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EDITED AND REVIEWED BY
Marcello Pelillo,
Ca' Foscari University of Venice, Italy

*CORRESPONDENCE
Francesco Rundo
francesco.rundo@st.com
Angelo Genovese
angelo.genovese@unimi.it

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Editorial: Deep neural computing for advanced automotive system applications

Francesco Rundo[1]*, Sabrina Conoci[2], Sebastiano Battiato[3], Carmelo Pino[3], Massimo Villari[2], Angelo Genovese[4]*, Stefanos Kollias[5] and Konstantinos N. Plataniotis[6]

[1]STMicroelectronics, ADG R&D Department, Catania, Italy, [2]Università degli Studi di Messina, Messina, Italy, [3]Università di Catania, Catania, Italy, [4]Università degli Studi di Milano, Milan, Italy, [5]National Technical University of Athens, Athens, Greece, [6]University of Toronto, Toronto, ON, Canada

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Editorial on the Research Topic
Deep neural computing for advanced automotive system applications

Technological progress in Artificial Intelligence (AI), data storage, and hardware accelerators, have fostered modern intelligent approaches, inspired by the biology of human neural networks, that permit the management of large amounts of data with human-like accuracy to be used for the implementation of various bio-engineering applications. Specifically, AI approaches based on deep learning are being increasingly studied to design robust and reliable systems for both assisted driving and fully autonomous driving. These deep learning-based approaches leverage bio-inspired neural computing to address critical challenges such as driver attention-level monitoring, driving risk assessment, and enacting safe and robust driving strategies. The advent of electric and hybrid cars, and the use of silicon carbide (SiC) devices and lithium-ion batteries, has introduced further issues to be addressed. Within the field of automotive engineering, there is now particular interest in the scientific investigation into solutions based on deep learning and neural computing for the prediction of the remaining useful battery life, as well as for defining predictive maintenance models for SiC devices in the car body.

The goal of this Research Topic has been to collect scientific contributions that highlight the advantages and robustness of deep learning and bio-inspired neural computing for addressing the critical issues of modern automotive developments, such as recognizing actions, predicting pathways, and detecting dangerous situations. In particular, the call for papers on this Research Topic has resulted in six papers, reflecting the interest of the research community in this topic. The papers were evaluated by a program committee composed of international researchers, professors, and industry experts, with each contribution processed by at least three independent reviewers. After the review phase, three papers were accepted for publication in Frontiers in Neurorobotics.

Liu et al. presented a joint spatial-temporal reasoning (JSTR) framework, leveraging relation between joints, to recognize actions from videos. Their method considers a joints spatial relation graph to model the relation between the position of the joints, and an intra-joint temporal relation graph to represent the time-related information of body joints. Yang et al. proposed a dual-flow network for autonomous driving using an attention mechanism,

with the purpose of automatically predicting the next waypoint in the path. The network is composed by a perception network, which processes RGB images captured at low speeds to extract a discriminant representation based on the object shape, a motion network, which analyzes grayscale images captured at high speeds to extract a discriminant representation based on the object motion, and an attention mechanism that fuses the information resulting from both the perception and motion networks. Wang et al. described a deep learning approach based on the You Only Look Once (YOLO) CNN to detect objects with a high accuracy also in situations of adverse weather such as rain, snow, and fog. Their method introduces both the anchor-free and the decoupled head in the YOLO architecture, relaxing some of the constraints of traditional YOLO CNNs to increase detection accuracy in the situations where objects may be scarcely visible. We hope that the papers in this Research Topic will stimulate further research contributions in the field of assisted and autonomous driving.

We wish to thank all the authors for their submissions as well as the reviewers for their valuable work in increasing the quality of the works. We would also like to thank Prof. Marcello Pelillo, Specialty Chief Editor of the Computer Vision section of Frontiers in Computer Science, Proff. Alois Knoll and Florian Röhrbein, Specialty Chief Editors of Frontiers in Neurorobotics, and Simon Rees, Journal Specialist of Frontiers in Computer Science, for their support and guidance during this editorial activity.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Conflict of interest

FR is employed by STMicroelectronics.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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