

Message from the Editor-in-Chief

Advances in AI, IoT, and smart systems for emerging electrical and computer engineering applications

Tole Sutikno^{1,2}

¹Faculty of Industrial Technology, Universitas Ahmad Dahlan, Yogyakarta, Indonesia

²Embedded System and Power Electronics Research Group, Yogyakarta, Indonesia

Article Info

Keywords:

Artificial intelligence
Autonomous systems
Deep learning
Intelligent control
Internet of things
Machine learning
Smart energy

ABSTRACT

The current issue of the International Journal of Electrical and Computer Engineering (IJECE) showcases a diverse array of research at the intersection of artificial intelligence (AI), Internet of Things (IoT), machine learning (ML), and advanced engineering systems. Highlighted studies explore the application of autonomous mobile robots for logistics and material handling, sensorless control and acceleration profiling of electric drives, hybrid control strategies for high-performance electric vehicles, and deep learning methods for image recognition, emotion detection, and software fault prediction. Further contributions address practical implementations of IoT in heatstroke prevention, hydroponics, Spirulina cultivation, and energy-efficient greenhouse management, demonstrating how intelligent systems can optimize resource use, safety, and productivity. The issue also emphasizes AI-empowered modeling in accelerator design, solar photovoltaic power forecasting, and GIS automation, while exploring cybersecurity through intrusion detection frameworks and fraud detection in financial systems. Cutting-edge deep learning models such as convolutional neural networks (CNN), vision transformers, and TinyML are leveraged for healthcare, nuclear monitoring, and prenatal diagnostics. Collectively, these contributions underline the transformative role of AI, IoT, and hybrid intelligent systems in electrical and computer engineering, bridging theoretical advances with practical, real-world applications. This issue aims to inspire continued research and development toward efficient, secure, and adaptive technologies that advance smart engineering solutions worldwide.

This is an open access article under the [CC BY-SA](#) license.



Corresponding Author:

Tole Sutikno

Master Program of Electrical Engineering, Faculty of Industrial Technology, Universitas Ahmad Dahlan
UAD 4th Campus, South Ring Road, Tamanan, Banguntapan, Bantul, Yogyakarta 55166, Indonesia

Email: tole@te.uad.ac.id

The February 2026 issue, Volume 16, Number 1 of the *International Journal of Electrical and Computer Engineering (IJECE)*, presents a comprehensive overview of contemporary advances in electrical and computer engineering. The issue highlights significant contributions in artificial intelligence (AI), machine learning (ML), deep learning (DL), Internet of Things (IoT), intelligent systems, and hybrid computational frameworks. Collectively, the research demonstrates the increasing convergence of theoretical development and practical applications, reflecting global efforts to design intelligent, efficient, and adaptive systems that address pressing challenges across diverse sectors, including industry, healthcare, energy, agriculture, automation, cybersecurity, and software engineering.

This issue is organized around several thematic clusters, each emphasizing a distinct aspect of electrical and computer engineering research. These clusters include autonomous systems and intelligent robotics, electric drive and propulsion systems, computer vision and DL applications, cybersecurity and fraud detection, intelligent IoT and artificial IoT (AIoT) monitoring, energy and smart grids, healthcare and safety applications, software engineering and GIS applications, and hybrid approaches for domain-specific problem solving.

Autonomous Systems and Intelligent Robotics

The rapid development of autonomous systems and robotics continues to reshape modern industrial operations, logistics, and manufacturing processes. This issue explores intelligent mobile robotics applied to material handling, intralogistics, and automated transportation systems, where innovations in navigation, localization, and route optimization have become central to reducing human intervention in repetitive tasks. Advanced integration of simultaneous localization and mapping (SLAM) techniques, real-time path planning algorithms, and adaptive control mechanisms enables mobile robots to operate reliably within dynamic and complex industrial environments.

The studies demonstrate measurable gains in operational efficiency, reduction of error rates, and improvements in task completion times. Intelligent robotic systems are increasingly capable of responding to environmental changes, optimizing delivery routes, and coordinating multiple autonomous agents simultaneously. These advancements signify a major step toward Industry 4.0 and smart manufacturing, where automated systems, adaptive algorithms, and real-time decision-making converge to create agile and cost-effective production environments.

Electric Drive and Propulsion Systems

Electric drive systems for elevators, industrial machinery, and electric vehicles are a key focus, emphasizing precision control, energy efficiency, and high-performance operation. Advances in sensorless control, adaptive backstepping, and sliding-mode strategies demonstrate how intelligent algorithms can optimize torque response, ride comfort, mechanical reliability, and disturbance rejection. The application of S-curve acceleration profiles and predictive torque estimation to multi-phase induction motors reduces mechanical wear, minimizes vibrations, and improves operational smoothness. Hybrid control approaches for electric vehicle propulsion integrate variable-gain super-twisting algorithms with real-time torque optimization, enabling fast dynamic response under varying load conditions while maintaining system stability and energy efficiency. These methods highlight the importance of sophisticated control frameworks in meeting the growing demands for reliable, safe, and efficient electric drive solutions.

