

# MIS 510 Guest Lecture: Software Agents, Multi-Agent Systems, and Data Mining

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Topics To Be Covered Today . . . . .	2
What Are <b>Software Agents</b> . . . . .	3
Single Agents . . . . .	4
Multi-Agent Systems . . . . .	5
Agent Technology and Artificial Intelligence (AI) . . . . .	6
How to Develop A Single Agent? . . . . .	7
How to Develop Multi-Agent Systems . . . . .	8
Semantic Web is for AGENTS!! . . . . .	9
Agent Technology and Data Mining . . . . .	10
Two Interesting Agent Competitions . . . . .	11

## Topics To Be Covered Today

- What Are
  - software agents
  - multi-agent systems
- Relevant Disciplines and Technical Foundation
- Agent Technology + Data Mining
- Selected Case Studies

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## What Are Software Agents

- Agent as a term is overloaded
- Software agents are **computational** systems that
  - have goals, sensors, and effectors in a networked infrastructure (softbot vs. robot)
  - interact with other agents/users
  - are autonomous
  - are adaptive
  - are proactive
  - are long lived

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## Single Agents

- Automated problem solvers
- User task delegation
- May be able to learn from past experience
- Examples: intelligent interfaces, NASA “deep space I” remote agent

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## Multi-Agent Systems

- Multiple agents working together to solve problems
- Two main classes:
  - Distributed Problem Solving (DPS) (e.g., distributed sensor networks)
  - Multi-Agent Systems (e.g., negotiation support systems)

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## Agent Technology and Artificial Intelligence (AI)

- Agent technology is inherently multi-disciplinary
- AI is the main contributing academic discipline for agent-related research and technology development.
- Other related academic fields:
  - Distributed systems and networks
  - Economics and game theory
  - Linguistics and information retrieval
  - Software engineering
  - Human-computer interaction

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## How to Develop A Single Agent?

- Knowledge representation (logic, frame, semantic net, etc.)
  - JESS and FOPL/theorem proving (<http://fipa-os.sourceforge.net/features.htm>)
- Automated problem solving (search, AI planning, etc.)
  - GraphPlan (<http://www.cs.cmu.edu/~avrim/graphplan.html>)
- Interface design
- Adaptive behavior (machine learning/data mining)
- Toolkits: JADE; FIPA-OS standards

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## How to Develop Multi-Agent Systems

- All the above +
- Communication mechanisms
  - Historic: Speech Act/KQML
  - Current: DAML = XML + Ontologies
- Coordination
  - Cooperative (contract nets)
  - Strategic

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## Semantic Web is for AGENTS!!

- DARPA Agent Markup Language: as an extension to XML and the Resource Description Framework (RDF).  
DAML+OIL provides a rich set of constructs with which to create ontologies and to markup information so that it is machine readable and understandable

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## Agent Technology and Data Mining

- “Intelligent” agent: data mining and adaptive behavior make agents act smartly
- Intelligent data mining systems: agent technology helps make data mining systems better
- MAS presents unique data mining problems
  - Mining strategic interaction data
  - Distributed data mining
- MAS provides interesting data mining solutions
  - Prediction market

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## Two Interesting Agent Competitions

- RoboCup ([www.robocup.org](http://www.robocup.org))  
“By the year 2050, develop a team of fully autonomous humanoid robots that can win against the human world soccer champion team.”
- Trading agent competition: travel “agents,” supply chain management, online ads management, market-makers
- Data mining plays an essential role in these competitions

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- Visit [agents.umbc.edu](http://agents.umbc.edu) to learn more about agent technology and its applications

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