AI U-1 : Artificial Intelligence (AI) & Knowledg Based System (KBS)

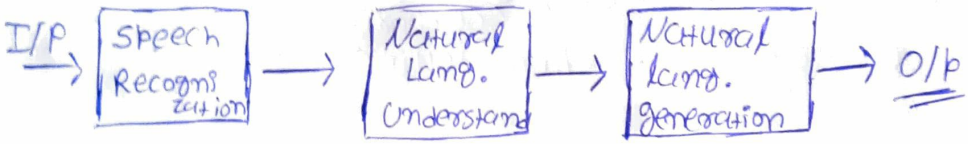
Points

- Natural and Artificial Intelligence
- Testing Intelligence with Turing test, and Chinese room experiment, Application area of Artificial Intelligence, Data pyramid.
- Production systems and AI based searches like Hill climbing and Heuristic Search.
- KBS structure, Components of KBS, ~~Components~~ Categories of KBS, Knowledge-based shell, Advantages, Limitations and applications of KBS.
- Knowledge acquisition, Knowledge update
- Factual and Procedural Knowledge representations
- Knowledge management cycle.

→ Natural and Artificial Intelligence

> Natural language Processing (NLP):

- How human communicate with each other
- Computer should replicate the same thing
- Applications of NLP
  - Speech recognization (Assistant, siri)
  - Sentimental Analysis
  - Machine Translation (Google translate)
  - Chat box, etc.



> Natural Intelligence:

- Responds to situations Flexibly.
- Makes sense of ambiguous / erroneous msg.
- Assigns relative importance to elements of a situation.
- Finds similarities even through the situation might be different.
- Draws distinctions between situations even though there may be many similarities between them.

> Artificial Intelligence:

AI is the study of how to make computers do things at which, at the moment, people are better.

- AI is science and engineering of making intelligent machines.
- AI is a technique of getting machines to work & behave like humans.

> Turing Testing:

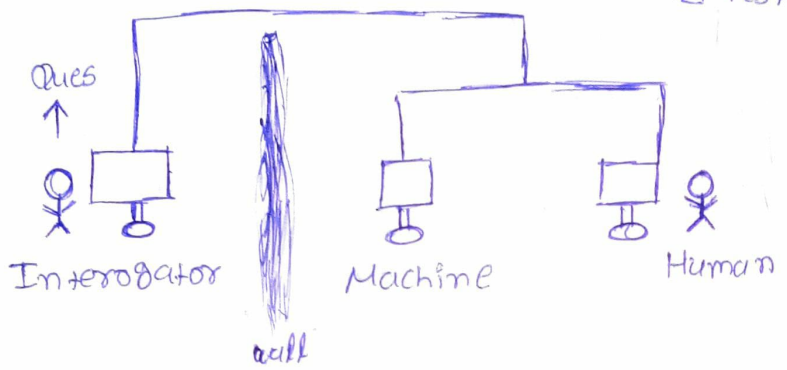
Turing test is used to determine "whether or not machines can think Intelligently like humans."

→ Basic Configuration:-

↳ There will be a human Interagator on one side of wall and other side a machine and human.

↳ Machine Intelligent ⇒
when human interrogator can't distingish response given by machine & human.

] Machine has passed the test & it is intelligent.



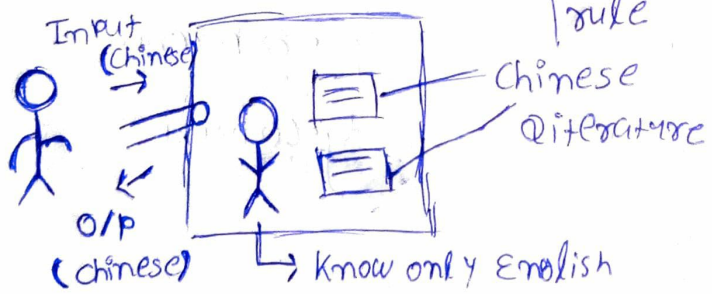
> Chinese room experiment:

- Also Known as Chinese room argument.
- Against Turing Test
- Argued that Turing Test could be used to determine, "whether or not machine is considered as intelligent."
- According to John searle a machine could pass Turing Test simply by manipulating symbols, without any understanding of those symbol.
- A person / machine can be considered as Intelligent, if and only if they have the understanding what they are doing.
- Basic Configuration

↳ A person Knowing English not chinese sits in room with huge volume of Chinese literature.