Moreover, adaptive and model-based estimation techniques allow real-time monitoring and adjustment of performance parameters to account for environmental changes, load fluctuations, or component aging. Such capabilities enhance system longevity, reduce maintenance needs, and improve overall operational sustainability. By combining predictive control, disturbance rejection, and fault-tolerant mechanisms, modern electric drives achieve high reliability, smooth operation, and energy-conscious performance. Collectively, these innovations illustrate how intelligent electric drive systems are critical for advancing sustainable transportation, high-performance industrial machinery, and smart energy-efficient infrastructures.

Computer Vision and Deep Learning

Computer vision and DL represent a major thematic cluster, demonstrating the ability of advanced neural architectures to address complex challenges in real-time recognition, classification, and object detection. Contributions in this issue highlight facial emotion recognition under partial occlusion, fish and environmental species classification, and object detection in dynamic or cluttered environments. Vision transformers (ViTs) and convolutional neural networks (CNNs) are employed to improve accuracy and robustness, particularly in scenarios with limited visibility, occlusions, or variable lighting conditions. These models leverage attention mechanisms and spatial feature extraction to capture subtle patterns in images, enhancing performance compared to conventional methods. Moreover, hybrid architectures and ensemble approaches illustrate how combining multiple DL strategies can overcome dataset limitations, reduce misclassification, and achieve higher generalization for real-world applications.

Comprehensive reviews tracing the evolution of YOLO object detection models from early to the latest versions provide researchers with actionable guidance for selecting algorithms that balance accuracy, detection speed, small-object recognition, and computational efficiency. These advancements highlight the versatility of DL in tackling a wide range of practical problems, including autonomous systems, intelligent surveillance, environmental monitoring, biomedical imaging, and industrial quality control. By integrating sophisticated feature extraction, attention mechanisms, and optimized training strategies, these studies

showcase how computer vision and DL are becoming increasingly capable of handling complex visual data and real-world operational challenges, paving the way for more adaptive and intelligent automated systems.

Cybersecurity and Fraud Detection

With the rapid growth of digital networks and online financial systems, cybersecurity and fraud detection have become increasingly critical domains requiring timely, accurate, and automated solutions. Contributions in this issue showcase machine learning frameworks that integrate ensemble learning, convolutional and recurrent neural networks, and multilayer perceptrons to detect malicious behavior and financial fraud with high precision. By leveraging hybrid architectures and intelligent sampling strategies, these approaches effectively address challenges such as class imbalance, noisy data, and evolving attack patterns. Real-time analysis of network traffic and transaction data allows the systems to identify anomalous patterns promptly, enabling proactive interventions and automated blocking of suspicious activities before they escalate into larger threats.

Advanced predictive models further enhance resilience against emerging cyber threats by continuously adapting to new patterns of intrusion or fraudulent behavior. These frameworks demonstrate the capacity of AI-driven analytics to secure critical infrastructure, protect sensitive data, and maintain trust in digital financial ecosystems. The integration of machine learning for real-time monitoring, anomaly detection, and automated response underscores the transformative role of intelligent systems in building robust cybersecurity infrastructures. Collectively, these contributions highlight the growing potential of AI to enable adaptive, scalable, and highly effective security solutions across both public and private sectors.

Intelligent IoT and AIoT Monitoring Systems

The convergence of the IoT with AI is reshaping monitoring systems across environmental, agricultural, and healthcare domains. Contributions in this issue demonstrate intelligent solutions ranging from IoT-enabled heatstroke detection devices to automated hydroponic greenhouse management systems and AI-driven Spirulina cultivation frameworks. These innovations leverage a network of interconnected sensors, real-time data acquisition, and predictive analytics to provide actionable insights and automated responses. Edge computing and TinyML integration enable these systems to operate efficiently in low-power, resource-constrained environments, ensuring continuous monitoring and rapid response even in remote or challenging settings. Such capabilities are crucial for enhancing human safety, optimizing resource usage, and maintaining environmental sustainability.

AIoT monitoring systems extend beyond passive data collection by incorporating machine learning models that continuously learn and adapt to dynamic conditions. Predictive recommendations for plant growth optimization, nutrient management, and personalized health alerts illustrate the practical impact of intelligent decision-making at the edge. The synergy of autonomous sensing, real-time analysis, and adaptive control creates highly resilient and efficient operational frameworks. Collectively, these contributions highlight the transformative potential of AIoT systems to improve productivity, sustainability, and safety, demonstrating that intelligent, interconnected monitoring platforms are increasingly vital in addressing complex challenges across multiple sectors.

