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SPECIAL SESSION ON

Challenges of artificial intelligence for control and navigation of robots

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Session description:

For years, various control methods have been developed. All of these methods reveal advantages and disadvantages compared to other methods. The different control methods are subdivided into two categories: classic control and intelligent control. The differences between these two categories are based on the advantages of each of them. For any mobile robot, the ability to navigate its environment is crucial. Navigation is a field of research that is based on the process of determining/estimating a robot's position and speed, as well as its attitude. It is also frequently related with feedback control, which concerns the design of systems to control the movement of the robot. The control is based on the manipulation of actuators, to execute guidance commands and maintain vehicle stability. Recent progress has been made in this area and concerns the determination and (or) control of vehicle states (position, direction, attitude, altitude, speed, etc.). Especially since it makes it possible to intelligently avoid dangerous situations such as collisions and quite dangerous environmental conditions, which is very important to accomplish the robot's mission.

Artificial Intelligence (AI) has become a transformative force in various industries, including robotics. As the capabilities of robotic systems become more advanced, so too do the challenges concerning their control and navigation.

One of the key challenges in AI-based control and navigation of robotic systems is ensuring robustness and adaptability. Robots need to be able to navigate and interact with their environment in real-time, making decisions and adjusting their actions based on changing environments. This requires sophisticated algorithms and techniques that can handle uncertainties, noise, and unexpected events. Additionally, the ability to learn and adapt from experience is crucial in enabling robots to continuously improve their control and navigation capabilities.

AI algorithms, such as machine learning and deep reinforcement learning, allow robots to acquire knowledge, analyze data, and make informed decisions in real-time. By incorporating sensor data and perception systems, AI-powered robots can perceive their surroundings, recognize objects, and plan their movements accordingly. This level of autonomy and intelligence enables robots to navigate complex environments, avoid obstacles, and execute tasks efficiently. However, with the increasing complexity and autonomy of AI-powered robotic systems, challenges arise. Ensuring the safety and ethical considerations of these systems is of paramount importance. Robotic systems should be designed with fail-safe mechanisms and ethical guidelines to prevent any potential harm or misuse.

These challenges encompass a range of complex issues that researchers and practitioners must tackle in order to develop safe, efficient, and reliable AI-based control and navigation systems.

The goal of this special session is the implementation of artificial intelligence controllers toward smart robots control strategies; it consists of a smart tracking control and navigation of mobile robots with the use of artificial intelligence based on neural networks, fuzzy logic and genetic algorithms. Indeed, in its environment, the robot can encounter different obstacles in following a specific trajectory. These obstacles can alter the robot or block its navigation so that it changes its trajectory. Lately, in robotics, one of the most exciting tools to avoid these obstacles lies in the use of artificial intelligence. The objective is to implement controllers based on artificial intelligence for optimal navigation allowing optimization in terms of time and errors. It also requires trajectories that mobile robots must be able to follow.

This special session on control and navigation of robots aims to bring together researchers and experts in the field to address the unique challenges faced in this domain

We invite original articles that address new developments in research on artificial intelligence-based indoor/outdoor navigation and control strategies. The main objective is to summarize theoretical and experimental results in this field and present different applications.

The principal topics planned to be covered are as follows, but are not limited to:

- Artificial intelligence and data fusion in robotics
- Self-localization and path planning
- Speed, tracking and obstacle avoidance control
- Trajectory optimization in navigation
- Artificial intelligence and machine learning for robot state estimation
- Engineering system-based navigation and control.
- Location-based service navigation applications.
- Applications on aerial, marine and terrestrial robot navigation and control systems.
- Robot path planning in the presence of obstacles.
- Application of artificial intelligence in multi-robot systems.
- Intelligent control techniques for path planning of humanoid robots.