

Proceedings of the 4th International Conference on Image, Algorithms, and Artificial Intelligence

22-24 May 2026, Singapore, Singapore

ICIAAI 2026

General Chairs

Cheng Sion Chin, Newcastle University, Singapore

Technical Programme Chair

Kannimuthu Subramaniam, Karpagam College of Engineering, India

Conference Organization

General Chair

Cheng Sion Chin, Newcastle University, Singapore

Technical Program Committee Chair

Kannimuthu Subramaniam, Karpagam College of Engineering, India

Publication Chair

Lei Chen, Shandong University, China

Arunkumar PM, Karpagam College of Engineering, India

Organizing Committee Members

Jegathesh P, Karpagam College of Engineering, Anna University, India

Nandhini SS, Karpagam College of Engineering, Anna University, India

Aarthi D, Karpagam College of Engineering, Anna University, India

Hao Wang, Computer Science, Nanyang Technological University, Singapore

Yalan Yu, China University of Geosciences, China

Yi Xiang, Dalian University of Technology, China

Yuhang Qiu, Monash University, Australia

Zheming Xu, Fudan University, China

Mingyuan Liu, Beijing University of Aeronautics and Astronautics, China

Qi Su, Tianjin University, China

Jun Chen, Nanjing Normal University, China

Changhao Zhang, Queen's University, Canada

Yongchang Zhang, Harbin Institute of Technology, China

Chenming Li, Harbin Engineering University, China

Xie Ming, Nanyang Technological University, Singapore

El Hadji Yaya Koné, University of Ottawa, Canada

Ann Rosnida Md Deni, Sunway University, Malaysia

Nasir Abdul Jalil, Sunway University, Malaysia

Shin Ling Wu, Sunway University, Malaysia

Mohd Shahrizal Sunar, Universiti Teknologi Malaysia (UTM), Malaysia

Mustafa Sabah Taha, Missan Oil Training Institute, Ministry of Oil, Iraq

Nashwan Alromema, King Abdulaziz University, Saudi Arabia

Nor Azizah Ali, Universiti Teknologi Malaysia (UTM), Malaysia

Prakhar Consul, School of Computer Science Engineering & Technology, Bennett University, India

Rabia Javed, Lahore College for Women University, Lahore, Pakistan

Ruttam Mariam, Universiti Teknologi Malaysia (UTM), Malaysia

Suharmili Rosle, Universiti Putra Malaysia (UPM), Malaysia

Tan Chi Wee, Tunku Abdul Rahman University of Management and Technology (TAR UTM), Malaysia

Uzma Farooq, University of Management and Technology, UMT, Lahore, Pakistan

Zhe Liu, Universiti Sains Malaysia (USM), Malaysia

Technical Committee Members

Can Xu, Nanjing University of Technology and Technology, China

Honghui Chen, Fuzhou University, China

Hanqing Zhao, University of Twente, Netherlands

Xianxun Zhu, Shanghai University, China

Mengfan Zheng, Electronic Engineering, Imperial College London, UK

Shuze Geng, School of Computer Science and Technology, Tianjin University & Hebei University of Technology, China

Yihui Hu, Electro-Mechanical Engineering, Xidian University, China

Beini Zhang, School of advance material, Hong Kong University of Science and Technology, China
Hui Zhang, School of Electronic and Information, Tongji University, China
Qing Zheng, College of Engineering, California Baptist University, USA
Emmanuel Ndashimye, Carnegie Mellon University Africa (CMU-Africa), Rwanda
Xingyou Chen, North University of China, China
Nakul Sharma, Koneru Laxmiah Education Foundation (KLEF) University, India
Wei Hua Ouyang, Guizhou Normal University, China
Jiazhong Lu, Chengdu University of Information Technology, China
Wunan Wan, Chengdu University of Information Technology, China
Amin Ul Haq, University of Engineering and Applied Sciences Swat, Pakistan
Panfeng Chen, Guizhou University, China
Cheng Hu, Guangzhou University, China
Hangyu Zhu, Jiangnan University, China
Muhammad Khalid, HITEC University, Pakistan
Anwaar Ul-Haq, Central Queensland University, Australia
Wan Azani Wan Mustafa, Universiti Malaysia Perlis, Malaysia
Hua Jiang, Yunnan University, China
Shuhua Xu, Wenzhou Institute of Technology, China
Xi Tao, Guizhou University, China
Chen Ye, Guizhou University, China
Muhammad Shahid Iqbal Malik, HITEC University, Pakistan
Michele Melchiori, University of Brescia, Italy

Preface

We are delighted to present the proceedings of the 2026 4th International Conference on Image, Algorithms, and Artificial Intelligence (ICIAAI 2026). The conference brought together researchers, scientists, engineers, and practitioners from academia and industry worldwide to exchange ideas, share research findings, and discuss emerging developments in image processing, intelligent algorithms, machine learning, artificial intelligence, and related interdisciplinary fields. ICIAAI 2026 aims to promote scientific collaboration and technological innovation while providing an international forum for addressing current challenges and future opportunities in intelligent systems.