↳ Chinese symbol Φ, return Y.
↳ " " " " BΦ, return Ж.

↑ rule



⇒ But here that person don't Know in room person doesn't Know Chinese.

Applications of AI

Mundane Tasks
- Perception - Vision & speech
- Natural lang. understand, generation, and translation.
- Commonsense reasoning
- Robot control

Expert Tasks
- Engineering - design, Fault finding, manufacturing planning, etc.
- Scientific Analysis
- Medical diagnosis
- Financial Analysis.

Formal Tasks
- Games - Chess, backgammon, Checkers, etc.
- Mathematics, geometry, logic, integral calculus, theorem proving, etc.

> Data Pyramid:

This Framework describes a hirarchical relationship between data, information, knowledge and wisdom.

→ Data:

data comes in the form of signs and signals, such as nos, words or other signs that represent discrete facts about an objective reality.

→ Information:

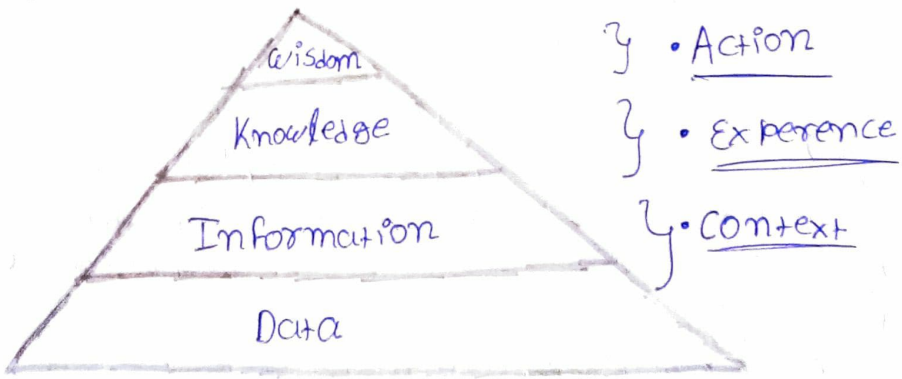
Info. comes from providing context to data, it is data that has been endowed with meaning and purpose.

→ Knowledge:

Knowledge is the synthesis of multiple sources of info over time to create conceptual frameworks, theories and axioms

→ Wisdom:

Wisdom is a state of awareness, a paradigm or set of principles, it is the ultimate context and frame of reference



> Production System:

↳ Helps in structuring All programs in a way that facilitates describing and performs the search process.

Production System consists of :-
- (i) Set of Rules
- (ii) Knowledge Base
- (iii) Control Strategy
- (iv) Rule Applier

→ Step to slove the problem:-

i) First reduce problem so that it can be shown in a precise statement.

ii) Problem can be slove by searching a path through space. [Start → Goal]

iii) Solving process can be modelled.

→ Advantages:-

i) Structuring AI problems.] Excellent tool.

ii) Highly modular.] rules - add, remove, changes

iii) Rules are expressed in natural form] Easy to understand.

→ Characteristics:-

i) Monotonic PS: App. of a rule never prevents later applin of another rule.] rules are Independent.

ii) Non-monotonic PS: which this is not true

iii) partially commutative PS:

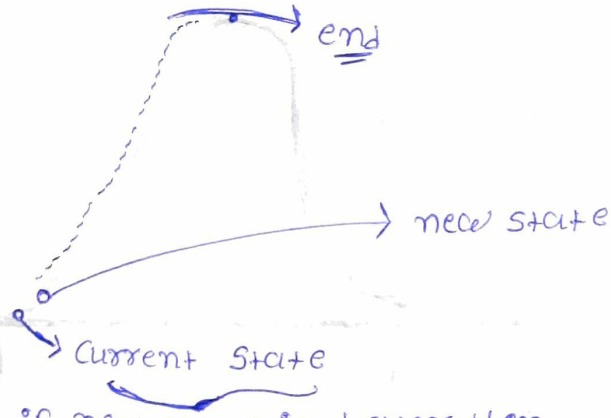
iv) commutative PS: Both monotonic and partially commutative.

