Artificial Intelligence

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Artificial Intelligence and KBS

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Artificial Intelligence and KBS

MSC IT II Semester

COURSE Code: PS02CINT33

Course Title: Artificial Intelligence

Unit 1: Artificial Intelligence (AI) and Knowledge Based Systems (KBS)

- Natural and Artificial Intelligence
- Testing Intelligence with Turing Test, and Chinese Room Experiment, Application Areas of Artificial Intelligence, Data pyramid
- Production systems and AI Based Searches like Hill Climbing and Heuristic Search
- KBS Structure, Components of KBS, Categories of KBS, Knowledge-Based Shell, Advantages, Limitations and Applications of KBS
- Knowledge Acquisition, Knowledge Update
- Factual and Procedural Knowledge Representations
- Knowledge Based Systems Development Model

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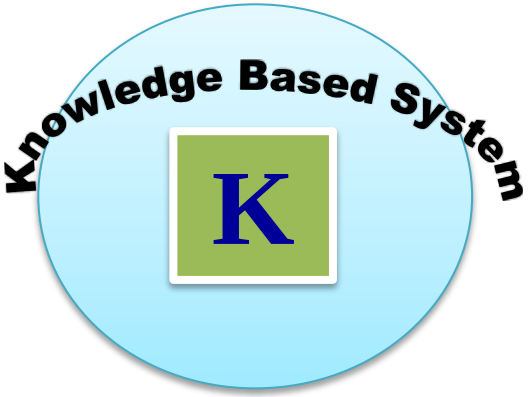
Knowledge-Based Systems



Knowledge-Based Systems (KBS) are Productive Artificial Intelligence Tools **working in a narrow domain.**

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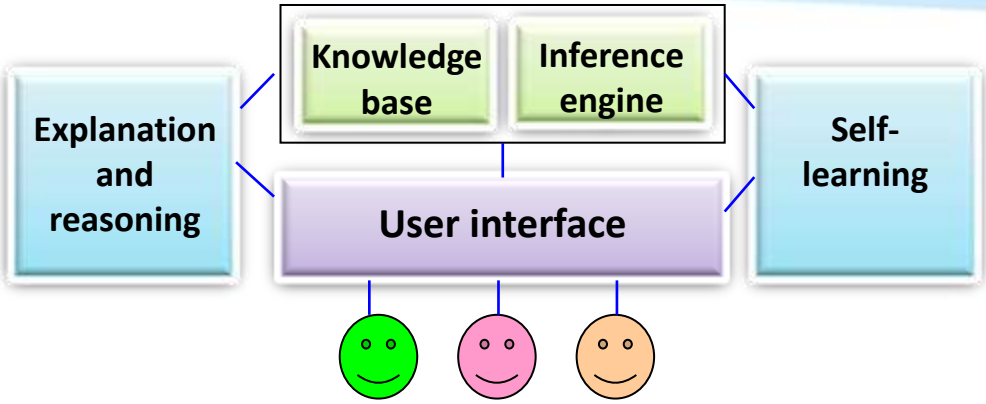

General structure of KBS

Knowledge-Based Systems (KBS) are **Productive Artificial Intelligence Tools** working in a narrow domain.

According to the classifications by *Tuthhill & Levy (1991)*, five main types of KBS exists:

- Expert systems
- Linked Systems
- CASE based Systems
- Intelligent Tutoring Systems
- Intelligent User Interface for Database

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Experts

Experience

Satellite Broadcasting (Internet, TV, and Radio)

Printed Media

Sources of knowledge

Types of Knowledge

- Tacit knowledge
- Explicit knowledge
- Commonsense knowledge
- Informed commonsense knowledge
- Heuristic knowledge
- Domain knowledge
- Meta knowledge

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Knowledge Components

- Facts
  - Facts represent sets of raw observation, alphabets, symbols, or statements.
    - *The earth moves around the sun.*
    - *Every car has a battery.*
- Rules
  - Rules encompass conditions and actions, which are also known as antecedents and consequences.
    - If there is daylight, then the Sun is in the sky.
    - If the car does not start, then check the battery and fuel.
- Heuristics
  - It is a rule of thumb, which is practically applicable however, does not offer guarantee of solution.
    - If there is total eclipse of the sun, there is no daylight, even though the sun is in the sky.
    - If it is a rainy season and a car was driven through water, silencer would have water in it, so it may not start.

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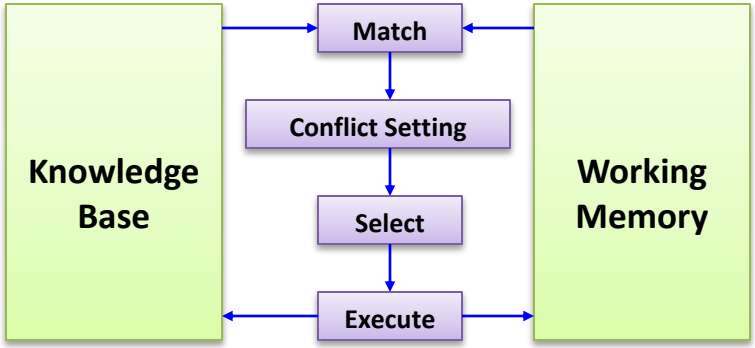
Inference Engine

An inference engine is a software program that refers the existing knowledge, manipulates the knowledge according to need, and makes decisions about actions to be taken.



