Agent-Based Systems Tutorial 5

Michael Rovatsos

Q1 The RoboCup Rescue web site gives the following summary description of the domain:

> RoboCupRescue is a new practical domain of RoboCup. Its main purpose is to provide emergency decision support by integration of disaster information, prediction, planning, and human interface. A generic urban disaster simulation environment is constructed on network computers. Heterogeneous intelligent agents such as fire fighters, commanders, victims, volunteers, etc. conduct search and rescue activities in this virtual disaster world. Real-world interfaces such as helicopter image synchronizes the virtuality and the reality by sensing data. Mission-critical human interfaces such as PDA support disaster managers, disaster relief brigades, residents and volunteers to decide their action to minimize the disaster damage.

The (publicly available RoboCupRescue Simulator) prototype includes four disaster simulator components:

1. A building collapse simulator based on real earthquake data of relation of ground surface acceleration, structure and age with destruction level.
2. A road blockage simulator using real data about relation the of seismic scale and street width with the probability of road obstruction.
3. A fire spread simulator using complex models to simulate combustion, propagation, ignition and extinguishing process models.
4. A traffic simulator which uses a rule-based micro-simulation method of complex systems considering road width, number of lanes, footpath width, traffic signals, etc.

Using basic sensing (see, hear, listen (for broadcasts)) and action (move, say, tell, extinguish, stretch, rescue, load/unload, clear) abilities, the following class of agents are provided by the simulator:

1. Moving agents: civilian, fire-fighter, rescuer, police
2. Static agents: fire station, police station, hospital, refuge, etc.

Consider the RoboCup Rescue MAS and the problem of designing global coordination mechanisms, which would you suggest for each type of inter-group/inter-agent interaction from the following list (under which circumstances):

- Teamwork-based cooperative distributed problem-solving based on joint intentions
- Generalised Partial Global Planning with blackboard-based communication
- Norms and social laws, enforced by (trustable, empowered) external authorities
- Mutual modelling supported by learning to improve models of others

Explain how you would use the suggested method in a concrete way, and discuss its advantages and disadvantages.

Q2 Define formally the concept of mixed-strategy Nash equilibria for n-player normal-form games.

Q3 You are given the following payoff matrices for two-player normal-form (matrix) games:

G1 2 / 1	D	C
D	(3,3)	(2,4)
C	(1,1)	(4,2)

G2 2 / 1	D	C
D	(-1,-1)	(1,2)
C	(2,1)	(-1,-1)

G3 2 / 1	D	C
D	(3,3)	(0,2)
C	(2,0)	(2,2)

G4 2 / 1	D	C
D	(2,-2)	(-1,1)
C	(-1,1)	(3,-3)

For each of these games

1. describe the nature of the decision problem represented by it,
2. identify best-response and dominant strategies for both players,
3. try to determine its dominant-strategy/Nash equilibria.