The technical program of ICIAAI 2026 consisted of high-quality peer-reviewed papers covering a broad range of research topics. The accepted papers were organized into six major thematic areas: (1) Human–Computer Interaction and Intelligent User Experience; (2) Large Language Models, Generative AI, and Intelligent Agents; (3) Machine Learning, Data Mining, and Intelligent Prediction; (4) AI for Healthcare, Medical Imaging, and Neuroscience; (5) Robotics, Reinforcement Learning, and Intelligent Systems; and (6) Computer Vision, Pattern Recognition, and Intelligent Perception. The contributions presented in this volume reflect current advances in multimodal intelligence, explainable artificial intelligence, federated learning, recommendation systems, brain–computer interfaces, medical diagnosis, computer vision, robotics, and emerging applications of large language models.

In addition to the technical paper presentations, the conference featured four distinguished keynote speeches delivered by internationally recognized scholars. Prof. Cheng Chin (Newcastle University, Singapore) presented recent advances in intelligent systems modelling and predictive analytics for complex infrastructures. Prof. Lei Chen (Shandong University, China) shared his research on multimodal spatio-temporal modelling methods for video anomaly detection. Prof. Philippe Fournier-Viger (Shenzhen University, China) introduced advanced algorithms for discovering meaningful structures and patterns in complex data. Prof. Kannimuthu Subramaniam (Karpagam College of Engineering, India) discussed hybrid deep learning approaches for autism spectrum disorder diagnosis. These keynote presentations provided valuable insights into the latest developments and future directions of artificial intelligence, data mining, computer vision, and intelligent healthcare.

The success of ICIAAI 2026 would not have been possible without the dedication and support of many individuals. We would like to express our sincere gratitude to the members of the Organizing Committee, Technical Program Committee, reviewers, keynote speakers, session chairs, and volunteers for their invaluable contributions. Special thanks are extended to all authors and participants whose enthusiasm and scholarly efforts made this conference a success.

We believe that ICIAAI provides an important platform for researchers and practitioners to discuss emerging theories, methodologies, and applications in image analysis, intelligent algorithms, and artificial intelligence. We hope that the papers collected in this volume will serve as a valuable reference for future research and inspire further innovations in these rapidly evolving fields.

ICIAAI 2026 Organizing Committee

Contents

Human–Computer Interaction, User Experience and Interactive Media

HCI Accessibility Principles-Driven Design of AI Programming Assistants for Developers with Special Needs <i>Yifan Jiang</i>	1
A Mechanism-Based Design Framework for Prospective Memory Failures in Human–Computer Interaction <i>Yaoxuan Cheng</i>	9
Speech Interaction in Industrial Noise Scenarios <i>Yiyang Li</i>	16
Data Tracking and Authorization Interface Analysis based on Adolescent and Adult Groups <i>Shicheng Huang</i>	26
Applications, Challenges, and Prospects of Augmented Reality (AR) Technology in Public Safety from the Perspective of Human-Computer Interaction <i>Ximeng Yang</i>	31
Driver Emotion Recognition and Regulation Based on Artificial Intelligence <i>Jiasheng Zhang</i>	40
Analysis of Big Data Privacy Risks and Countermeasures in Human-Computer Interaction Context <i>Lijing Jiang</i>	46
Brain-Computer Interfaces at the Crossroads: Navigating Ethical Issues in Clinical Application <i>Chongjing Wang</i>	56
Emotion’s Impact on Memory Encoding and Recall <i>Jialei Qiu</i>	61
A Biological Analysis of the Difficulties in Replicating Human Subjective Experience in Artificial Systems <i>Yifei Xie</i>	68
Analysis of the Current Situation and Trends in Player Modelling Based on Data <i>Guitan Zhang</i>	74
How Interactive Choice Design Influences Player Emotion and Decision Behavior in Narrative-Driven Games <i>Yingqi Wang</i>	83
On the Scientific Feasibility of the Brain-in-a-Vat Hypothesis <i>Musen Wan</i>	90
Evolution and Fairness Challenges of Content-Based and Multimodal Music Recommendation Systems <i>Yaoyu Zhang</i>	95

