

SPECIAL ISSUE ON ADVANCES IN SENSORS AND COMPUTATIONAL INTELLIGENCE FOR INDUSTRIAL APPLICATIONS: PART 1

PREFACE



Artificial intelligence (AI) is transforming how computers perceive and interpret their surroundings, while sensor technologies have simultaneously evolved into a rapidly expanding interdisciplinary domain. Recent progress has accelerated the integration of computational intelligence (CI) across diverse industries. As a branch of computer science inspired by human cognitive processes, CI leverages synergistic methodologies to address complex real-world problems. It provides systematic frameworks for modeling, simulating, and analyzing intricate phenomena, thereby enabling more adaptive and intelligent solutions.

This Special Issue (SI) concerns “Advances in Sensors and Computational Intelligence for Industrial Applications: Part 1” for *Sensors and Materials*. It synthesizes findings across seven studies at the intersection of sensing systems and CI within AIoT settings. In this SI, Lin *et al.* propose advances in sensors and CI to enhance traffic sign and road-condition detection, thereby improving safety, prediction, and automation in intelligent transportation systems. Zhao *et al.* present a real-time AR-based acupoints healthcare system integrating edge computing, DNN hand gesture recognition, and BERT-driven AI consultation. The system visualizes acupoints, supports symptom-based guidance, and enables physician monitoring, offering an interactive, efficient, and accessible solution for personalized health management. Chen *et al.* propose a lightweight efficient focal aggregation model for finger-vein recognition, integrating vision transformers with convolutional features, enhancing biometric security in smart systems and demonstrating the potential of advanced sensing and CI for robust industrial and IoT applications. Manual railway inspection is time-consuming and labor-intensive and fails to meet modern maintenance demands for efficiency and precision. Chung *et al.* propose an automatic rail fastener detection system based on the lightweight YOLOv3-tiny architecture, offering real-time performance and high accuracy, making it suitable for deployment on edge devices in practical railway inspections. Lee *et al.* present a mobile system integrating facial analysis, environmental sensors, and CI to deliver personalized, context-aware skincare recommendations, exemplifying intelligent sensing and adaptive decision-making for user-specific, sensor-driven optimization. Cho *et al.* present image-based coffee bean quality inspection leveraging automated optical inspection and imaging sensors. A class-aware unsupervised domain adaptation framework using vision transformers demonstrates high classification accuracy and generalization, highlighting the potential of intelligent sensing and CI for automated, industrial-quality control systems. Feng *et al.* present advanced sensor-based imaging, integrated with deep learning and XAI, that enables noninvasive monitoring and defect detection in industrial

components, demonstrating that sensor-driven CI can provide practical decision-making support for intelligent medical sensing and predictive maintenance applications.

Finally, I would like to thank the authors for their considerable contributions and the reviewers for their beneficial comments. In closing, we sincerely offer special thanks to the chief of the editorial department of MYU K.K., Ms. Momoko Kawamura, for her kind and proficient support in the review and publication processes.

Prof. Chih Hsien Hsia
Department of Computer Science and Information Engineering
National Ilan University
Taiwan