Dcs

Year IV
Semester I
2016

SESSION 11

Knowledge based systems (KBS)

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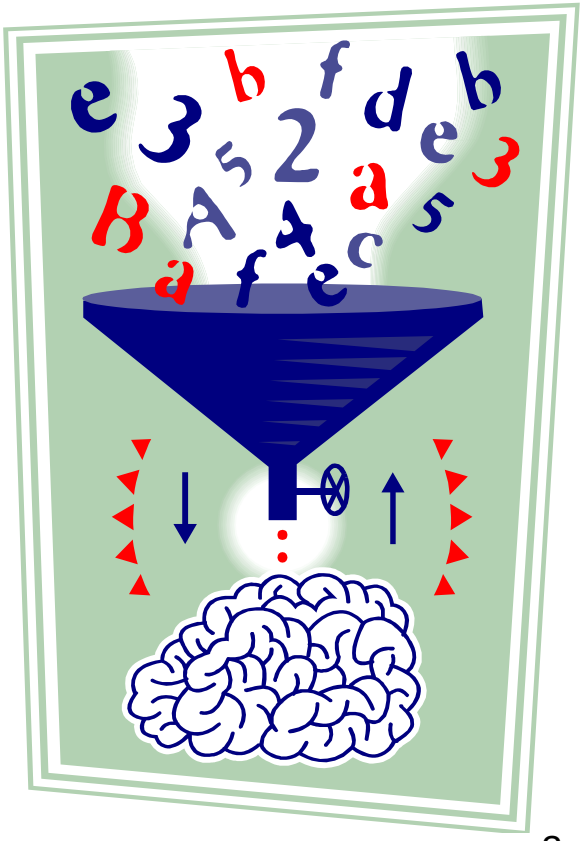
Contents will be covered

- Differentiate data, information and knowledge
- What is knowledge base?
- Define KBS
  - Architecture of KBS
- KBS in AI

Data, Information, and Knowledge

- What is Data and Information? Are they different from Knowledge?
  - ✓ data!=information!=knowledge
- D : Unorganized and unprocessed facts; static; a set of discrete facts about events
- i : Aggregation of data that makes decision making easier
- K : is derived from information in the same way information is derived from data; it is a person's range of information.



What is Knowledge

- **Knowledge** includes **facts, concepts, procedures, models**, **examples** ***about the real world entities*** and the relationship between them
  - It is an understanding gained through experience
  - It is **the sort of information** that people use to solve problems.
  - familiarity with the way to perform a task
  - an **accumulation of facts, procedural rules, or heuristics**

- **Characteristics of Knowledge:**
  - It ***is voluminous*** in nature and requires proper structuring.
  - It **may** be incomplete and imprecise.
  - It **may** keep on changing (dynamic).