In Short,

Production is a process of combining various material inputs and immaterial inputs (plans, know-how) in order to make something for output.

Hill Climbing Search: → Local search algo & No Backtracking → Greedy Approch

- Hill climbing is an AI based local search algorithm Also known as weak search, instead of blind search.
- Variant of generate and test method in which feedback from test procedure is used to help generator decide which dir^n to move in search space.
- It is like DFD.
- Always moves in a "Single direction".



if new state is better then current state.

⇓

new state = current state

- **Algorithm for simple Hill Climbing :-**

Step 1: Evaluate the initial state, if it is goal state then return success & stop.

Step 2: Loop until a solution is found or there is no new operator left to apply.

Step 3: Select and apply an operator to the current state.

Step 4: Check new state:
If it is goal state, then return success & quit.
Else if it is better than the current state then assign new state as a current state.
Else if not better than the current state, then return to step 2.

Step 5: Exit.

> Heuristic Search:

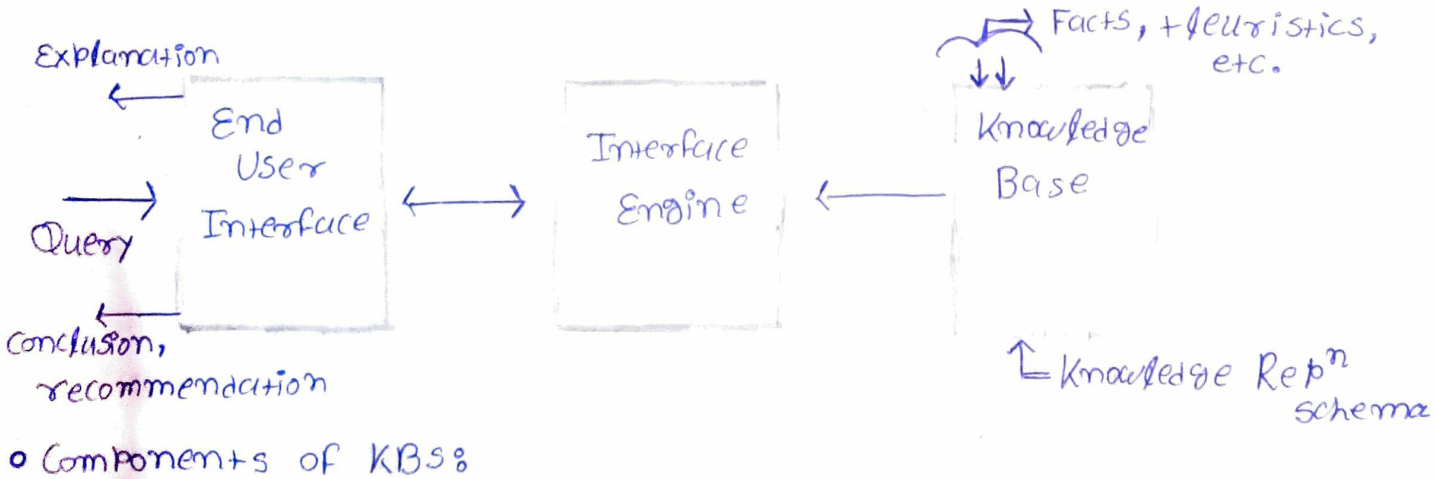
Tries to optimize a problem using heuristic Function [Informed Search].

- Tries to slove problem in minimum steps/cost.
- It is a function f(n) that gives an estimation on the cost of getting from node 'n' to the GOAL State. } Estimate value
  [Helps inselecting optimal node for expansion]
- The purpose of heuristic Function is to guide the search process in the most profitable path among all that are available.

