude selected attributes by design, resulting in uncollected data rather than conventional missing values. This limitation constrains downstream Business Intelligence (BI) applications by reducing analytical depth and segmentation capability. This study proposes a controlled Large Language Model (LLM) inference approach for deriving uncollected categorical attributes within structured data environments. The method integrates schema-constrained prompting, deterministic configuration, and principled abstention to ensure that generated outputs conform to predefined domains and remain suitable for direct integration. A prototype implementation is evaluated using indicators including schema compliance, output stability across repeated executions, and write-back readiness. The results demonstrate that enforcing constraints at generation time improves structural validity, reduces output variability, and minimises post-processing requirements. By shifting from post-hoc correction to generation-time control, the proposed approach enables reliable data enrichment within structured pipelines. This contributes to process innovation in data-driven infrastructure systems and supports more robust utilisation of incomplete datasets for BI applications.

P260153

Control-Oriented Orchestration Layer for Reliable LLM Output Integration in Data Pipelines

LEONG WAI SAN[1,a], LEONG WAI YIE[1,b] and LEONG YUAN ZHI[2,c]

[1]INTI INTERNATIONAL UNIVERSITY

[2]Queensland University of Technology

[a]berniceleong2000@gmail.com, [b]waiyie.leong@newinti.edu.my, [c]zhi.leong@ymail.com

Corresponding author: LEONG WAI SAN, berniceleong2000@gmail.com ; LEONG WAI YIE, waiyie.leong@newinti.edu.my

Keywords: Large language models, data pipelines, orchestration, output validation, data integration, process innovation

Abstract:

The integration of Large Language Models (LLMs) into data pipelines introduces variability that challenges their reliability in structured data environments. While prior work has explored constraint-based prompting and inference control techniques, less attention has been given to how such outputs can be governed at the pipeline level to ensure consistency and integration readiness. This paper proposes a control-oriented orchestration layer that operates independently of the underlying inference design, treating the LLM as a fixed external component. The proposed layer regulates outputs through schema validation, stability-aware decision gating, and structured acceptance control prior to downstream integration. By decoupling inference generation from operational control, the approach enables consistent handling of variable outputs without modifying model behaviour. A prototype workflow is used to examine system-level characteristics using indicators such as schema compliance, output stability patterns, accept

P260154

Design and Implementation of a Highway Guardrail Detection System Based on STM32

zhang lufen[1,a], Leong Waiyie[2,b], CHEN YIN[3,c] and YU Chengbo[1,d]

[1]Chongqing Institute of Engineering

[2]INTI International University

[3]Chongqing Institute of Engineering, INTI International University

[a]2932241979@qq.com, [b]waiyie.leong@newinti.edu.my, [c]i25035482@student.newinti.edu.my, [d]yuchengbo@cqut.edu.cn

Corresponding author: CHEN YIN, i25035482@student.newinti.edu.my

Keywords: Highway, , Guardrail Detection, Safety Warning, Data Communication

Abstract:

Traditional highway guardrail detection methods are mostly passive protection approaches, which cannot provide timely quality assessment of guardrail conditions. To address this issue, this paper designs and implements a “highway guardrail detection system” to improve the level of intelligent monitoring and road safety management. The system integrates a multi-level sensing architecture composed of a vibration switch, an accelerometer, and a radar module. When the guardrail is impacted, it can automatically trigger data acquisition and event recognition. Once the main controller confirms a collision event, it immediately activates an audible and visual alarm to prevent secondary accidents. Meanwhile, key data are packaged and transmitted to a cloud platform via LoRa and 4G communication. The system can effectively identify common guardrail abnormal states and respond promptly to emergencies, thereby ensuring driving safety and enhancing road management efficiency. In addition, the system adopts an independent power supply and a high-strength structural design to ensure normal operation even after collisions or fire incidents. It is capable of adapting to harsh environmental conditions such as heavy fog, rainstorms, and nighttime scenarios.