Typical Inference Cycle

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Forward Chaining

1. Consider initial facts and store them into working memory of the knowledge base.
2. Check the antecedent part (left hand side) of the production rules.
3. If all the conditions are matched, fire the rule (execute the right hand side).
4. If there is only one rule do the following:
   - 4.1 Perform necessary actions.
   - 4.2 Modify working memory and update facts.
   - 4.3 Check for new conditions.
5. If more than one rule is selected use the conflict resolution strategy to select the most appropriate rules and go to step 4.
6. Continue until appropriate rule is found and executed.

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Backward Chaining

1. Start with possible hypothesis, say H.
2. Store the hypothesis H in working memory along with the available facts. Also consider a rule indicator R, and set it to Null.
3. If H is in the initial facts, the hypothesis it is proven. Go to step 7.
4. If H is not in the initial facts, find a rule, say R, that has a descendent (action) part mentioning the hypothesis.
5. Store R in working memory.
6. Check conditions of the R and match with the existing facts.
7. If matched, then fire the rule R and stop. Otherwise, continue to step 4.

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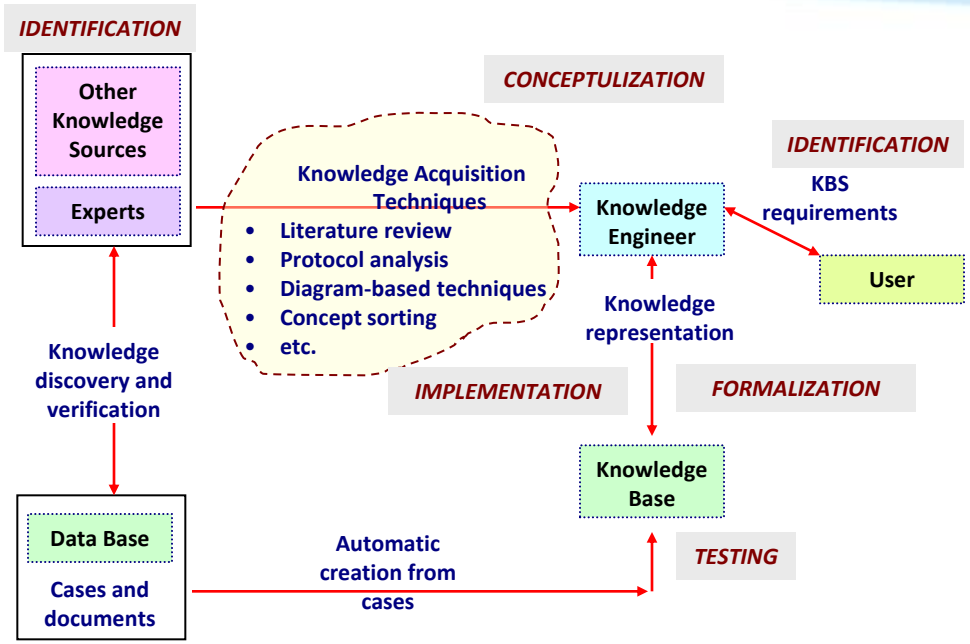

Activities in the knowledge acquisition process

- Find suitable experts and a knowledge engineer
- Proper homework and planning
- Interpreting and understanding the knowledge provided by the experts
- Representing the knowledge provided by the experts

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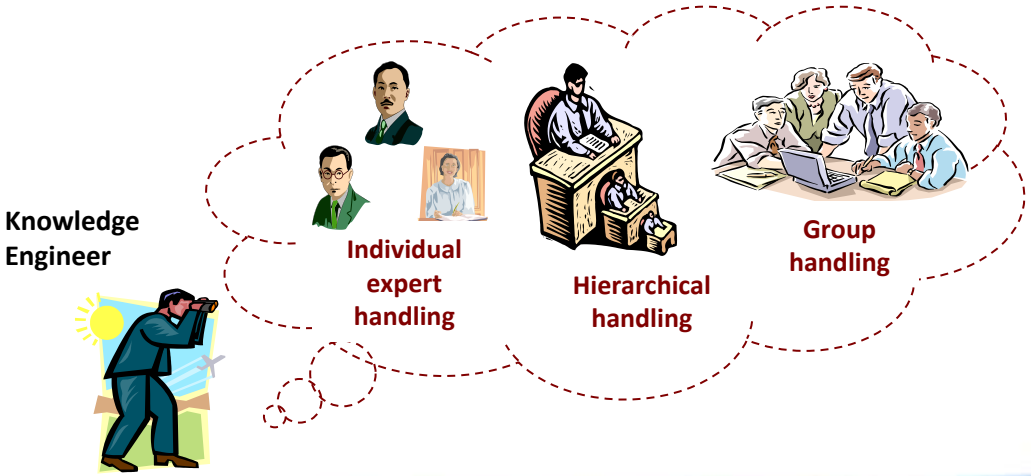
Knowledge Acquisition

