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Special Issue on Beyond Classic Deep Learning: Algorithms for Dealing with Real-World Applications in Industrial Automation

In the context of Industry 4.0/5.0, the primary goal is to enhance efficiency, productivity, and flexibility through real-time data monitoring and connectivity. Deep Learning plays a vital role in powering Industry 4.0/5.0 by enabling machines to learn from complex data and make informed decisions. It addresses various industrial challenges like anomaly detection, predictive maintenance, and quality control.

Although the classic supervised learning paradigm has seen a lot of work in the contexts of Deep Learning and Industry 4.0/5.0, practical industrial applications frequently require the study of other paradigms. Two major obstacles stand out in particular. The first is the problem of the information on the labels. For example, it can be absent because it is expensive or time-consuming to obtain by human annotation. In such situations, paradigms like weakly supervised learning, unsupervised learning, and active learning can be beneficial. The second challenge is brought on by the dynamic environment in which models are deployed. Often, in real-world applications, the environment only remains consistent for a brief period of time. As time progresses, the environment changes, which causes a shift in the distribution of data and a deterioration in the model's performance. For instance, modifications to production processes, the replacement of sensors, or the installation of new equipment at an industrial facility might lead to changes in the data distribution that must be taken into consideration. Online learning, continual learning, and domain adaptation are some of the paradigms that could be used to address this difficulty.

The central theme of the Special Issue will be **Beyond Classic Deep Learning: Algorithms for dealing with real-world Industrial Applications**, where the focus areas are (1) how to address dynamic environments with changes in the data distribution and (2) how to handle the training in case of absent or weak labels. The goal of the special issue is to publish novel, noteworthy, and innovative papers outlining scientific techniques and technologies that advance the state of the art of real-world applications such as the manufacturing industry.

Researchers and practitioners from diverse academic backgrounds, as well as experts from global academia and industry, are encouraged to submit their research on various learning paradigms, including:

- *Continual Learning, Meta Learning, Multi-Task Learning, Lifelong Learning, Online Learning, AutoML, Few-Shot Learning, Domain Adaptation, Active Learning, Transfer Learning, Open-World Learning, and Out-Of-Distribution.*

These topics will be explored within the context of industrial challenges such as:

- *Anomaly Detection, Fault Detection, Predictive Maintenance, Process Optimization, Production Scheduling, Quality Control, Soft Sensing, and Sensor Fusion.*

Our primary aim is to introduce innovative techniques and validate both traditional and novel approaches in industrial sectors like:

- *Additive Manufacturing, Automotive, Chemical, Pharmaceutical, Semiconductor, OEMs, and Robotics.*

Important Dates

• Paper submission deadline: May 15, 2024
• Completion of the first round review: September 15, 2024
• Completion of the second round review: January 15, 2025
• Final submission due: March 15, 2025
• Tentative publication date: August 15 2025

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Paper Submission

All papers are to be submitted through the IEEE's Manuscript Central for Transactions on Automation Science and Engineering http://mc.manuscriptcentral.com/t-ase. Please select the Manuscript Category "Topic-Based Special Issue" under "Type" in Step 1 and this specific Special Issue in Step 6 of your article's submission process. All manuscripts must be prepared according to the IEEE Transactions on Automation Science and Engineering publication guidelines (http://www.ieeeras.org/publications/t-ase). Please address inquiries to Prof. Gian Antonio Susto.