Energy Systems and Smart Grids

Energy management and smart grid optimization are critical areas of research, particularly as renewable energy sources become increasingly integrated into modern power systems. Accurate forecasting of solar photovoltaic (PV) power generation is essential to balance supply and demand, reduce reliance on fossil fuels, and enable efficient grid operation. Hybrid AI and machine learning models, including convolutional neural network–long short-term memory (CNN-LSTM) architectures, have shown significant improvements in capturing complex spatiotemporal patterns and weather-dependent variability, resulting in highly reliable and precise PV power predictions. These models allow for proactive planning, load balancing, and demand response, enhancing grid stability while supporting sustainable energy management practices. In addition, data-driven predictive approaches facilitate integration with energy storage systems and distributed generation units, further improving the resilience and flexibility of smart grids.

Beyond forecasting, the development of energy-efficient IoT networks and blockchain-integrated frameworks provides secure, low-latency communication for distributed sensor systems within smart grids. Advanced optimization strategies for adaptive clustering, sleep scheduling, and consensus protocols extend network lifetime, reduce energy consumption, and maintain high data integrity. These intelligent, decentralized systems enable real-time monitoring, autonomous control, and secure data sharing across energy networks, offering scalable solutions for urban infrastructure, industrial automation, and renewable energy integration. The combination of AI, optimization algorithms, and distributed architectures demonstrates the transformative potential of intelligent energy systems, establishing robust frameworks for sustainable, resilient, and high-performance smart grids.

Healthcare and Safety Applications

AI, DL, and TinyML are increasingly applied in healthcare and safety monitoring, providing innovative solutions for critical diagnostic and protective tasks. Applications in this issue include fetal heart anomaly detection using enhanced image augmentation, generative adversarial networks (GANs), and high-precision DL models, enabling accurate identification of complex conditions in prenatal care. Lightweight embedded systems for radiation monitoring show how TinyML can process sensor data in real-time on low-power devices, making them suitable for constrained environments such as remote monitoring stations or mobile healthcare units. These systems combine predictive analytics, automated decision-making, and efficient computation to enable timely interventions and enhance operational safety in medical and industrial settings.

Integrating AI-driven methods in healthcare and safety provides precise diagnostics, early anomaly detection, and continuous real-time monitoring while reducing reliance on high-performance computational infrastructure. By leveraging DL for complex image analysis and TinyML for low-power embedded applications, these systems deliver scalable, accessible, and reliable solutions across diverse environments. The advancements highlight the potential of AI and machine learning to improve healthcare outcomes, minimize human error, optimize resource use, and maintain high standards of accuracy, performance, and operational efficiency.

Software Engineering and GIS Applications

In the domains of software engineering and geographic information systems (GIS), research highlights the advantages of parameter-efficient fine-tuning of small language models (SLMs) and the development of open-source AI frameworks for code generation and spatial problem-solving. Techniques such as LoRA and QLoRA enable lightweight adaptation of language models for domain-specific applications, facilitating cost-effective and resource-constrained deployments.

These frameworks expand access to AI-assisted software synthesis, geospatial intelligence, and autonomous GIS analysis, bridging the gap between research and practical deployment. Software fault prediction techniques and hybrid data preprocessing methods provide insights into improving software reliability, highlighting the broader impact of AI and machine learning in creating resilient, adaptive, and intelligent computational systems.

Hybrid Approaches and Emerging Trends

Across the thematic clusters, several hot topics and emerging trends are evident. These include the integration of TinyML for edge and embedded computing, vision transformers for occluded and low-visibility image recognition, hybrid DL models for predictive analytics, AIoT frameworks for autonomous agriculture and environmental monitoring, and parameter-efficient fine-tuning of LLMs for code generation.

The convergence of AI, IoT, DL, and optimization frameworks highlights the potential for cross-domain innovation, enabling practical, high-impact solutions. Applications span autonomous logistics, smart energy networks, precision agriculture, predictive healthcare, cybersecurity, and software development. These advancements illustrate the growing importance of interdisciplinary research, adaptive intelligence, and low-power embedded AI systems in shaping the future of electrical and computer engineering.

Conclusion

The current issue presents a diverse collection of interdisciplinary research at the forefront of electrical and computer engineering. The studies highlight the transformative role of AI, the IoT, DL, and hybrid intelligent systems in solving real-world challenges, improving efficiency, enhancing safety, and promoting sustainability. Applications cover autonomous robotics, smart energy management, AI-driven healthcare, intelligent agriculture, cybersecurity, and software engineering, demonstrating the breadth and impact of innovation in the field. The research emphasizes that integrating AI, IoT, machine learning, DL, and optimization techniques enables the development of intelligent, adaptive, and autonomous systems capable of self-optimization, real-time decision-making, and high-performance operation. These contributions provide practical frameworks for real-world applications, support interdisciplinary collaboration, and advance the dissemination of innovative methods. Overall, this issue showcases emerging trends, practical solutions, and future directions in electrical and computer engineering, serving as a valuable resource for researchers, practitioners, and educators. The work featured here underscores the potential of intelligent and resilient technologies to shape the future of engineering, technology, and society.