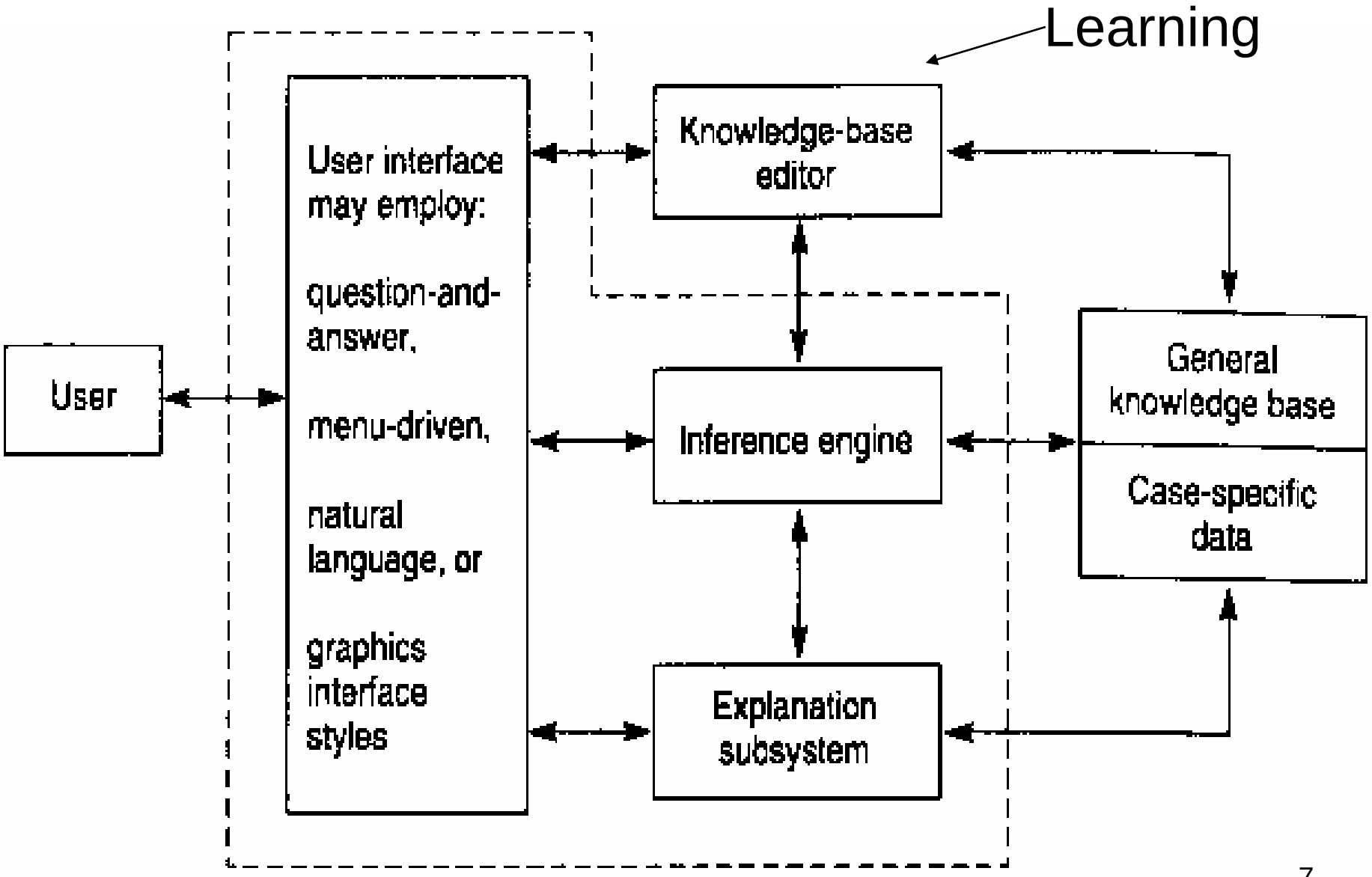
Knowledge base

- **Knowledge base** is used to store facts and rules.
- In order to solve problems, the computer needs an ***internal model*** of the world.
  - This model contains, for example, ***the description of relevant objects*** and ***the relations between these objects.***
  - All information must be stored in such a way that it is readily accessible.
- Various methods have been used for KR, such as
  - **logic,**
  - **semantic networks,**
  - **frames,**
  - **scripts**, etc...

Knowledge base systems (KBSs)

- Is a computer system *w/c generates and utilizes* **k/ge** *from d/t sources*, data and information. These systems aid to solving problems, especially complex ones, by utilizing AI concept.
- Deal with treating **knowledge** and ideas on a computer.
  - Emphases to the importance of knowledge.
- Use **inference** to solve problems on a computer.
  - Knowledge-based systems describes programs that reason over extensive knowledge bases.
- Have the ability to **learn** ideas so that they can obtain information from outside to use it appropriately.
  - The value of the system lies in its ability to make the workings of the human mind understandable and executable on a computer.

KBS Architecture



Artificial Intelligence and KBS

- Knowledge based system is ***part of Artificial Intelligence***
- AI also **requires extensive knowledge** of the subject at hand.
  - AI program should have **knowledge base**
  - Knowledge representation is one of the most important and most active areas in AI.
  - AI programs **should be learning in nature** and **update its knowledge** accordingly.

❖ ***Is AI equals human intelligence?***

Can we create a KB called mind?

Reading Assignment

- KNOWLEDGE ACUISTIONS
- KNWOLEDGE REPRSENATION(KR)
- KNOWLEDGE ORGANIZATION
- KNOWLEDGE MANIPULATION

Intelligence

Contents will be covered

- Describe the concept of intelligence
- What are the constitute of intelligence?
- Describe what an agent is?
- classify the inputs and the outputs of various agents