P260155

Hazard Detection System for Visually Impaired Mobility with Directional Audio Feedback using YOLOv8n

Marcus Alexander C. Allas[1,a], Allen John A. Dalangin[1,b] and Dionis A. Padilla[1,c]
[1]Mapúa University

[a]macallas@mymail.mapua.edu.ph, [b]ajadalangin@mymail.mapua.edu.ph, [c]dapadilla@mapua.edu.ph

Corresponding author: Dionis A. Padilla, dapadilla@mapua.edu.ph

Keywords: Edge AI, YOLOv8n, Object Detection, Assistive Technology, Model Quantization

Abstract:
Navigational autonomy for visually impaired individuals is commonly hindered by the latency and physical bulk of existing assistive technologies. This research study proposes a real-time hazard detection system integrated into a traditional white cane, utilizing a quantized YOLOv8n model optimized for the Raspberry Pi 5 and Coral USB Accelerator. INT8 post-training quantization is used to address the computational constraints of edge deployment, achieving a stable 30 FPS inference rate. The system is specifically trained to identify six urban hazards: cracks, lamp posts, manholes, potholes, road blocks, and signs. Detected hazards are processed through a spatial analysis pipeline that determines directional positioning (left ahead, straight ahead, right ahead) and estimates distance within a 2-meter safety envelope using checkerboard-based calibration. A field test with 60 samples yielded an overall classification accuracy of 71.6%, reflecting the system's performance in identifying the six targeted hazard classes in a real-world urban environment. Using prioritized audio alerts via bone-conduction headphones, the system provides a lightweight, spatially aware solution that serves as an effective assistive technology for enhancing the independent mobility and safety of visually impaired individuals.

P260156

Tree Recognition via Bark Texture Analysis Using Convolutional Neural Networks and Local Binary Patterns

Syrha Kristinne M. Olaso[1,a], Larrline Angelique Anne C. Quiambao[1,b] and Cyrel O. Manlises[1,c]
[1]Mapua University

[a]skmolaso@mymail.mapua.edu.ph, [b]laacquiambao@mymail.mapua.edu.ph,
[c]ccontimare@mapua.edu.ph

Corresponding author: Cyrel O. Manlises, ccontimare@mapua.edu.ph

Keywords: Tree Classification, Tree Bark, Image Processing, Texture Analysis, MobileNet

Abstract:
In the Philippines, accurate identification of native tree species plays a crucial role in bio-10 diversity conservation, forestry management and environmental monitoring. However, 11 tree identification can be challenging due to visual similarities among species and varying 12 environmental conditions. To assist in the classification process, this study developed a 13 tree recognition system using bark texture analysis. The system integrates Local Binary 14 Pattern (LBP) for bark texture extraction and a Convolutional Neural Network (CNN) 15 with MobileNetV2 architecture for classification. The model was trained using a dataset 16 consisting of bark images from selected Philippine native trees, namely Bangkal, Siar, and 17 Talisay. The system was tested using bark images captured using a Raspberry Pi camera, 18 which were validated by an authorized forester at the data collection site. A confusion 19 matrix was used to evaluate the accuracy of the model in classifying the various tree spe-20 cies. The system achieved an accuracy of 77%, 89%, and 89% in classifying Bangkal, Siar, 21 and Talisay, respectively. The overall accuracy obtained by the system was 85%.

P260159

Stability Analysis of IoT Monitoring Systems in Semi-Outdoor Animal Shelters Based on Open Meteorological Data

YU-CHENG WANG[1,a], YA-GE HUANG[2,b], YU-KAI SHEN[2,c] and GUAN-LIN LI[3,d]

[1]Department of Mathematics and Information Education National Taipei University of Education

[2]Advanced Electronics Assembly Technology Ph.D. Program Lunghwa University of Science and Technology

[3]Department of Computer Information and Network Engineering & Master Program Lunghwa University of Science and Technology

[a]starckwang@mail.ntue.edu.tw, [b]G1144191002@gm.lhu.edu.tw, [c]G1134191001@gm.lhu.edu.tw, [d]G1132181002@gm.lhu.edu.tw

Corresponding author: YA-GE HUANG, G1144191002@gm.lhu.edu.tw ; YU-CHENG WANG, starckwang@mail.ntue.edu.tw

Keywords: Animal Shelters, Internet of Things, Open Meteorological Data, Connection Stability

Abstract:

To address the management bottlenecks in animal shelters and the adverse effects of semi-outdoor environments on the stability of remote monitoring equipment, this study proposes a connection stability analysis system based on open meteorological data and low-cost Internet of Things (IoT) devices. An edge computing architecture was deployed at Shelter A in Zuozhen, Tainan, where the hardware utilized a Raspberry Pi Zero 2 W paired with a 1080p IP camera for live video streaming and link-failure detection. On the software side, a Flutter application invoked the OpenWeatherMap API hourly to fetch temperature and humidity data, synchronizing these readings along with local connection logs into Google BigQuery. During a 30-day trial, the system collected 720 environmental observations and 1,243 disconnection events. Real-time correlation and linear regression analyses were conducted directly using BigQuery Standard SQL functions, specifically CORR and ML.LINEAR_REG. Results confirm that combining edge devices with open weathe data is sufficient to quantify communication risks in semi-outdoor shelter settings, demonstrating the feasibility of completing threshold derivation and automatic dispatch entirely inside native BigQuery SQL. The proposed closed-loop workflow—data streaming, cloud computation, threshold push, and effect evaluation—offers a quickly replicable and cost-effective upgrade path for budget-constrained shelters, establishing a statistical baseline for future multi-site extensions.

P260161

Integrating Non-Head-Mounted VR into Elementary Heritage Education: Evidence from Yingge, Taiwan

YU-CHENG WANG[1,a] and YU-DE YAN[1,b]

[1]Department of Mathematics and Information Education National Taipei University of Education

[a]starckwang@tea.ntue.edu.tw, [b]2113L6007@grad.ntue.edu.tw

Corresponding author: YU-DE YAN, 2113L6007@grad.ntue.edu.tw ; YU-CHENG WANG, starckwang@tea.ntue.edu.tw

Keywords: Local Heritage Education, Virtual Reality, Prototyping Approach, Technology Acceptance Model, Local Cultural Identity

Abstract:

Local heritage education is essential for cultivating students' cultural identity; however, its practical implementation in elementary schools is often hindered by limited class hours, budget constraints, and safety concerns, making frequent field trips difficult. To address this challenge, this study aims to develop a localized Virtual Reality (VR) heritage educational material system specific to Yingge District, New Taipei City, and to investigate its technology acceptance and learning experience among fourth-grade students. Utilizing a prototyping approach, system requirements were first established through teacher interviews and literature analysis. Subsequently, a tablet-based VR system integrating 360-degree panoramic technology (AR2VR) was developed, featuring 13 virtual scenes of local Yingge landmarks, including Bilong Temple, the Ceramics Old Street, and the Yingge Ceramics Museum. Following expert evaluation for content validity and systematic revisions, the prototype was implemented in an actual classroom setting. The study involved 5 teachers with social studies teaching experience and 64 fourth-grade students. An extended Technology Acceptance Model (TAM) questionnaire was employed to collect quantitative data across five dimensions: perceived usefulness, perceived ease of use, behavioral intention, perceived playfulness, and learning satisfaction. This study expects that the non-head-mounted VR educational material will effectively overcome the spatial limitations of traditional teaching, reduce teachers' preparation burdens, and provide students with a safe, immersive virtual field trip experience, thereby enhancing learning motivation and local cultural identity. The findings will offer empirical evidence and practical design guidelines for integrating emerging technologies into localized elementary curricula.

P260163

An Edge Computing-Based Adaptive Monitoring System for Heterogeneous Environments: Multi-Site Deployment and Field Validation in Stray Animal Shelters

YU-CHENG WANG[1,a], GUAN-LIN LI[2,b], YU-KAI SHEN[3,c] and YA-GE HUANG[3,d]

[1]Department of Mathematics and Information Education National Taipei University of Education

[2]Department of Computer Information and Network Engineering & Master Program Lunghwa University of Science and Technology

[3]Advanced Electronics Assembly Technology Ph.D. Program Lunghwa University of Science and Technology

[a]starckwang@mail.ntue.edu.tw, [b]G1132181002@gm.lhu.edu.tw, [c]G1134191001@gm.lhu.edu.tw, [d]G1144191002@gm.lhu.edu.tw

Corresponding author: GUAN-LIN LI, G1132181002@gm.lhu.edu.tw ; YU-CHENG WANG, starckwang@mail.ntue.edu.tw

Keywords: Edge Computing, Heterogeneous Environments, Stray Animal Shelters, Field Validation

Abstract:

This study presents the design and implementation of an adaptive edge computing surveillance system to address the challenges of large-scale deployment in the heterogeneous environments of stray animal shelters. While existing studies primarily focus on the impact of isolated environmental factors on device stability, this research investigates how to maintain highly reliable monitoring services through software-defined adaptive mechanisms across disparate hardware specifications (ranging from Raspberry Pi 2W to 5) and extreme network conditions (including mountainous, coastal, and urban areas). The proposed distributed edge architecture utilizes Raspberry Pi as core processing nodes, integrating FFmpeg video processing and the Google Firebase cloud platform. The core contribution is an "Environment-Aware and Adaptive Adjustment Engine" that monitors real-time network bandwidth, latency, packet loss, and hardware load. Based on quantified environmental conditions, this engine dynamically regulates video encoding parameters —such as bitrate, frames per second (FPS), and resolution—and optimizes data upload strategies. A smart offline retransmission mechanism is also implemented to ensure data integrity under extreme weak-network scenarios or severe weather interference. A 30-day field validation was conducted across multiple geographically diverse stray animal shelters in Taiwan. Experimental results demonstrate that compared to traditional fixed-parameter systems, the proposed adaptive architecture improves the video upload success rate by over 25% in extremely weak network environments, such as deep mountains and strong-wind coastal areas. Concurrently, it targets a 30% reduction in cloud storage and bandwidth costs while preserving service quality. This study confirms that the proposed system exhibits exceptional robustness and flexibility, effectively overcoming real-world heterogeneity to provide a universal technical framework for smart shelter management and remote public engagement.

P260164

Unsupervised Learning for Pattern Discovery in Medical Data Using KNIME and Public Health Repositories

Jorge Medina-Avelino[1,a], Maria Antonieta Touriz Bonifaz[2,b], Roberto Augusto Poveda Paez[3,c] and Lorenzo Cevallos-Torres[4,d]

[1]University of Granada, Granada, Spain
[2]Facultad de Ciencias Médicas, Universidad de Guayaquil
[3]Instituto Superior Tecnológico Vicente Rocafuerte
[4]Universidad Bolivariana del Ecuador

[a]jorgemedinaa@correo.ugr.es, [b]maria.tourizb@ug.edu.ec, [c]rpoveda@istvr.edu.ec, [d]ljcevallost@ube.edu.ec

Corresponding author: Jorge Medina-Avelino, jorgemedinaa@correo.ugr.es ; Lorenzo Cevallos-Torres, ljcevallost@ube.edu.ec

Keywords: Association rule mining, clustering, medical data analysis, unsupervised learning, KNIME

Abstract:
Unsupervised machine learning serves as a significant alternative for medical data analysis in the absence of diagnostic labels or when the interrelations among clinical, demographic, and behavioural factors are not pre-established. This paper presents an unsupervised learning framework to uncover latent patterns, similarities, and relationships in medical data sourced from public sources, utilising the open-source KNIME platform and supplementary visualisation tools in Python. The proposed methodology encompasses data selection, preprocessing, variable transformation, and the use of clustering methods, including K-means, hierarchical clustering, and DBSCAN, with association rule mining to investigate pertinent combinations of clinical variables. Clustering efficacy is evaluated using internal validation measures such as the silhouette coefficient, Davies-Bouldin index, and Calinski-Harabasz index, whilst association rules are tested via support, confidence, and lift. The anticipated results may facilitate the discovery of patient profiles, subtle correlations among medical factors, and pertinent trends for preventive medicine and public health management. The study suggests that unsupervised learning offers an appropriate exploratory method for medical data analysis, especially in situations where the absence of labelled data restricts the direct use of supervised predictive models.

P260165

A Study on AI-Based Instructional Question Generation: A Case Study of the Taipei Online Public Teaching System in Taiwan

YU-CHENG WANG[1,a] and JUI-HUNG WANG[1,b]

[1]Department of Mathematics and Information Education National Taipei University of Education

[a]starckwang@tea.ntue.edu.tw, [b]2113L6009@grad.ntue.edu.tw

Corresponding author: JUI-HUNG WANG, 2113L6009@grad.ntue.edu.tw ; YU-CHENG WANG, starckwang@tea.ntue.edu.tw

Keywords: Smart Question Generation, CooC AI, Generative AI, Customized Prompts, Thematic Analysis

Abstract:

This study explores the practical application and effectiveness of the AI-assisted "Smart Question Generation" feature in educational settings, focusing specifically on generating English subject questions for fifth-grade students using Taipei City's "CooC AI" platform. With the implementation of Taiwan's 108 Curriculum Guidelines, which emphasize competence-based and contextualized assessments, teachers face an increasing workload in designing questions. Therefore, this research investigates how different generation variables—such as question types (multiple-choice and fill-in-the-blank), difficulty levels (low, medium, high), precision modes (speed, medium, precision), and the use of customized prompts—affect the quality and accuracy of the generated questions.