- Problem Solving

- Talking and Story Telling

- Supervisory Style

- Dealing with multiple experts



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Knowledge Representation

Constant: RAM, LAXMAN

Variable: Man

Function: Elder (RAM, LAXMAN) returns any value, here, RAM

Predicate: Mortal (RAM) returns a Boolean value, here, True

WFF: 'If you do not exercise, you will gain weight is represented as:
$\forall x[\{Human(x) \wedge \sim Exercise(x)\} \Rightarrow Gain\ weight(x)]$

Factual Knowledge Representation

Semantic Network

Name:	Power Bike
Broad Category:	Land Vehicle
Sub Category:	Gearless
Fuel Type:	Gas
Cost:	$ 350
Capacity:	Two persons
Speed:	160 Km/Hour

Frame

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Knowledge Representation

Name: Visit to Pharmacy

Props: Money, Symptoms, Treatment, Medicine

Roles: Dentist - D, Receptionist - R, Patient - P

Entry Conditions:
Patient P has toothache.
Patient P has money.

Exit Conditions
Patient P has less money.
Patient P returns with treatment.
Patient P has appointment.
Patient P has prescription.

Scene 1: Entry
P enters to the pharmacy.
P goes to reception. P meets R.
P pays registration and/or fees and gets appointment.
Go to Scene 2.

Scene 2: Consulting Doctor
P meets D.
P conveys symptoms.
P gets treatment.
P gets appointment.
Go to Scene 3.

Scene 3: Exiting
P pays money to R.
P exits the pharmacy.

Script

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Knowledge Update

Self-update by system

Update by knowledge engineer

Update by expert through interface

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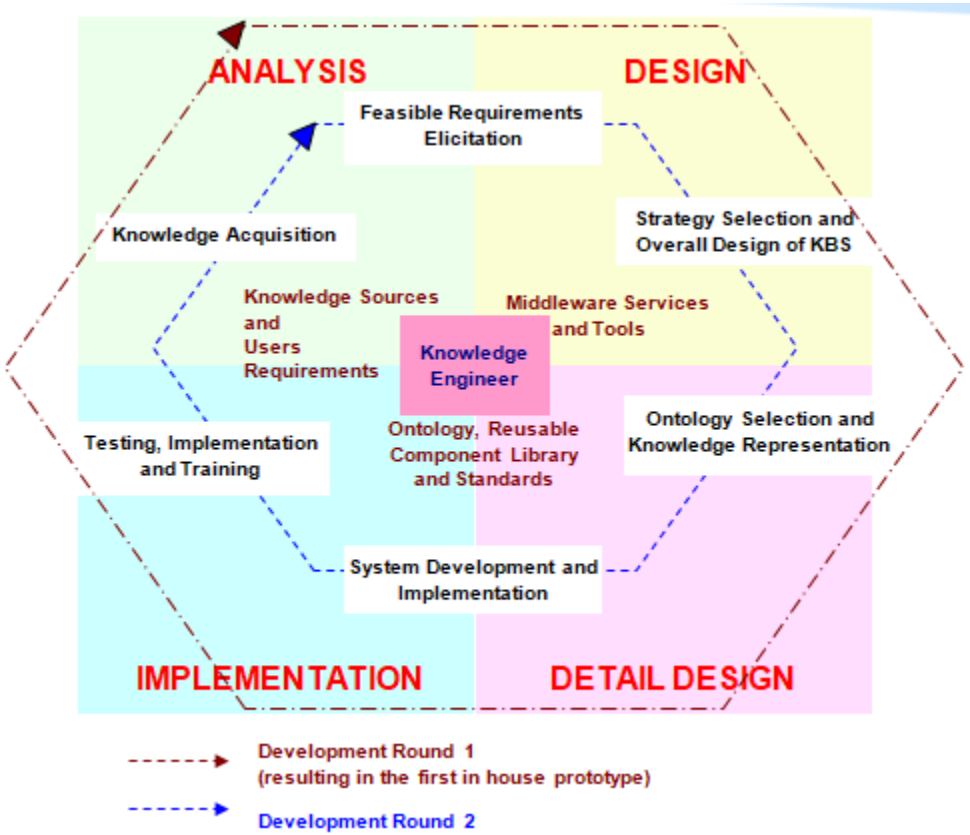

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Limitations of Symbolic representations

- **Nature of knowledge**
  - Hard to characterize
  - Voluminous
  - Dynamic
- **Knowledge acquisition**
  - Fact finding methods support only
  - Tacit and higher level knowledge
  - Multiple experts
- **Knowledge representation**
  - Limited knowledge structures support
- **KBS development models**
  - Only SAD/SE guidelines and a few quality metrics
- **Large size of knowledge base**

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