Intelligence

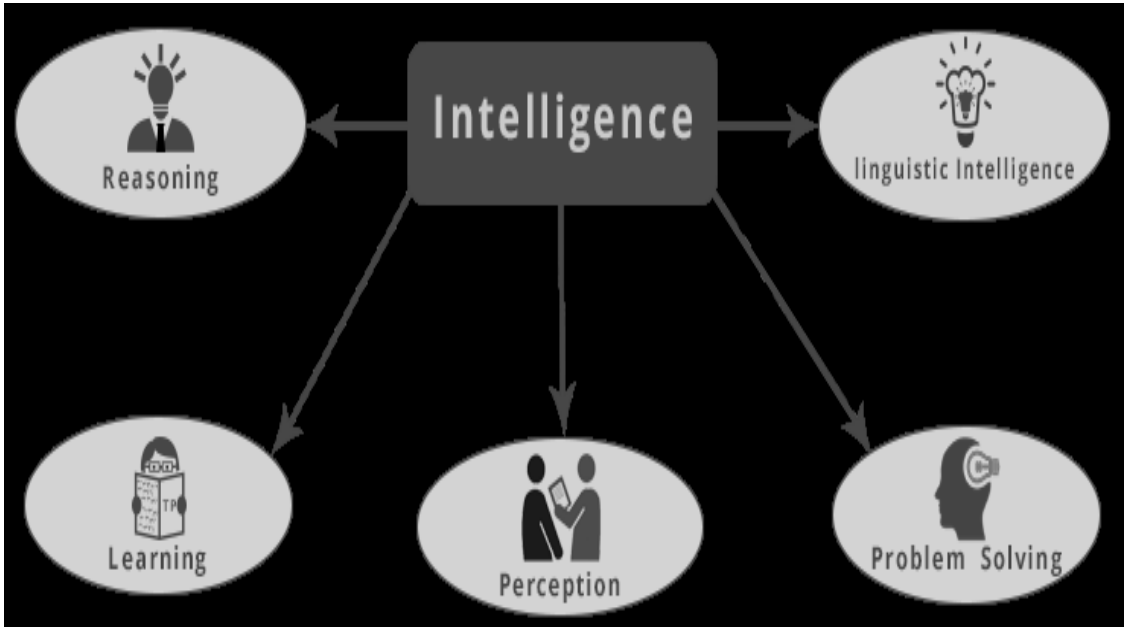
- The ability of a system to
  - **calculate,**
  - **reason,**
  - **perceive relationships and analogies,**
  - **learn from experience,**
  - **store and retrieve information from memory,**
  - **solve problems,**
  - **understand complex ideas,**
  - **use natural language fluently,**
  - **classify,**
  - **generalize, and**
  - **adapt new situations.**
- Intelligence is the capability of **observing, learning, remembering** and **reasoning.**
- AI attempts **to develop intelligent agents.**

Cont'd

Characteristics of Intelligent system

- Use vast amount of knowledge
- Learn from experience and adopt to changing environment
- Interact with human using natural language and speech
- Tolerate error and ambiguity in communication
- Respond in real time

What is Intelligence Composed of?



- **Reasoning:** is ***the set of processes*** that enables us to provide basis for **judgment, making decisions,** and **prediction.**
  - There are broadly two types:
    - ✓ Inductive Reasoning
    - ✓ Deductive Reasoning

Cont'd

- **Learning:** is the activity of **gaining knowledge** or **skill by studying**, **practicing, being taught**, or **experiencing something.**
    - Learning **enhances the awareness of the subjects of the study.**

- **Problem solving:** is the process in which one perceives and tries to arrive at a desired solution from a present situation by taking some path, which is blocked by known or unknown hurdles.
    - includes **decision making,** which is **the process of selecting the best suitable alternative out of multiple alternatives to reach the desired goal are available.**