The research adopts a qualitative approach. The researcher first uses the CooC AI system (powered by Azure GPT 5.0 and Gemini 2.5 Flash models) to generate sample English questions under various variable settings. Subsequently, semi-structured interviews are conducted with specialized English teachers with over five years of teaching or question-designing experience to evaluate the AI-generated questions. The interview data is then analyzed using Braun and Clarke's Thematic Analysis.

By drawing on the professional perspectives of frontline teachers, this study aims to evaluate the rationality and curriculum alignment of AI-generated questions. The ultimate goal is to identify the most recommended question generation strategies and prompt designs, thereby assisting teachers in effectively utilizing Generative AI tools. This will not only enhance teaching and preparation efficiency but also strike a balance between maintaining high assessment quality and reducing teachers' daily workloads.

P260167

A New and Data Driven Adhesion Model for Railway Vehicles with Traction

Altan Onat[1,a], Abdulkadir Zirek[1,b] and Can Uysal[1,c]

[1]Eskisehir Technical University

[a]altanonat@eskisehir.edu.tr, [b]azirek@eskisehir.edu.tr, [c]canuysal@eskisehir.edu.tr

Corresponding author: Altan Onat, altanonat@eskisehir.edu.tr

Keywords: Railway Vehicles, Adhesion Models, Voting Regression, Machine Learning, Wheel-Rail Contact

Abstract:

Traction and braking of railway vehicles are influenced by the adhesion conditions between the wheel and the rail. To adjust traction and braking optimally, adhesion information is critical. This study investigates a new and data-driven adhesion model for railway vehicles with traction. The main aim is to create a noise-free adhesion model which utilizes the outputs of a machine learning model. This machine learning model is trained based on experimental data, and this study aims to propose an analytical and data-driven optimal adhesion model based on the machine learning model. It is demonstrated that this new and optimal adhesion model can capture the fundamental properties of the phenomenon and provide a reduced structure.

P260168

Machine Learning Model for Facial Micro-Expression Detection Using Video Streams

Gabriel Troy C. Alfonso[1,a], Juan Miguel C. Ocampo[1,b], Analyn N. Yumang[1,c] and John Christopher D. Castillo[1,d]

[1]Mapúa University

[a]gtcalfonso@mymail.mapua.edu.ph, [b]jmcocampo@mymail.mapua.edu.ph, [c]anyumang@mapua.edu.ph, [d]jcdcastillo@mapua.edu.ph

Corresponding author: Analyn N. Yumang, anyumang@mapua.edu.ph ; John Christopher D. Castillo, jcdcastillo@mapua.edu.ph

Keywords: Micro-Expression Detection, MobileNetV3, BiLSTM, Regions of Interest, Involuntary Facial Movements

Abstract:

Counseling and academic assessments often require the identification of subtle, involuntary facial movements to better understand student engagement and emotional states. This research study proposes a facial micro-expression detection system utilizing a hybrid architecture of MobileNetV3 for spatial feature extraction and a Bidirectional Long Short-Term Memory (BiLSTM) network for temporal sequence analysis. The system is integrated into a Raspberry Pi 5 environment, utilizing a 1080p USB camera to capture spontaneous video streams. A specialized preprocessing pipeline identifies facial landmarks using MediaPipe to anchor Regions of Interest (ROI) and filter out macro-expression interference such as blinks and speech through Eye and Mouth Aspect Ratio thresholds. The model is specifically trained to classify five distinct micro-expressions: eyebrow raises, eyebrow furrows, eye twitches, smirks, and nose scrunches. Experimental results yielded a training accuracy of 80% and a testing accuracy of 58%, reflecting the system's current performance in identifying high-speed, low-intensity expressions within a controlled counseling scenario. While the variance between training and testing indicates a need for further dataset diversification, the system provides an automated solution for non-invasive expression monitoring in educational environments.

