CT421 Artificial Intelligence

Agent Based Systems/Multi-agent systems

Some trends in computing history

- Ubiquity (Processing power increases while cost)
- Increased connectivity
- Increased complexity
- Increased Delegation
- Human-orientation - use of metaphors

Introduction

- New challenges for computer systems
- Traditionally, system design involved designing a system that took in correct input and outputted the desired result
- Modern days systems design involves building systems that can operate a networked, distributed, largely dynamic environment.

Introduction

- Individual agents are capable of autonomous action to a certain extent
- These agents interact with each other in multiagent systems
- Fundamental problems in MAS research:
  - The agent design problem: how should agents act to achieve their goals? (micro perspective)
  - The society design problem: how should agents interact to achieve their goals? (macro perspective)

Definition

- An agent is anything that can perceive its environment (through its sensors) and act upon that environment (through its effectors)
- Focus on situatedness in the environment (embodiment)

Another definition

- An agent is a computer system that is situated in some environment, and that is capable of autonomous action in this environment in order to meet its design objectives (Wooldridge and Jennings)
- A key idea here is that an agent is capable of independent autonomous action

Agent Autonomy

- Autonomy is required to ensure flexible action in unpredictable environments
- Allow agents to act without much input from user and without detailed specifications from users
- Allows agents to chose their own goal and a means to pursue it
- Raises issues re: allowing autonomy and maintaining control
- A key idea here is that an agent is capable of independent autonomous action

Desirable properties of agents

- Reactivity: intelligent agents should respond in a timely fashion to changes they perceive in their environment
- Proactive manner: intelligent agents can take the initiative and exhibit goal-directed behaviour
- Social ability: intelligent agents can interact with other agents (and humans) to satisfy their design objectives

Social Ability

- Many real-world application domains involve environments which are inhabited by multiple agents
- Each agent has limited resources/capabilities; certain goals may require others to take action
- Social ability is the ability to manage these interactions effectively

Interaction and coordination

- An interaction between the agents involves some form of interdependence between the agents
- Coordination is a special often studied case of interaction in which agents attempt to choose their actions appropriately.

Agent systems: Software Engineering

- Agents as a software engineering paradigm
- Interaction is most important aspect of complex software systems
- Ideal for loosely coupled "black-box" components

Agent system Views: Modelling

- Agents as a tool for modelling and understanding human societies (and others)
- Human society is very complex, computer simulation can be useful
- This has given rise to the field of (agent-based) social simulation

Agent system Views: Distributed Systems

- Long tradition of distributed systems research; usually designed with a common goal in mind
- But MAS are not simply distributed systems, because of different goals

Agent system Views: Economics/game theory

- Rational decision making extensively studied in economics,
- Game theory is a popular approach to representation and reasoning in this domain