2022 IEEE 18th International Conference on Automation Science and Engineering

Workshop on "Robot Teams: Challenges, Models, and Methodologies"

August 21st, 2022, Mexico City, Mexico

Abstract

Multi-robot teams have been used in a wide range of applications, including surveillance, inspection, rescue, automation, and logistics. Due to the variety of critical components in these applications, the collaboration between agents in the robot team can quickly become a challenging problem, particularly when there is a variety of hardware, battery life, size, and functionalities of the robots that are moving in a dynamic environment. Because the robots are working in an dynamic environment, they need to dynamically change their behaviors to adapt to the state of the environment in a way that is fully coupled to the type of agent. For example, depending on the robot, some environmental constraints can be waived or become more restricted. The tasks need to be assigned and managed precisely to achieve the goals while minimizing the execution time and energy costs and avoiding collisions.

Due to the collaboration among autonomous robots, robot team establishment introduce new requirements, new challenges, and new solutions to real-world problems. While many heterogeneous and autonomous robots are organized as a team to accomplish a mission, assigning a proper task to each robot, and evaluating their performance before acting is essential. Optimal task assignment can avoid failures and increase operating efficiency while the robots are executing their mission.

Role-Based Collaboration (RBC) is a flexible strategy that can facilitate agent collaboration between agents in centralized or decentralized management by using the Environments – Classes, Agents, Roles, Groups, and Objects (E-CARGO) model. Research shows that the RBC methodology can be used to manage a robot team's performance by optimizing task allocations. However, a critical part of RBC is the role assignment which requires a pertinent evaluation matrix, i.e., Q, that reflects the qualification of each agent for each role.

This workshop will discuss related methodologies including RBC approaches and the E-CARGO model.

Speakers:
Haibin ZHU, Nipissing University, Canada
Junqi ZHANG, Tongji University, China
Behzad AKBARI, Nipissing University, Canada
Peng ZU, Tongji University, China
YuXuan LIN, Tongji University, China

Panelists:
Ya-Jun PAN, Dal-Housie University, Canada
Ming HOU, Defence Research and Development Centre, Canada
Giacomo CABRI, Università di Modena e Reggio Emilia, Italy
Junqi ZHANG, Tongji University, China
Haibin ZHU, Nipissing University, Canada

Program (Online):

Time	Theme	Speaker
08:00 – 08:15	Workshop introduction & opening remarks	Haibin Zhu, Junqi Zhang
08:15 – 09:00	Establish Robot Teams using E-CARGO	Haibin Zhu
09:00 – 09:45	A Swarm Intelligence-based Swarm Robots Confrontation Method	Junqi Zhang
09:45 – 10:00	*Break*	
10:00 – 10:20	Path Planning of Robot Teams – Process Roles of Robots	Behzad Akbari
10:20 – 10:40	A Herd-Foraging-Based Approach to Adaptive Coverage Path Planning in Dual Environments	Peng Zu
10:40 – 11:00	Virtual Source-based Particle Swarm Optimizer for Multi-source Location	YuXuan Lin
11:00 – 11:10	*Break*	
11:10 – 12:00	Panel Discussion	Ya-Jun Pan, Ming Hou, Giacomo Cabri, Junqi Zhang, Haibin Zhu