IEEE T-RO Special Issue on:
<u>**Resilience in Networked Robotic Systems**</u>

Call for papers

Scope: We are living in an increasingly networked world, where people connect with people, people connect with machines, and machines connect with machines. We have long departed from a status quo of disjoint and independent physical, cyber, and human components — yet, so much more still needs to be done to unleash the transformative potential of highly equipped, networked 'swarms'. However, as connections are established, information is shared, and dependencies are created, these systems give rise to new vulnerabilities and threats. If our systems are to succeed, they must be built to resist environmental disturbances, internal malfunctions, and malicious manipulations. How do we build resilient robotic networks?

Resilience is particularly relevant to collections of units that are connected through communication or sensory networks, and have dependencies that arise from spatial or functional relationships. As such, the original development of resilience leverages techniques from the fields of network science, signal processing, and systems theory. Although early works have begun to translate these concepts to the domain of robotics and automation, we still lack a deeper understanding of what resilience is, and how (and whether) it differs from robustness.

Currently, we understand resilience as the ability to withstand or overcome adverse conditions or shocks, and unknown, unmodeled disturbances. It refers to the changes in behavior and the underlying system dynamics (e.g., transformation, reorganization, growth) that enable the system to retain the desired functionality. Resilience can have several manifestations. For example, it can be measured by the extent of structural or behavioral changes that occur over time to stymie an attack. It could also be measured by the time it takes for the system to reach a new steady state, and the performance of the system at that steady state after disruption.

Although there is a substantive body of work on methods providing robustness to robotic systems, research on resilience is scattered, and the distinction between resilience and robustness is still poorly understood. As a result, this special issue has two main goals, *(1)*, to provide a deeper understanding of *resilience* for networked systems, and *(2)*, to assemble works that demonstrate the importance of resilient methods.

In an effort to disseminate the current advances in designing and operating resilient robotic networks, and to stimulate a discussion on the future research directions in this field, the *IEEE Transactions on Robotics* (T-RO) invites papers for a Special Issue in this area. Researchers are invited to submit papers on the foundational, algorithmic, and experimental aspects of design, modeling, control and validation of resilience in robotic networks.

Topics: We are soliciting contributions in the areas of networked robotic systems, multi-robot systems, and collaborative human-robot teams. Topics of particular interest include, but are not restricted to:

- Coordination for resilience
- Perception-action-communication loops for resilience
- Networking and topology control for resilience
- Resilience against adversarial robots
- Abstraction, synthesis, and validation of resilient behaviors
- Formalization of redundancy and heterogeneity
- Machine learning in networked teams
- Game theory in networked teams

Authors should read information on submitting at https://www.ieee-ras.org/publications/t-ro. Authors should mention in their submission cover letters that they are responding to the Special Issue call.

Submission Deadline: July 31, 2020 (extended from April 1, 2020)

GUEST EDITORS:

Amanda Prorok, University of Cambridge (asp45@cam.ac.uk)
Vijay Kumar, University of Pennsylvania (kumar@seas.upenn.edu)
Brian M. Sadler, Army Research Laboratory (brian.m.sadler6.civ@mail.mil)
Gaurav Sukhatme, University of Southern California (gaurav@usc.edu)