ARTIFICIAL INTELLIGENCE

MODEL QUESTION PAPER-1

As per the new NEP syllabus for 5th semester course of

Bengaluru City University & Bangalore University

| Answer any four questions. Each questions carries two marks (4*2=8)

1.What is intelligence composed of?

The intelligence is intangible. It is composed of:

1. Reasoning
2. Learning
3. Problem Solving
4. Perception
5. Linguistic Intelligence

2.Define A*Search

Informed Search: A* Search Algorithm

A * search is the most commonly known form of best-first search. It uses heuristic function h(n) and cost to reach the node n from the start state g(n) It has combined features of UCS and greedy best first search, by which it solve the problem efficiently. A search algorithm finds the shortest path through the search space using the heuristic function.

3.Define Rote learning?

The meaning of rote in 'rote learning' itself means learning by repetition. It differs from other forms of learning in that it doesn't require the learner to carefully think about something, and rather dependent on the act of repetition itself.

4.List the stages of Planning in AI.

1. Initial State
2. Goal
3. Actions
4. Transition Model
5. Search Algorithm
6. Plan Representation
7. Plan Execution and Monitoring

5.What is Image classification?

Image classification is the simplest technique of Computer Vision. The main aim of image classification is to classify the image into one or more different categories. Image classifier basically takes an image as input and tells about different objects present in that image, such as a person, dog, tree, etc.

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6.List any two characteristics of Expert system

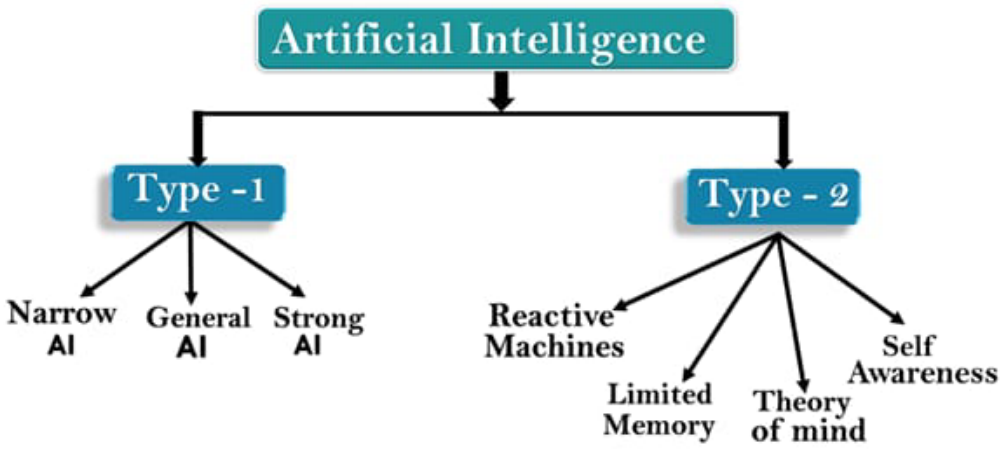
1. No memory Limitations
2. High Efficiency
3. High security
4. Expertise in a domain.

|| Answer any four questions. Each questions carries five marks (4*5=20)

7.Define AI. Explain the four categories of AI

Artificial intelligence is, in sometimes called machine intelligence, is intelligence demonstrated by machines, in contrast to the natural intelligence displayed by human sense other animals, such as "learning" and "problem solving".

CATEGORIES:



1. Weak Al or Narrow Al:

• Narrow Al is a type of Al which is able to perform a dedicated task with intelligence. The most common and currently available Al is Narrow Al in the world of Artificial Intelligence. Narrow Al cannot perform beyond its field or limitations, as it is only trained for one specific task. Hence it is also termed as weak Al. Narrow Al can fail in unpredictable ways if it goes beyond its limits.

• Apple Siri is a good example of Narrow Al, but it operates with a limited pre-defined range of functions.

• IBM's Watson supercomputer also comes under Narrow Al, as it uses an Expert system approach combined with Machine learning and natural language processing.

• Some Examples of Narrow Al are playing chess, purchasing suggestions on e-commerce site, self-driving cars, speech recognition, and image recognition.

2. General Al:

• General Al is a type of intelligence which could perform any intellectual task with efficiency like a human.

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The idea behind the general Al to make such a system which could be smarter and think like a human by its own. Currently there is no such system exist which could come under general Al and can perform any task as perfect as a human.

The worldwide researchers are now focused on developing machines with General AI.

• As systems with general Al are still under research, and it will take lots of efforts and time to develop such systems.

3. Super Al/Strong Al:

Super Al is a level of Intelligence of Systems at which machines could surpass human intelligence, and can perform any task better than human with cognitive properties. It is an outcome of general AL.

• Some key characteristics of strong Al include capability include the ability to think, to reason, solve the puzzle, make judgments, plan, learn, and communicate by its own.

• Super Al is still a hypothetical concept of Artificial Intelligence. Development of such systems in real is still world changing task.

TYPE -2

1. Reactive Machines:

• Purely reactive machines are the most basic types of Artificial Intelligence.

• Such Al systems do not store memories or past experiences for future actions.