Cont'd

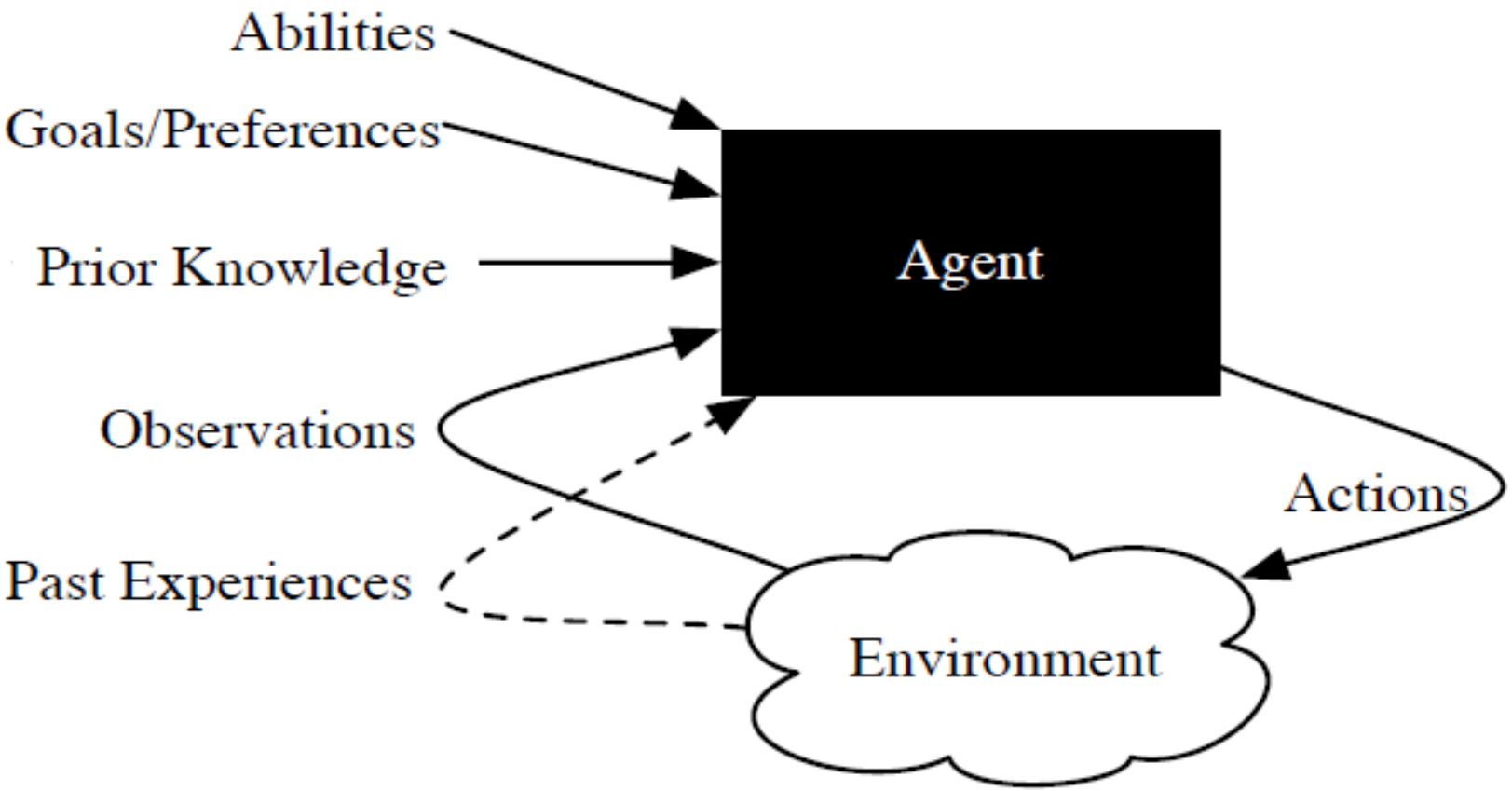
- **Perception**: is the process of **acquiring, interpreting, selecting**, and **organizing sensory information**.
  - presumes **sensing**. In humans, perception is aided **by sensory organs.**
  - In the domain of AI, perception mechanism puts the data acquired by the sensors together in a meaningful manner.

- **Linguistic Intelligence:** is one's ***ability to use***, ***comprehend***, ***speak***, and ***write*** the **verbal** and **written language.**
  - ***is important in*** **interpersonal communication.**

Agent

- An agent is something that acts in an environment.
- **An agent acts intelligently** if:
  - its ***actions are appropriate*** for its goals and circumstances
  - **it is flexible** to changing environments and goals
  - ***it learns from experience***
  - ***it makes appropriate choices*** given perceptual and computational limitations

Agents acting in an environment



Examples of Agent

- **Organisations :** Microsoft, Al Qaeda, Government of Canada, UBC, CS Dept,...
- **People:** teachers, physicians, engineers, researchers, travel agents, farmers, waiters, stock traders...
- **Computers/devices:** thermostats, user interfaces, airplane controllers, network controllers, games, advising systems, tutoring systems, diagnostic assistants, robots, Google
- car, Mars rover...
- **Animals:** dogs, mice, birds, insects, worms, bacteria...

Inputs of an agent

- **Abilities:** ***the set of things it can do.***
- **Goals/Preferences:** ***what it wants***, ***its desires, its values,...***
- **Prior Knowledge :** what it comes into being knowing, what it doesn't get from experience,...
- **History of observations** (precepts, stimuli) of the environment
    - **(current) observations** : what it observes ***now***
    - **past experiences** : what it has observed in the past

Examples of agent: robot

- **Abilities:** movement, grippers, speech, facial expressions,. .
- **Goals:** deliver food, rescue people, score goals, explore,. . .
- **Prior knowledge:** what is important feature, categories of objects, what a sensor tell us,. . .
- **Observations:** vision, sonar, sound, speech recognition, gesture recognition,. . .
- **Past experiences:** effect of steering, slipperiness, how people move,. . .

Class work

- Agent
  - Teacher
  - Student
  - Researcher
  - Medical Doctor

Assignment II (due: 5 days)

- Discuss one of the following concepts. Refer **at least five sources (books, articles**). present in class and send via email.
- **Knowledge based system:[1,3]**
  - What is KBS? KBS vs. ES vs. AI; Knowledge acquisition, knowledge modeling and knowledge representation .
- **Reasoning: [2,4,6]**
  - What is reasoning, Case based reasoning; probabilistic reasoning; fuzzy reasoning; rule-based reasoning
- **Learning: [5,8]**
  - What is Machine learning? Support Vector Machine(SVM), Hidden Markov Model(HMM), Bayesian Belief Network

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