Intelligent Agents

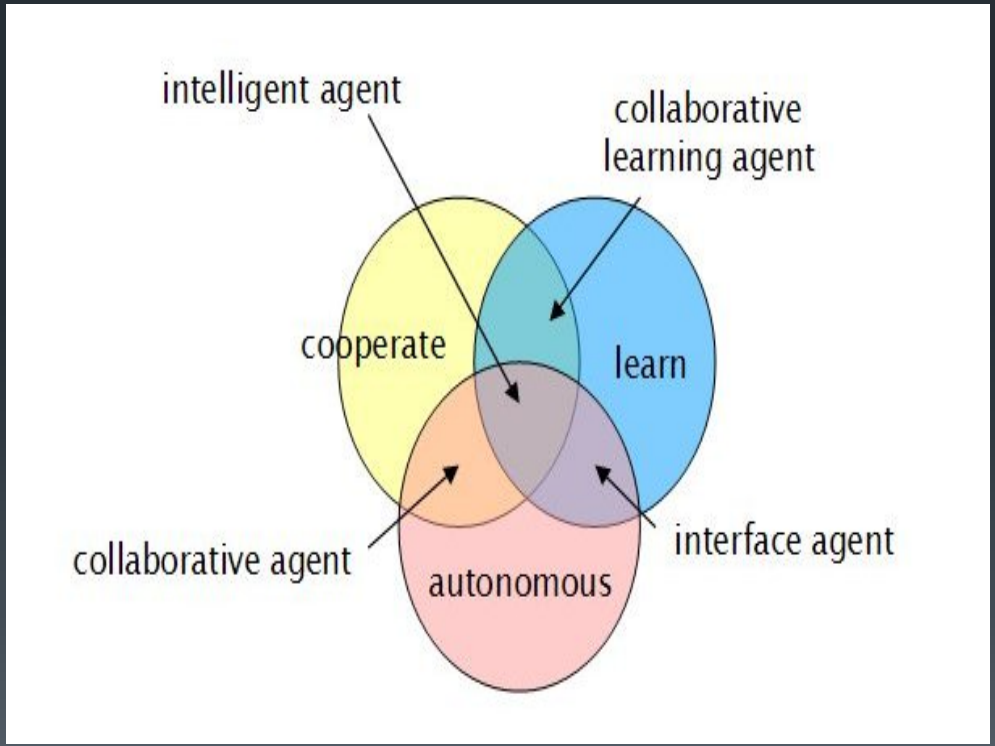
Adnan Shahzada

Intelligent Agents

- In AI, an **intelligent agent** (**IA**) is an autonomous entity which observes and acts upon an environment and directs its activity towards achieving goals.
- The agents can contain AI tools such as neural networks, expert systems, searching algorithms etc.
- The agents can also communicate and negotiate with each other, allowing solutions to emerge collectively

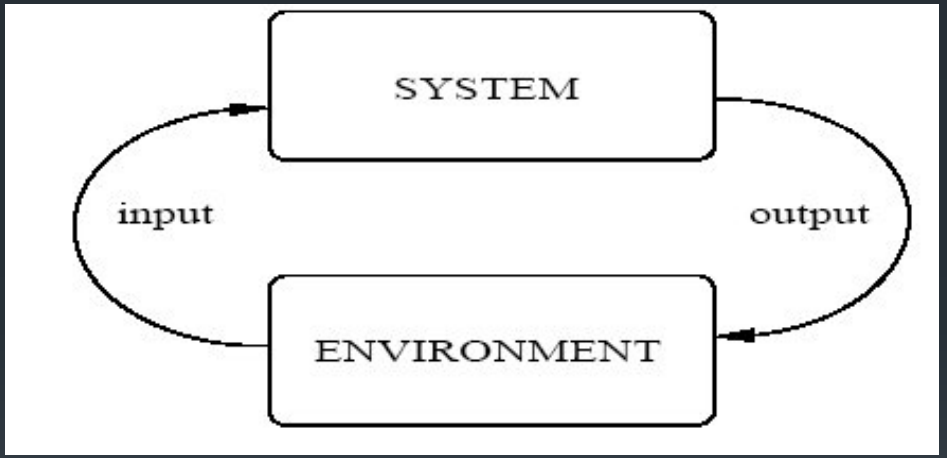
Agent

- Nwana defines agent in three behavioural attributes:
  - Autonomy
  - Co-operation
  - Learning



