2021 NSF CYBER-PHYSICAL SYSTEMS PRINCIPAL INVESTIGATORS' MEETING

# CAREER: Towards Secure Large-Scale Networked Systems: Resilient Distributed Algorithms for Coordination in Networks under Cyber Attacks

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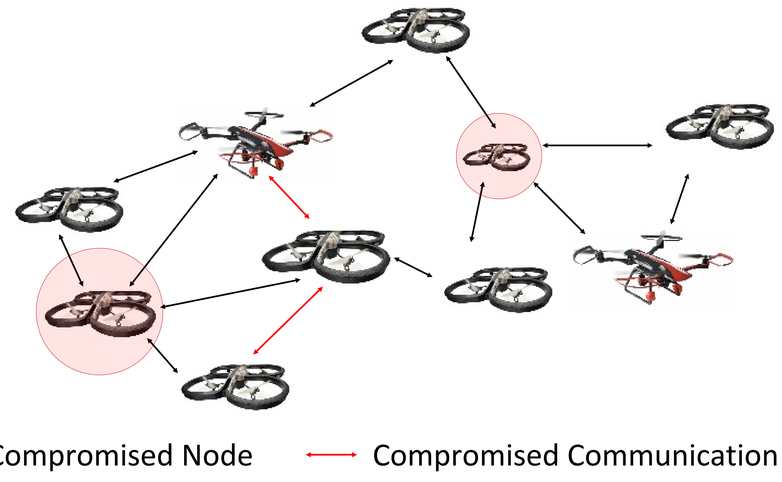
## Challenge:

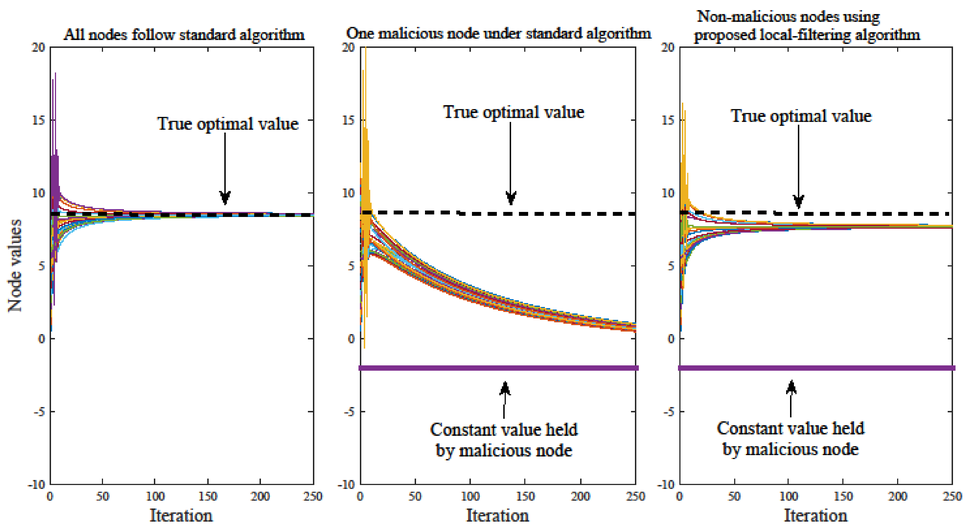
- Information gathered in large-scale cyber-physical networks is dispersed throughout network
- Agents in network need to coordinate in order to share information and achieve globally optimal objectives
- CPS can be attacked by adversaries, compromising vulnerable agents and causing them to behave maliciously
- How to enable **resilient** distributed coordination, learning, and decision-making?

## Solution:

- Created algorithms for distributed optimization, state estimation, and learning with provable performance guarantees, even under a large number of adversaries
- Algorithms are scalable and do not require nodes to know global information (such as network topology)




### Illustration of our Algorithms for Resilient Distributed Optimization




## Scientific Impact:

- Understanding of fundamental limitations of achievable performance in presence of adversaries
- "Plug-and-play" algorithms for large variety of distributed coordination, learning, and decision-making tasks
- New design principles for large-scale cyber-physical systems in a variety of application domains

## Broader Impact:

- Resilient cyber-physical systems and critical infrastructure enabled by the project will mitigate economic and safety consequences of cyber attacks
- Students trained in the science of resilient system design
- Easy-to-use and widely accessible web-based swarm simulator currently under development

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