⇒ Knowledge Based System (KBS)

A Knowledge based system (KBS) is a form of artificial intelligence (AI) that aims to capture the knowledge of human experts to support decision-making.

- KBS also include an interface through which users query the system & interact with it.
- 'KBS' is a system that draws upon knowledge of Human Experts captured in Knowledge Base to slove problems that normally require human expertise.
- KBS is more general than Expert-System.
  ↳ Knowledge Base + Interface Engine.



o Components of KBS:

Knowledge-based systems usually contain three components: 1. human-computer interface, 2. Knowledge base and 3. Interface engine program.

1. Knowledge base: Contains system organized collection of facts about system domain.
2. Interface Engine: Tries to derives answers from Knowledge base. [Brain]
3. User Interface: Enables the User to communicate with KBS.

Categories of KBS:

Knowledge-based systems are categorized as expert systems, intelligent tutoring systems, hypertext manipulations systems, CASE-based systems, and databases having an intelligent user interface.

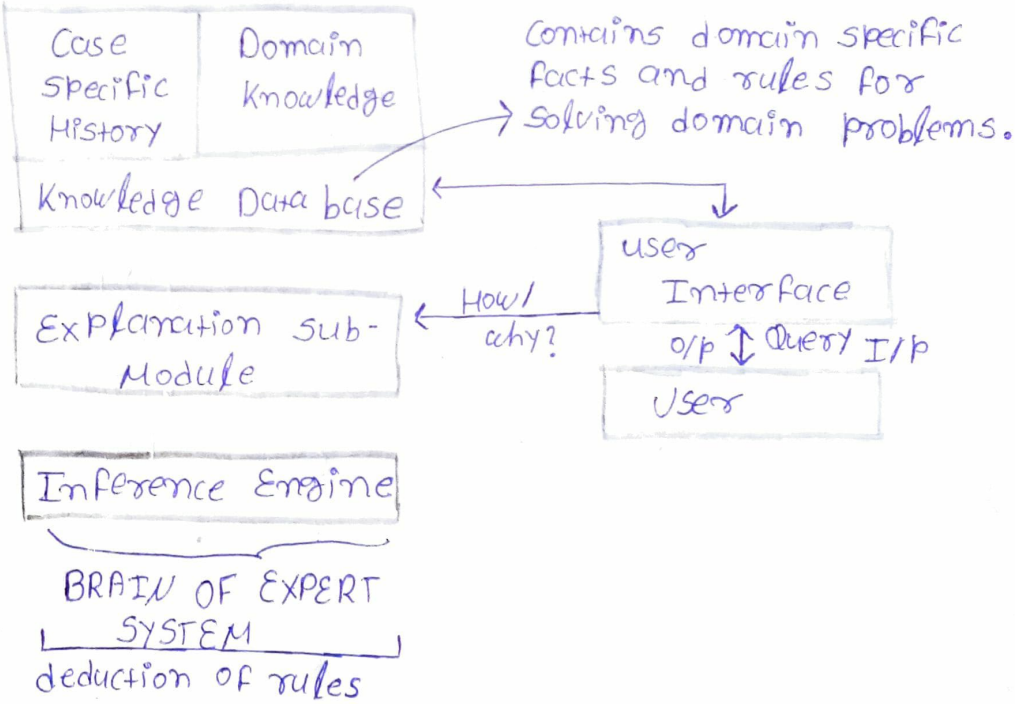
Knowledge-based shell (Expert System Shell):

- Expert system in AI are computer application with the level of human intelligence & expertise.
- draws upon knowledge of human experts captured in a knowledge base to slove problems that require human expertise.

→ Characteristics:-

- i) High Performance
- ii) Reliable
- iii) Highly Responsive
- iv) Understandable

→ Architecture:-



- **Advantages:**

1. Allow distribution of 'expertise'.
2. Easy to update
3. Consistent answers
4. Availability
5. Preservation of expertise
6. Capable of 'working' with incomplete information
7. capable of explaining their solution
8. Encourages organizations to clarify the logic of their decision making.
9. Never "forgets" to ask a question - as a human might.