What is an Agent

- The main idea with Agents is autonomy
  - They have the capability to act independently and establish control over their internal state
- An agent has a list of actions available.
- This set of possible actions is representing the agents environments



Agent definition

- An intelligent agent is an entity that is capably of flexible autonomous action in some environment
- What does we mean being flexible?
- By flexible we mean:
  - Reactive
    - An intelligent agent are able to see their environment and take action in a timely fashion to changes that happen in it in order to satisfy their design objectivise
  - Proactive
    - Intelligent agent are able to show goal directed behaviour by taking the initiative in order to satisfy their design objectives
  - Social
    - Intelligent agents are capable of work together with other agents (and possible humans) in order to satisfy their design objectives

Reactive

- A program's environment can be guaranteed
  - It doesn’t have to be worried about its own success or failure
  - Example of a guaranteed environment is compilers
- Most environments are dynamic
  - things change and information is incomplete
- It is hard to build software for dynamic domains:
  - Programs must take account of possibility of failure
- A reactive system is one that maintains on ongoing interaction with its environment and responds to changes that occur in it (in time for the response to be useful)

Pro-activeness

- Reacting to an environment is easy
  - Using response rules
- But generally we wants the agents to do things for us
  - The goal is directed behaviour
- Proactiveness is to generate and attempting the goals
  - By taking the initiative

Social Ability

- “Man is a social animal”
- In real life we are living in a society (multi-agent environment in the case of agent)
  - We cannot go around attempting to achieve goals without taking others into account
- Some goals can only be achieved through cooperation
  - Be friends, play tennis, maintaining law
- An agent is said to possess social abilities if it is able to interact with other agents
  - Agent communication language

Other properties

- Mobility: Ability of an agent to move around a network
- Veracity: An agent will not communicate when it has false information
- Benevolence: Agents do not have conflicting goals and that every agent will therefore always try to do what is asked for
- Rationality: Agent will act in order to achieve its goals and will not act in a such a way as to prevent its goals
- Learning: An agent must be able to learn

Interaction among agents

- Organization
  - An arrangement of relationships between individuals or components, division of tasks, distribution of roles and contribution-award
- Cooperation
  - Sharing responsibilities is satisfying shared goals and generating manually depended on the roles in joint activities
- Coordination
  - Management of agents activities so that they coordinate their needs with each other in order to share resources, meet their own interests

Interaction among agents (contd.)

- Negotiation
  - Information exchange aimed at resolving conflict of access to resources, different solutions so the same problem or goal conflict
- Communication
  - Information, knowledge and request exchange
- Benevolence
  - Is when a assumption is generally acceptable if all the agents in a system are designed and owned by the same organization and individual

Agent

- There are many types of agents:
  - Collaborative Agent
  - Interface Agent
  - Mobile Agent
  - Information Agent
  - Reactive Agent
  - Hybrid Agent
  - Heterogeneous Agent

Questions

- Are agent just objects but with another name?
- Are agents just like expert system but with another name?

The differences between agents and objects

- Agents are autonomous
  - Agents embody a stronger notion of autonomy than objects.
  - They decide themselves whether or not to perform an action on request from another agent
  - You *order* objects to *do* things, but you *request* agents to *cooperate*
- Agents are smart
  - Capable of flexible (reactive, proactive, social) behaviour
  - The standard object has nothing to say about such behaviour
- Agents are active
  - A multi agent system is inherently multi-threaded and each agent is assumed to have at least one thread of active control

Are agents just like expert system but with another name?

