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Research Theme: Multiple Actors

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Task: Coordinated Problem Solving

Partha S. Dutta & Mair Allen-Williams
School of Electronics and Computer Science
University of Southampton

{psd,mhaw05r}@ecs.soton.ac.uk

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Requirements

- Coordinate multiple actors whose actions are constrained by limited resources
- Model and predict global behaviour given the local behaviour of individual actors
- Develop local mechanisms to generate predictable global behaviour
- Design mechanisms for dynamic team formation

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Task Description

- Define the resources
- Define constraints on resource availability and access
- Define various tasks and their dependencies on resources
- Define agent roles in performing different tasks
- Identify global objective function(s) to measure task performance

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Task Description (2)

- Appropriately schedule tasks among agents
- Appropriately schedule resource usage between agents
- Enable distributed planning for agents
  - Delegation of control
  - Information flow
- Flexibly change planned course of action depending on environment dynamics
- Ensure reliability of performance by agents

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Domain Characteristics

- Dynamic – *environment may be changing*
- Open – *agents may leave or enter the system at any point*
- Heterogeneous – *may be agents of several different types*
- Uncertain – *agents cannot tell everything about their environment*

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Approaches (1)

- Changes in network structure often only directly affect a few agents and can be quickly adapted to using local algorithms
  - distributed algorithms
  - DCOP under uncertainty
- Coherently incorporating resource constraints into local coordination algorithms

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Approaches (2)

- Algorithms which learn can explore their environment and adapt to environmental changes
  - methods based on (PO)MDPs and Q-learning
- Incorporating competitive agents
  - ideas from game theory
  - Bayesian techniques for learning about other agents

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Summary

- Planning and acting under uncertainty
- In dynamic, open domains
- Incorporating resource constraints
- Exploiting local interactions
- Using learning, probabilistic techniques, game theory, ...