Introduction to “Autonomous Mobile Agents” and its Applications

Juan Ramón Acosta
ECE3890 Advanced Seminar
Northeastern University
Outline

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3. Technology Survey
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   3.2 Engineering Multi-Agent Systems
4. Case Study: Robotic Software System
Block 1

Software Agents: Basics
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1.1 Agent Origin

- In 1970, *Carl Hewitt* proposed the “Actor Model”
- *Actor*, a computational *Agent* with an address and behavior that communicates with other via message-passing
- Based on Distributed Artificial Intelligence (DAI) and Parallel Artificial Intelligence (PAI) theories and formalisms
- Systems based on *Actors* became *Multi-Agent Systems* (MAS)
1.2 Definition of Agent

Today the term *Agent* is misused and a times abused

Members of the agent community such as Pattie Mae, Leonar N. Foner and Hycinth Nwana have agreed on the following definition:

“An Agent is a software and/or hardware component which is capable of acting exactly in order to accomplish tasks on behalf of its user”

Requirements: Cooperate with other Agents, Interact with its Environment, Learn and be Autonomous
1.3 What is not an Agent

- Anything outside the intersecting areas is not an Agent
- **Not Agents** are: Expert Systems, Knowledge Systems and Distributed Processes
- Agents operate at knowledge level not symbol level
- [Foner93] and Pattie Mae, “Current commercially available agents barely justify their name”
1.4 Type of Agents: Collaborative

Attributes:
* Autonomous, Social Ability, Responsiveness and Pro-Activeness*

Goals:
* Create a system that Interconnects other agents to assemble a more complex Function*

Applications:
* Distributed Sensor Networks, Air Traffic Control and Enhance Reliability*

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Figure 2. The Pleiades Architecture at Carnegie Mellon University (CMU)
1.4 Type of Agents: Interface

Attributes:

Emphasis on autonomy and Learning in order to perform Tasks on behalf of the user

Goals:

Promote cooperation between end users and software agents

Applications:

Assistants (Travelers, Schedulers)  
Memory Aid, Filters, Match Making, Buying or Selling on behalf

Figure 3. How Interface Agents Work by Pattie Maes
1.4 Type of Agents: Mobile

Attributes:
Computational process capable of roaming the network gathering information on behalf of their Owner to return later “home”

Goals:
Reduce communication costs, Maximize local resources usage, Create a flexible distributed computing environment

Applications:
Personal intelligent communicators, Emergency Alert systems, Reconfigurable Mobile Computing, Network Routing

Figure 4. Whether Alarm System [Johansen99]
1.4 Type of Agents: Information\Internet

Attributes:
Manage or collate information from Distributed sources and have Knowledge where to look for and find information

Goals:
Provide an expressive integrated interface to the Internet

Applications:
Filtering Email, Meeting Schedulers, System Maintenance, Newspapers online.

Figure 5. WebBot running in Browser [Nwana95]
1.4 Type of Agents: Reactive

Attributes:
- Respond to stimulus generated by the environment
- Manages complex patterns that emerge from this behavior

Goals:
- Used to build systems with no internal symbolic models and
- Whose “smartness” derives from interactions

Applications:
- Physical Robots, Video games, Virtual Worlds and Real-Time embedded systems

Figure 6. Brook’s Sumpton Architecture [Nwana95]
1.4 Type of Agents: Hybrid

Attributes:

Agents constructed combining one or more of the agent types mentioned earlier.

Goals:

Maximize the strengths and minimize deficiencies of some techniques

Figure 7. The InteRRaP Hybrid Architecture [Nwana95]
1.5 Sociological View into Agents

- According to Leonard N. Foner an agent must have a "Social Contract"
- "Sociology of an Agent," must include: Discourse, Risk and Trust, Graceful Degradation, Anthropomorphism and Expectation
- An Agent needs to be under scrutiny as human interaction moves into cyberspace-like realms
- Agents and their applications “need to be subject to same behavioral analysis as human”
- An example: Julia TinyMUD developed at Carnegie Mellon University can start polemical discussions
Conclusions

- **Agent** is a software/hardware component that cooperate with other agents, interacts with its environment, learns, is autonomous and has a social contract with its user.

- Not all applications that claim to be agent based are...
References