- Expert system have the capable of solving problems or a giving advice in some knowledge-rich domain
  - MYCIN knows about the blood diseases in humans. The expert system have a knowledge about blood diseases by using form of rules

The differences between Agents and Expert systems

- Agents are situated in an environment
  - MYICIN is not aware of the world, the information obtained by asking the user questions
- Agents act
  - MYICIN does not operate on patients – all of it's output actions are directed through a human being

Intelligent Agents and AI

- When we building an agent, we want a system that can choose the right action to perform, typically in a limited domain
- We do not have to solve all the problems of AI to build useful agent
  - A little intelligence goes a long way
  - “We made our agents dumber and dumber and dumber until finally they made money”

Environments

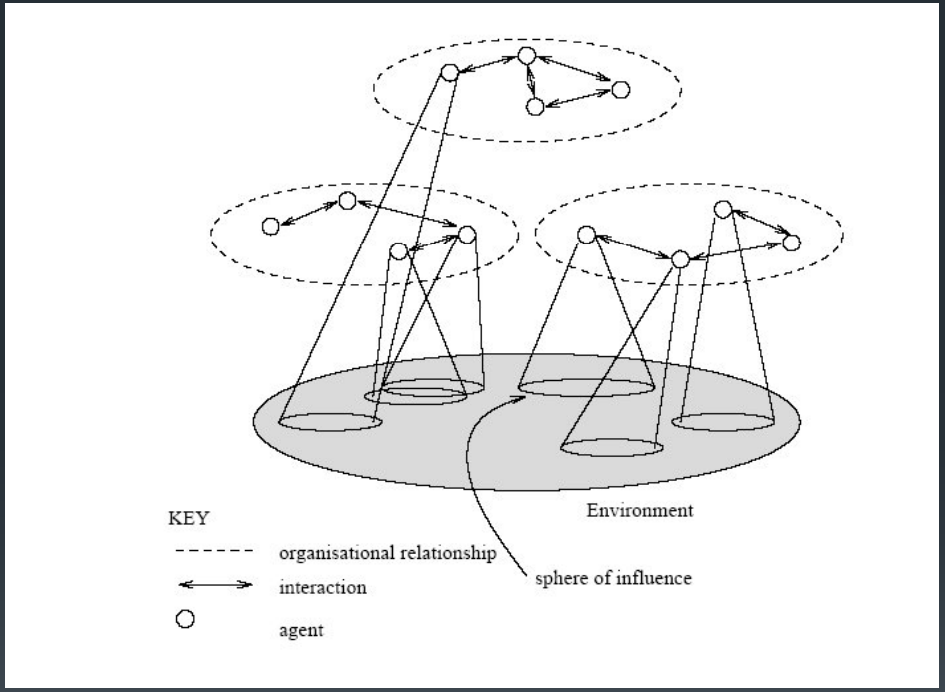
- Static
  - A static environment is one that can be assumed to remain unchanged expect by the performance of actions by the agent.
- Dynamic
  - A dynamic environment is one that has other processes operating on it and which hence changes in ways beyond the agent control
  - The physical world is a highly dynamic environment

Environments

- Discrete
  - A environment is discrete if there are a fixed, finite number of actions and precepts in it
- Continuous
  - Example of Continuous is Taxi driving

What are multiagents systems?

- A multi agent contains of numbers of agents
  - Which interact through communication
  - Are able to act in an environment
  - Have different “spheres of influence ”
  - Can be linked by other (organisational) relationship



Foundation for Intelligent Physical Agents (FIPA)

- FIPA is an international organization dedicated to promoting the industry of intelligent agents by developing specifications supporting interoperability among agents and agent-based applications

Java Agent Development Environment

- JADE (Java Agent Development Framework) is a software framework fully implemented in Java language.
  - It simplifies the implementation of multi-agent systems through a middle-ware that claims to comply with the FIPA specifications and through a set of tools that supports the debugging and deployment phase