- **Limitations:**

1. High-tech image of the AI field.
2. Abstract nature of the knowledge.
3. Knowledge is not always readily available.
4. It can be difficult to extract expertise from human.
5. The approach of each expert to a situation assessment may be different.
6. It is hard, even for a highly skilled expert, to abstract good situational assessments when under time pressure.
7. ES work well only within a narrow domain of knowledge.
8. Most experts have no independent means of checking whether their conclusions are reasonable.
9. Help is often required from knowledge engineers who are rare and expensive, a fact that could make ES construction costly.

- **Application:**

A KBS assists with solving problems, particularly complex issue, by ai. These systems are primarily used to support human decision making, learning, and other activities.

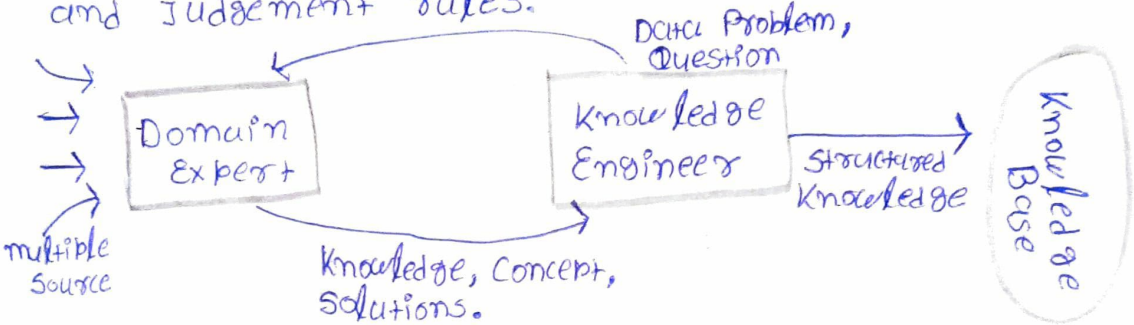
These systems can make decisions based on the data and information that resides in their data base.

1. Forecasting system
2. Medical records analysis
3. Expert systems, etc.

> Knowledge Acquisition:

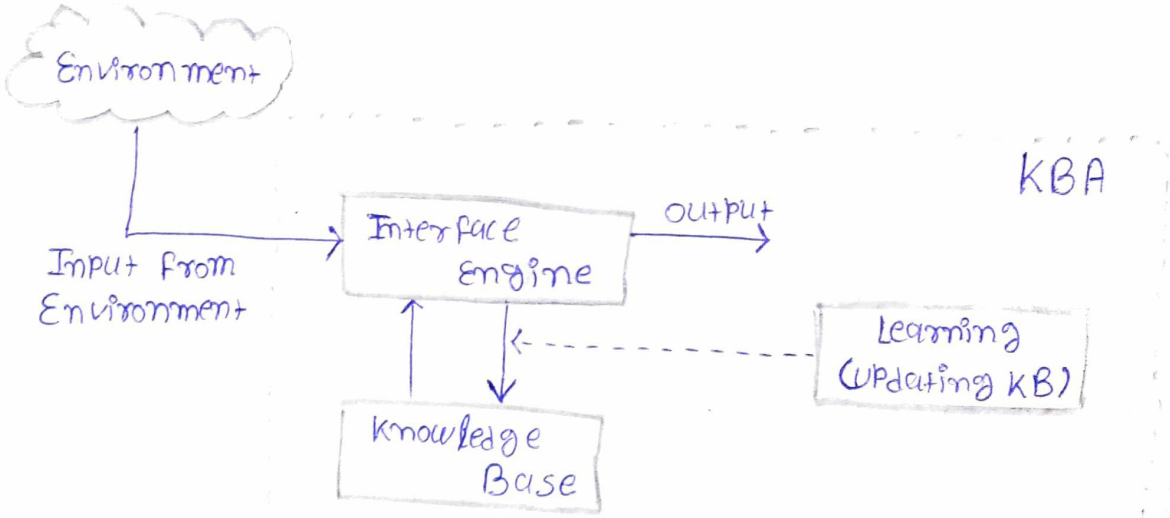
'KA' is the process of extracting, structuring and organizing knowledge from one or more sources.