P260169

Enhancing Beginner Korean Learning through a Structured Web-Based E-Learning System

Ssu-Hsuan Lu[1,a]

[1]Lunghwa University of Science and Technology

[a]shlu@gm.lhu.edu.tw

Corresponding author: Ssu-Hsuan Lu, shlu@gm.lhu.edu.tw

Keywords: Korean Language Learning, E-learning System, Interactive Learning, Adaptive Learning, Learning Analytics

Abstract:

This study presents the design and implementation of a web-based Korean learning platform aimed at facilitating beginner-level language acquisition. The system focuses on essential components of the Korean language, including Hangul recognition, pronunciation, basic vocabulary, and fundamental grammar structures. Through a modular learning architecture, the platform organizes content into progressive units that support step-by-step learning and knowledge reinforcement. Interactive exercises and immediate feedback mechanisms are incorporated to enhance learner engagement and improve retention. In addition, the interface is designed with usability considerations to enable intuitive navigation and self-paced study. The proposed platform lowers the entry barrier for learners with no prior background in Korean and supports independent learning outside traditional classroom settings. Preliminary observations suggest that integrating structured content with interactive features can effectively improve learning motivation and foundational language proficiency. This work contributes to the development of lightweight, accessible digital tools for foreign language education and provides a practical reference for future e-learning system design.

P260176

An Event-Driven Smart Floor Sensing System Using Piezoelectric Signals and ESP32 Edge Analytics

Akshatha Kamath[1,a], Shrestha Sunil[1,b], Suhani Srikantaswamy[1,c] and Shreya Mahesh[1,d]
[1]M. S. Ramaiah Institute of Technology

[a]akshathakamath@msrit.edu, [b]shrestha.sunil051@gmail.com, [c]suhanisrikantaswamy@gmail.com, [d]shreyamahesh701@gmail.com

Corresponding author: Suhani Srikantaswamy, suhanisrikantaswamy@gmail.com ; Shrestha Sunil, shrestha.sunil051@gmail.com

Keywords: Piezoelectric sensing, ESP32, edge computing, event-driven architecture, IoT, smart floor, ADC, signal conditioning, threshold detection.

Abstract:
This paper presents the design and implementation of an event-driven smart floor sensing system that leverages piezoelectric transducers for non-invasive human footstep detection. The proposed architecture integrates analog signal conditioning comprising a bridge rectifier, a capacitor filter, and a resistive voltage divider with the ESP32 microcontroller's 12-bit analog-to-digital converter (ADC) for real-time edge-level signal processing. Unlike conventional IoT sensing paradigms that rely on continuous data streaming, the system adopts a threshold-based event-driven model wherein data transmission is triggered exclusively upon detection of a valid pressure event. This paradigm significantly reduces bandwidth consumption, processing overhead, and power utilisation. Experimental validation demonstrates a voltage output range of 0.2 V to 3.1 V, ADC readings spanning 40 to 4095, and a system response latency of less than 100 ms. The detection accuracy achieved under controlled conditions was 85–90%. The system is well-suited for applications in smart buildings, occupancy monitoring, elderly care, and perimeter security. The novelty of this work lies in the confluence of robust analog conditioning, ESP32-based edge analytics, and event-driven communication, presenting a scalable, low-cost alternative to existing solutions.

P260177

Operator-Independent 3D Surveillance of Arteriovenous Fistula Stenosis: Clinical Evaluation of an AI-Guided Tilting Robotic Ultrasound System

Ming-Jui Wu[1,a], Chien-Yu Lee[2,b] and Yi-Chun Du[2,c]

[1]college of pharmacy & health care, Tajen University, Pingtung County 90741, Taiwan
[2]NCKU

[a]wmr2162014@gmail.com, [b]p86144136@gs.ncku.edu.tw, [c]terrydu@gs.ncku.edu.tw

Corresponding author: Yi-Chun Du, terrydu@gs.ncku.edu.tw

Keywords: Hemodialysis Vascular Access, Clinical Surveillance, Point-of-Care Ultrasound, Arteriovenous Fistula, 3D Morphological Assessment

Abstract:

