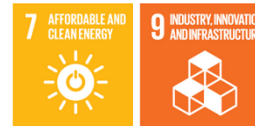


Decentralized Cooperative Learning and Control for Networked Dynamical Systems

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1. COPELABS: Centro de Investigação em Computação Centrada nas Pessoas e Cognição

Abstract :

The subject of the proposal belongs to the emerging area of Intelligent Networked Cyber-Physical Systems (INCPS) dealing with complex, spatially distributed and networked heterogeneous multi-agent dynamical systems, representing one of the greatest challenges in modern science and

technology. The impacts of INCPS will be ground-breaking, revolutionary and pervasive; this is evident today in emerging applications such as swarms of autonomous vehicles, smart buildings, cities and power grids, intelligent agriculture, transportation and manufacturing systems. Dimensionality, uncertainty, potential vulnerability, and information structure constraints, as fundamental characteristics of these systems, have led to the development of the decentralized decision making theory, providing scalability and robustness to structural uncertainties. However, high level of decentralization may increase vulnerability and decrease performance of the overall system.

The general objective of the project is development of new methods, algorithms and practical tools for decentralized learning and intelligent control for resilient INCPS, based on applications of consensus techniques, robust statistics theory, game theory and reinforcement learning. More specifically the objectives are: 1) Development of decentralized and distributed estimation algorithms, for resilient cooperative learning in INCPS; and 2) Development of novel decentralized algorithms for cooperative multi-agent reinforcement learning control.

Besides the short-term (1 year) expected results, the formulated objectives should also be considered in a long-term sense, having in mind the complexity, interdisciplinarity and generality of the approach.