- Knowledge is a collection of specialized facts, procedures and judgement rules.



- Tasks in KA: (CIAD)
  - ↳ i) Collect:- Acquiring knowledge from expert.
  - ii) Interpret:- Review & identifying key parts.
  - iii) Analysis:- Forming theories, strategies
  - iv) Design:- Forming better understanding of problem.

> Knowledge Update:



1. Updating knowledge automatically as part self-learning based on cases.
2. Providing knowledge base editor to experts.

> Knowledge Engineer:

- Works with experts to capture the knowledge they process.
- Builds the knowledge base, and if necessary, the rest of the expert system.
- Performs a role similar to that of systems analysts in conventional information systems development.

> Knowledge Representation:

1. Functional Knowledge Representation
2. Procedural " "

1. Functional Knowledge Representation:

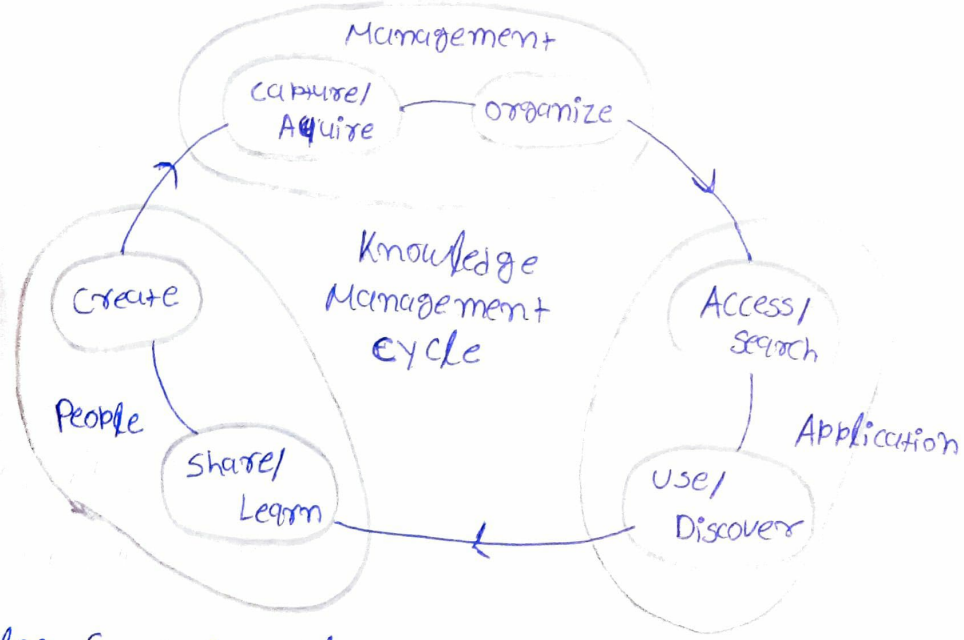
- this mean basic knowledge about something.
- Process oriented (Procedural knowledge)
- data oriented in nature (declarative/functional knowledge)
- Ex, Facts, world history, rules for mathematic equation.

2. Procedural Knowledge Representation:

- this is one type of knowledge that can be possessed by an intelligent agent.
- this knowledge represented as a partial or complete finite-state machine or computer program.
- Procedural knowledge is knowing how to do something.
- Ex., how to drive a car, how to throw boomerang correctly.
- The key feature of procedural knowledge is that it is hard to explain verbally.

> Knowledge Management Cycle:

- A Knowledge Management process is the way in which a business manages knowledge, including its capture, storage, organization, verification, security, distribution and use.



- Example:, Customer relationship systems, learning management systems and knowledge bases.

- This is IMP for any organization to maintain a competitive advantage over others for growth and progress.
- This is obtaining, creating, gathering and sharing knowledge in an organization.
- It has been observed that these processes very in different references. This because knowledge management processes are covered from a different perspective in some sources than others. This is the reason why they come up with different name.
- It focus on saving the knowledge.