The Impact of VR Technology on Enhancing Emotional Experiences in Otome Games <i>Zixuan Zhang</i>	102
A Visualization Study of Emotional Expression for Children with Autism Spectrum Disorder <i>Haoyue Guan</i>	111
AI Use in Game Design: Optimizing NPC Interaction While Preserving Narrative Stability <i>Hau Tak Zeng</i>	122
Research on An Independent Game Intelligent NPC Adaptation Solution Based on Lightweight LLMs—Taking "Ghost Valley: Eight Wastelands" as An Example <i>Ziquan Wang</i>	131
Analyzing the Algorithms and Evaluation of Homo Sapiens Artificial Intelligence Agents in Application - A Case Study of Gaming <i>Yanting Yu</i>	136
Large Language Models, Generative AI and Intelligent Agents	
Exploring the Development Status of Agents Based on Large Language Models <i>Zixi Chen</i>	143
Comparison of Core Abilities of Four Large Language Models: GPT-3, GPT-4, LLaMA 2, and PaLM 2 <i>Guoyu Xu</i>	154
Language-Guided Generation of Specific Driving Scenarios Using Diffusion Models <i>Jiongqi Li</i>	161
The Evolution, Application, and Future Challenges of Large Language Model <i>Weiqi Li</i>	168
Classification and Scenarios Analysis of Hallucination Suppression Methods Based on ReAct Framework of Reflection Mechanism <i>Ruiyi Wang</i>	178
Towards Automated Reinforcement Learning: Applications and Prospects of Large Language Models as Cognitive Components in the Full RL Lifecycle <i>Shenghao Yuan</i>	188
From Artificial Intelligence to Embodied Intelligence: The Evolution from Abstract Problem-Solving to 3D Scene Understanding <i>Jingyuan Huo</i>	198
Text-to-image generation: From GANs and Diffusion Models to LLM-Augmented Paradigms <i>Ran Tao</i>	206
Cross-domain Image Generation: Style Transfer and Image-to-image Translation <i>Pengfei Ran</i>	211

Image Cross-Domain Generation and Adaptation: A Frequency-Domain Decoupling Perspective <i>Qiwang Gao</i>	217
Deepfake Face Detection from GAN to Diffusion Model <i>Hanyao Xu</i>	227
Dynamic Shading Geometric Models for Buildings Based on Boundary Projection and Polygonal Boolean Operations <i>Changyue Li, Boxi Hou, Yixi Wan, Guanhao Zhong, Kaifeng You</i>	235
Machine Learning, Data Mining and Intelligent Prediction	
Off-Policy Evaluation of Contextual Bandit Algorithms for Personalized News Recommendation Using the MIND Dataset <i>Yikai Zhao</i>	248
Comparative Analysis of Logistic Regression and Random Forest Models for Cardiovascular Disease Prediction Using Clinical Data <i>Keliang Li</i>	258
Smartphone Price Prediction via Enhanced Interaction Features <i>Luoqi Li</i>	265
Improvements of Multi-Armed Bandit Algorithms <i>Hengnian Pan</i>	272
BYD Stock Price Prediction Based on LSTM and XGBoost Models <i>Sihang Chen</i>	278
Stock Return Prediction: A Lightweight Innovative Framework Based on Feature Engineering and Tree Model Ensemble <i>Lanlin Zhang</i>	287
Stock Return Prediction in the Tokyo Stock Exchange using Machine Learning Methods <i>Yuhaobai Yuan</i>	295
Prediction of Stock Pledge Financing Default Based on Machine Learning <i>Jialu Wu</i>	304
Analysis of Factors Influencing Air Quality in Chinese Cities Based on Multiple Linear Regression <i>Yijie Wang</i>	312
Clustered UCB-C: Exploiting User Heterogeneity for Low-Regret Recommendation in Structured Multi-Armed Bandit Settings <i>Zhitao Wang</i>	319
Boston Housing Price Prediction and Factor Analysis: A Comparative Study of Linear Regression and Random Forest <i>Jixuan Chen</i>	326
Application of Deep Learning Methods in Predicting Stock Market Direction <i>Zhengyu Ding</i>	333
Customer Churn Prediction in Telecommunications Using Machine Learning Models <i>Jiaqi Cao</i>	341