Routine surveillance of arteriovenous fistula (AVF) stenosis and aneurysmal degeneration is critical for maintaining hemodialysis access patency. However, conventional point-of-care ultrasound remains highly operator-dependent, and severe aneurysmal skin deformations frequently impede stable probe-skin coupling, limiting standardized longitudinal evaluation. To address these clinical diagnostic challenges, this study evaluated an automated, operator-independent 3D morphological assessment approach using an advanced robotic ultrasound system (RUS). Designed to mimic the compensatory probe-tilting maneuvers of experienced clinicians, the system utilized RGB-D point cloud-derived surface normals to maintain optimal acoustic contact over complex, undulating arm geometries. This scanning strategy was supported by a streaming Hybrid artificial intelligence (AI) framework to ensure continuous target visualization. Specifically, a YOLOv8-based model performed real-time intra-scan vessel tracking, while a U-Net++ model—optimized via a two-stage phantom-to-clinical transfer learning strategy—enabled precise luminal segmentation.

The integrated diagnostic platform demonstrated high clinical reliability. On clinical test sets, the fistula detection model attained a recall of 1.0000, and the lumen segmentation model achieved a Dice score of 0.9082. In simulated patient phantoms, the degree of stenosis (DOS) was quantified with a mean absolute error below 0.62%, and stenotic regions were localized in 3D space with sub-millimeter accuracy (error < 0.37 mm along all axes). These findings indicated that the proposed AI-guided tilting RUS successfully overcame the anatomical barriers of aneurysmal AVFs. By providing highly reproducible, standardized 3D vascular models, this system offered a practical clinical tool to enhance longitudinal AVF surveillance and support evidence-based hemodialysis access management.

P260178

Temporal-Aware Diffusion Scheduling for Sequential Recommendation with Dynamic User Preferences

Mian Ren[1,a] and Wai Yie Leong[1,b]

[1]INTI International University

[a]I24027330@student.newinti.edu.my, [b]waiyie.leong@newinti.edu.my

Corresponding author: Wai Yie Leong, waiyie.leong@newinti.edu.my

Keywords: Sequential Recommendation, Diffusion Models, Temporal Modeling, Noise Scheduling, User Preference Dynamics

Abstract:

Existing diffusion-based sequential recommenders typically overlook the temporal dynamics inherent in user behavior by employing fixed noise schedules. In this paper, we propose a Temporal-Aware Diffusion Scheduling approach to explicitly model the evolution of dynamic user preferences. We introduce a temporal-conditioned noise intensity function that maps interaction time intervals into the diffusion process, enabling the model to adaptively adjust corruption strength based on the recency of user behaviors. By incorporating temporal information into both the forward diffusion (noising) and reverse denoising processes, our method effectively balances the preservation of long-term preference patterns with sensitivity to short-term interest shifts. This unified temporal-diffusion framework allows the model to better capture non-stationary user dynamics in sequential recommendation scenarios. Extensive experiments on benchmark datasets demonstrate that the proposed approach consistently outperforms competitive baselines, particularly in scenarios with sequence sparsity and distribution drift. Further analysis confirms the effectiveness of temporal-aware noise scheduling in improving recommendation accuracy and robustness.

P260180

Research On Similarity Retrieval Algorithm For Power Settlement Based On Case-Based Reasoning

Suyan Long[1,a], Lin Zhou[1,b], Jun Xu[1,c], Shuo Zhang[1,d], Liangqi Si[1,e] and Yujie Meng[2,f]

[1]Institute of Automation, China Electric Power Research Institute, Nanjing, China

[2]Nanjing University of Information Science and Technology, Nanjing, China

[a]longsuyan@epri.sgcc.com.cn, [b]zhou-lin@sgcc.com.cn, [c]xujun3@epri.sgcc.com.cn, [d]zhang-shuo@sgcc.com.cn, [e]liangqi-si@sgcc.com.cn, [f]meng_yu_jie@163.com

Corresponding author: Yujie Meng, meng_yu_jie@163.com

Keywords: CASE BASED REASONING, POWER SETTLEMENT, SIMILARITY RETRIEVAL, KNN ALGORITHM

Abstract:

Traditional power settlement operations rely on manual work and fixed rules, resulting in low efficiency and poor adaptability. Case-based reasoning (CBR) similarity retrieval is the key to reusing historical cases. Focusing on the task of power settlement case retrieval, this paper constructs a case representation model that includes numerical, categorical, and rule-based features, designs a hybrid feature similarity measurement method, and realizes case retrieval by combining constraint-based filtering, cluster-based pre-screening, and KNN ranking. By building an experimental case base and comparing the proposed method with traditional KNN, rule matching, and a variant without cluster pre-screening, the effectiveness of the method is validated in terms of retrieval accuracy, recall, and retrieval time.

