

## Special Issue on Artificial Intelligence and Edge Computing for Trustworthy Robots and Autonomous Systems

### I. AIM AND SCOPE

Autonomous Systems are becoming ubiquitous in different application domains, such as aerospace, transport, manufacturing, agriculture, social healthcare, and extreme environments. The Internet of Things (IoT) delivers new value by connecting People, Process and Data. Sensor and data analytics technologies in the IoT are used to give robots a wider situational awareness that leads to better task execution. Hence, IoT technology could inspire wider applications of robots and autonomous systems (RAS).

However, some recent incidents, in which these systems have failed, illustrate the dangers to human life of the use of autonomous systems that have not been fully verified as trustworthy. For instance, an autonomous vehicle killed a person in the street in Arizona, US in 2018, successful cyberattacks have been executed to demonstrate how autonomous vehicles could potentially be hijacked, and the failure of an intelligent support aviation system on Boeing planes was responsible for the crash of two airplanes killing 189 and 157 people, respectively. These lessons reinforce to us that an effective RAS must be trustworthy.

The trustworthiness framework of cyber physical systems, proposed by the National Institute of Standards and Technology (NIST), covers cybersecurity, privacy, safety, reliability, and resilience. A trustworthy robot or autonomous system should have the capacity to deal with anomalies from cyber space, external environments, and internal system, while interacting with humans without misunderstanding. Hence, the four aspects of cybersecurity, safety, health and interaction of RAS directly affect the development of RAS towards fully autonomous systems without human intervention, and their integrated performance with system autonomy ensures the trustworthiness of RAS.

Artificial intelligence (AI) is a wider paradigm, including perception, reasoning, knowledge representation, planning, learning, and the ability to move and manipulate objects. AI technology has played significantly important roles in improving the trustworthiness of RAS from the four aspects of cybersecurity, safety, health and interaction of RAS.

This special issue extends previous work in cognitive and developmental RAS, focussing on AI and Edge Computing for trustworthy RAS, by enhancing the abilities of RAS to address anomalies from cyber space and external environments. It focusses on self-diagnosis and interactions with humans on a mutual trust basis, improving the performance of RAS in the context of different application domains, such as extreme environments, social & health care and manufacturing, and exploring new applications enabled by the Internet of Robotic Things.

### II. THEMES

Specifically this special issue aims to report on state-of-the-art approaches and recent advances in (a) AI algorithms to improve the performance or capability of RAS in the four key aspects of cybersecurity, safety, health and interaction; (b) solutions of Edge Intelligence for RAS; (c) AI and Edge Computing (AIEC) for improving the performance of RAS in different application domains of RAS; (d) New solutions for Internet of Robotic Things for widespread applications. The special issue will cover (but is not limited to) the following topics related to the trustworthy RAS through AIEC,

- (1) AIEC for the Cybersecurity of RAS, dealing with anomalies in cyber space, cognitive cybersecurity, privacy, security by design, privacy by design, anomaly detection, (cyberattack, malware, intrusion, virus) and security architectures, etc.
- (2) AIEC for the safety of RAS, dealing with anomalies in surrounding environments, covering safe navigation, obstacle detection, obstacle avoidance, pedestrian awareness, and system autonomy, etc.
- (3) AIEC for the health of RAS, self-diagnosis, self-healing and maintenance of health, fault detection and diagnosis, system life prediction, etc.
- (4) AIEC for interaction of RAS with humans, trustworthy human-robot interaction, AI interpretation / semantics, and mixed initiative in human-robot interaction.

- (5) AIEC for improving the performance of RAS in task planning, performance optimisation, resource optimisation, and reduction of power consumption, etc. for different application domains, such as social-health care, advanced manufacturing, and extreme environments, etc.
- (6) Architectures of trustworthy RAS enabled by Internet of Robotic Things for widespread applications.

### III. SUBMISSION

Manuscripts should be prepared according to the “Information for Authors” of the IEEE Transactions on Cognitive and Developmental Systems journal found at <http://cis.ieee.org/publications.html> and submissions should be done through the IEEE TCDS Manuscript centre: <https://mc.manuscriptcentral.com/tcds-ieee>. Please select the category “SI: AI and Edge Computing for Trustworthy Robots and Autonomous Systems”.

### IV. IMPORTANT DATES

1 Sept 2020 – Deadline for manuscript submission  
1 Dec. 2020 – Notification of authors  
1 Mar. 2020 – Deadline for revised manuscripts  
1 Jun. 2021 – Final version

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