Comparative Analysis of Ensemble LSTM and Random Forest for Stock Trend Prediction: A Many-to-One Transfer Learning Approach <i>Pengtian Si</i>	351
Comparative Analysis of ARIMA, LSTM, and TCN for Time Series Forecasting <i>Fangxudong Liu</i>	358
Isolating the Impact of Dimensionality on Bandit Regret via Fixed-Gap Gaussian Environments <i>Luhui Zheng</i>	368
Adaptive Cold-Start Thompson Sampling for Cold-Start Problems <i>Zixu Wang</i>	375
A Comparative Analysis of Multi-Armed Bandit Algorithms in the Research of Optimal Product Discovery in E-Commerce <i>Tailin Su</i>	385
A Comparative Study of Bitcoin and Gold Investments <i>Yi Liu</i>	394
A Mechanism-Level Comparison of ETC, UCB, and Thompson Sampling Under Finite-Horizon Constraints <i>Yichen Fan</i>	406
Stock Data Analysis and Empirical Research Based on Python Data Visualization <i>Yichang Sun</i>	415
Machine Learning Approaches for Medical Insurance Cost Prediction <i>Chenglin Wang</i>	421
Machine Learning-Based Forecasting of U.S. State Unemployment Rates for 2026 <i>Jiahao Ma, Tingyu Xie</i>	428
Stock Return Prediction Using Machine Learning Regression Models <i>Ning Deng</i>	435
Research and Analysis of Cryptocurrency Price Prediction Based on Deep Learning <i>Zhaoliang Xu</i>	443
Customer Lifetime Value Prediction Model Focus on High-Value Customer Reliability Analysis <i>Bowen Xu</i>	451
Sentiment-Based Bitcoin Volatility Prediction: A Comparative Study of Linear and Non-Linear Models <i>Zixin Ye</i>	462
Prediction of Investment Revolution of Green Enterprises: A Two-dimension Approach to the Combination of Characteristics and Temporalities of Green-specific Characteristics <i>Shiyao Lu</i>	469
Multi-Armed Bandit Algorithms and Their Applications in Online Recommendation Systems <i>Zijie Zhao</i>	476

The Bandit Learning beyond Stationarity under the Game Theory <i>Beishen Guo</i>	482
Machine Learning Modeling and Evaluation for E-commerce Transaction Fraud Detection <i>Zixiao Ding</i>	491
AI for Healthcare, Medical Imaging and Neuroscience	
Application and Analysis of AI Large Models in Health Science Popularization Q&A and Medical Image Interpretation <i>Kaiye Zhou</i>	501
Techniques for Detecting Depression-related Emotions, Challenges and Future Prospects <i>Mingyuan Zhang</i>	507
Breast Nodule Classification: Single-modality Feature Mining and Multi- modality Information Fusion <i>Chengchuan Xu</i>	515
Behavioral Analysis of Semantic-Guided Self-Supervised Learning for Low- Labeled Medical Image Segmentation <i>Jihan Fan</i>	521
An Agentic Multimodal Framework for Reliable Medical Reasoning under Privacy Constraints <i>Hao Lin</i>	530
A Structured Explainability Framework for Heart Disease Risk Prediction Based on SHAP-Nomogram Integration <i>Chen Tang</i>	540
Intelligent Diagnosis and Prediction of Pancreatic Cancer based on Unimodal and Multimodal Data <i>Yuxiang Chang</i>	551
A Chest X-ray Pneumonia Recognition Model Based on Quality Perception <i>Zhiyuan Li</i>	556
Dual-Stream Feature Synergy and Prior Fusion Method for Chest X-ray Anomaly Detection <i>Chenxi Gao</i>	564
Medical Image Segmentation Based on the CLIP and SAM Base Models <i>Jingyi Yu</i>	574
Research Progress and Development Trends of Identity Authentication Technologies for Ordinary Users <i>Haochen Ma</i>	580
Application of Machine Learning Technology in Sleep Health <i>Jiayu Zhang</i>	588
Explainable Biomarker Discovery in Hepatocellular Carcinoma: an XGBoost and SHAP Framework <i>Guangrui Xu, Xiaoyu Shen</i>	597