P260184

A Platform-Supported Outcome Alignment Framework for Digital Signal Processing Education: Integrating Progressive Experimental Learning and Attainment Evaluation

CHEN YIN[1,a], Leong Waiyie[2,b] and Yang Jie[3,c]

[1]INTI International University；Chongqing Institute of Engineering

[2]INTI International University

[3]Chongqing Institute of Engineering

[a]i25035482@student.newinti.edu.my, [b]waiyie.leong@newinti.edu.my, [c]773783896@qq.com

Corresponding author: Leong Waiyie, waiyie.leong@newinti.edu.my

Keywords: Outcome-Based Education, Digital Signal Processing, Outcome Alignment Framework, Progressive Experimental Learning, Attainment Evaluation

Abstract:

Digital Signal Processing (DSP) is a core course in electronic information and communication engineering programmes, but its abstract mathematical concepts and algorithm-intensive content often make it difficult to connect theoretical learning, experimental implementation and outcome-based assessment. To address this issue, this study proposes a platform-supported outcome alignment framework for DSP education under the Outcome-Based Education (OBE) paradigm. The framework establishes a structured connection among course learning outcomes, graduation requirement indicators, learning activities and multi-source assessment evidence. Based on this framework, a four-stage progressive experimental learning model was developed, covering theoretical learning, theoretical verification, small-scale design and large-scale comprehensive design. The Zhixue Chonggong and Hailang Zhixue platforms were used to support task release, AI-assisted learning, MATLAB-based experimentation, process monitoring, evidence collection and attainment evaluation. Empirical data from 308 students in the 2025–2026 academic year showed that the overall course attainment reached 0.78, with most students concentrated in the medium and upper-medium attainment ranges. Compared with the previous cohort, the score distribution changed significantly, indicating a more rigorous and differentiated evaluation of learning outcomes. The findings suggest that the proposed framework supports students' system modelling, MATLAB-based implementation and problem decomposition abilities, while providing a course-level example for integrating digital platforms, progressive experimental learning and outcome-based assessment in engineering education.

P260186

A Hybrid FAHP–DEMATEL–TOPSIS Evaluation Model for Multi-Stage Oil Painting Translation into Immersive VR Envi-ronments

LEI, Siran[1,a] and Hsin-Hung Lin[2,b]

[1]1 PhD Candidate, De Institute of Creative Arts and Design, UCSI University, Kuala Lumpur, Malaysia
[2]2 Department of Creative Product Design, Asia University, Taiwan

[a]leisiran@foxmail.com, [b]hhlin@asia.edu.tw

Corresponding author: Hsin-Hung Lin, hhlin@asia.edu.tw ; LEI, Siran, leisiran@foxmail.com

Keywords: Hybrid Decision-Making, Fuzzy Analytic Hierarchy Process (FAHP), Decision-Making Trial and Evaluation Laboratory (DEMATEL), Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), Virtual Reality (VR)

Abstract:

This study integrates FAHP, DEMATEL, and TOPSIS to construct a hybrid deci-sion-making framework for evaluating multi-stage oil painting translation into im-mersive VR environments. FAHP is first applied to determine the relative importance of perceptual and experiential evaluation criteria under uncertainty. DEMATEL is then used to identify the causal relationships among the criteria and clarify the key driving factors affecting media translation quality. Finally, TOPSIS is employed to rank the four transformation stages, including traditional oil painting, digitized two-dimensional painting, VR-based planar presentation, and VR animation. Through this integrated model, the study provides a systematic evaluation method for com-paring artistic, perceptual, and immersive differences across multiple media translation stages.

Organized by:

University of Guam, Guam

IEEE Tainan Section Sensors Council

International Institute of Knowledge Innovation and Invention

UNIVERSITY OF GUAM
UNIBETSEDÅT GUÅHAN

IIKII
International Institute of Knowledge Innovation and Invention

IEEE
Tainan Section Sensors Council

NPU

AIOTA
Asia IoT Alliance
亞洲物聯網聯盟