Neurotechnology for ADHD and Depression: Mechanisms, Evidence, and Challenges <i>Yicheng Zeng</i>	606
Neural Encoding and Decoding in Brain-Machine Interfaces for Learning and Memory Applications <i>Ethan Yincheng Gao</i>	614
Artificial Intelligence in Brain-Computer Interfaces: Current Studies and Emerging Trends <i>Yauyu Wang</i>	622
Neuroplasticity and Therapy: The Role of Neuroplasticity in Dyslexia support <i>Yuxiang Niu</i>	628
Machine Learning Prediction of Depression Risk from Behavioural and Self-Reported Data <i>Shuhan Yuan</i>	635
Aperiodic-Aware EEG Features for Cross-Subject Acute Sleep Deprivation Detection <i>Zhuoyan Li</i>	642
Application and Development of AI Imaging Technology in the Biological Clinical Field <i>Xiao Nan</i>	651
Disease Diagnosis Based on Deep Learning and Transfer Learning: Evolution from CNN to SAM <i>Yufei Huang</i>	657
Advances in the Application of Machine Learning and Deep Learning in Drug-Drug Interaction Prediction <i>Junru Lu</i>	665
Artificial Intelligence in The Diagnosis and Prediction of Diabetic Retinopathy <i>Hanyu Zheng</i>	670
Robotics, Reinforcement Learning and Intelligent Systems	
Rule Conflict Detection and Resolution Technology in Smart Home IoT <i>Hanwen Xia</i>	678
Learning-Based Service Selection for Latency Optimization in Heterogeneous Fog Computing <i>Haoshen Zhai</i>	685
Application of Path Planning Algorithms in Logistics Transportation - Optimization Based on Ant Colony Algorithm and Multi-Algorithm Comparison <i>Bowen Hu</i>	694
The Application, Mechanisms, and Challenges of Artificial Intelligence in Sustainable Development <i>Shenrui Li</i>	701

Exploration of the Application of Artificial Intelligence in Mathematics Education <i>Ruixin Zhang</i>	711
Improving Model-Contrastive Federated Learning under Non-IID Data Constraints <i>Hao Pi</i>	717
KT-pFL: A Personalized Federated Learning Model Based on Knowledge Transfer <i>Chenrui Li</i>	725
Analysis of the Application of Reinforcement Learning in Motion Control of Robots in Unstructured Environments <i>Weihan Wang</i>	735
Quantum-Enhanced Combinatorial Multi-Armed Bandit Algorithms for Drug Discovery <i>Yucheng Xia</i>	741
An Improved MOON Federated Learning Algorithm Based on Negative Sample Quality Awareness <i>Sen Yang</i>	756
MapReduce Distributed Computing System on A Serverless Platform <i>Mohan Zhang</i>	767
LCD Defect Detection Based on Deep Learning and MapReduce <i>Shihao Zhao</i>	774
Optimizing Cold Start Performance in Serverless Computing Platforms <i>Chenye Kang</i>	781
Spatial Quantification of the Urban Self-Healing Index Using IoT-Based Noise GeoTIFF Data <i>Jiixin Liu</i>	789
Machine Learning-Based Approximation of MOSFET DC and Small-Signal Characteristics from LTspice Simulation <i>Wenbo Wu</i>	799
A Phase-Aware Automated Parameter Search Benchmark Framework and Search Behavior Study for OpenROAD Physical Design <i>Junkai Wang</i>	807
Word Count Frequency Statistics Application of MapReduce Based on Alibaba Cloud FC <i>Jingqi Zhang</i>	820
Collaborative Strategy of Multi-Agent Deep Reinforcement Learning for Complex Tasks <i>Hang Yin</i>	828
Incremental Learning Technology for Embodied Evolution of Intelligent Robots <i>Chunxi Yu</i>	837
Multimodal Perception and Real-Time Fusion of Biomimetic Robots <i>Yifei Xu</i>	847

Deep Reinforcement Learning for Real-Time Obstacle Avoidance and Local Path Replanning of Robots in Complex Dynamic Scenes <i>Borui Zhang</i>	857
Natural Human-Robot Interaction Paradigm for a New Generation of Intelligent Robots <i>Xinyang Wang</i>	867
Autonomous Robot Motion Planning Technology Based on Diffusion Model <i>Hanbin Sun</i>	875
Design of A Robotic Arm Error Compensation System Based on the Transformer Model <i>Yuqian Li</i>	887
Computer Vision, Pattern Recognition and Intelligent Perception	
Automated Script Recognition Based on Human-Computer Interaction Features of Mouse Movement Trajectory <i>Chenyang Wu</i>	899
Fine-Grained Image Classification Based on Attention Mechanism and Fusion Method <i>Shenboyi Wang</i>	907
Accuracy and Real-Time Performance Evaluation of Pedestrian Detection Models Based on the COCO Dataset <i>Haoyu Wang</i>	912
SPD-CBAM: Small Target Detection in UAV Images <i>Haorui Huang</i>	923
Multimodal Fusion Object Detection Technology in Intersection Traffic <i>Tianyuke Wang</i>	934
Industrial Defect Detection Based on Computer Vision <i>Yiyuan Chen</i>	946
Research and Performance Analysis of Person Re-Identification Methods in Occluded Scenarios <i>Yitong Yu</i>	952