• These machines only focus on current scenarios and react on it as per possible best action.

• IBM's Deep Blue system is an example of reactive machines.

• Google's AlphaGo is also an example of reactive machines.

2. Limited Memory:

• Limited memory machines can store past experiences or some data for a short period time.

• These machines can use stored data for a limited time period only.

• Self-driving cars are one of the best examples of Limited Memory systems. These cars can store recent speed of nearby cars, the distance of other cars, speed limit, and other information to navigate the road.

3. Theory of Mind:

Theory of Mind Al should understand the human emotions, people, beliefs, and be able t interact socially like humans.

This type of Al machines are still not developed, but researchers are making lots of efforts and improvement for developing such Al machines.

4. Self-Awareness:

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Self-awareness Al is the future of Artificial Intelligence. These machines will be supe intelligent, and will have their own consciousness, sentiments, and self-awareness.

These machines will be smarter than human mind.

Self-Awareness Al does not exist in reality still and it is a hypothetical concept.

8.With an example, Explain BFS

Greedy best-first search algorithm always selects the path which appears best at that moment. It is the combination of depth-first search and breadth-first search algorithms. It uses the heuristic function and search. Best-first search allows us to take the advantages of both algorithms.

ALGORITHM:

Step 1: Place the starting node into the OPEN list.

Step 2: If the OPEN list is empty, Stop and return failure.

Step 3: Remove the node n, from the OPEN list which has the lowest value of h(n) and places it in the CLOSED list.

Step 4: Expand the node n, and generate the successors of node n.

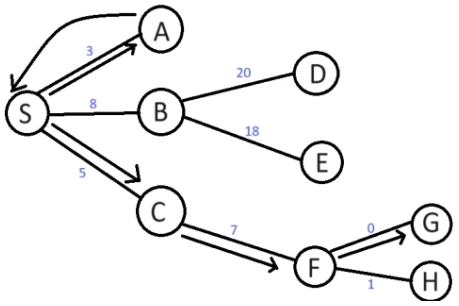
Step 5: Check each successor of node n, and find whether any node is a goal node or not. If any

successor node is goal node, then return success and terminate the search, else proceed to Step 6.

Step 6. For each successor node, algorithm checks for evaluation function f(n) and then check if the node has been in either OPEN or CLOSED list. If the node has not been in both list, then add it to the OPEN list.

Step 7: Return to Step 2.

Example:



Expanded node	Children	Node available	Nodes selected
S	[A:3], [B:8], [C:5]	[A:3], [B:8], [C:5]	[A:3]
A	-		
C	[F:7]	[B:8], [C:5]	[C:5]
F	[G:0], [H:1]	[G:0], [H:1]	[G:0]
G	-	-	-

S->A->C->F->G = 3+5+7+0 = 15

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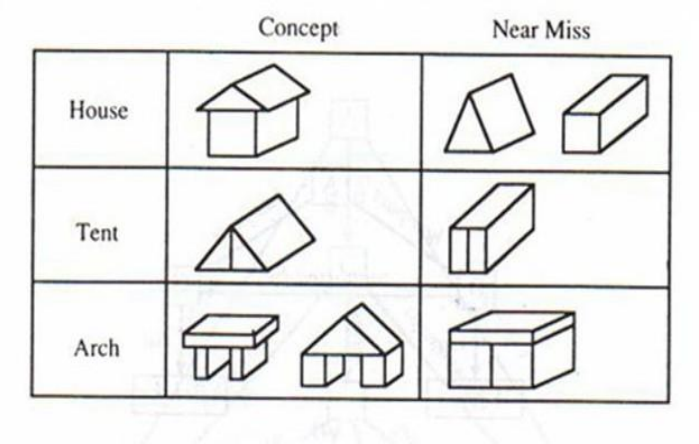
9.Briefly explain Winston's Learning Program

Winston's doctoral thesis at MIT entitled "Learning Structural Descriptions from Examples" (1970) was a major step towards a clarification of how concepts involving complex structural relations might be learned.

His program is presented with line drawings of scenes containing children's toy blocks, such bricks, cubes, pyramids, and wedges. The program forms descriptive networks for these scree which shows the properties and relationships of the objects appearing in them. Using these structur descriptions, the program can learn structural concepts such as "pedestal", "arch" or "arcade" ont basis of examples and counterexamples of the concepts.

Winston's program uses Guzman's algorithm to determine the bodies in a scene; it then determines Which eniges belong to which object and fills in partially occluded edges. Then it infers the types of objects (brick, wedge, etc.) from the shapes and adjacency relationships of the viable faces. The sizes

particular things (such as the object "ABC", and its faces "A", "B", and "C") or general concepts (such as BRICK, LARGE, etc.) and the edges are relations between things and/or general concepts (e.g., PART. IS is a relation which holds between a thing and its parts).



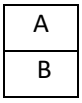
10.Define Green's Approach.Explain Green's Approach for Simple block world problem.

Green's Approach : Basically, a given state was described by a set of predicates representing

the facts that were true in that state. Each state was represented explicitly as part of the

predicate.

Green' Approach for Simple block world description



ON(A, B, S.) ^ ON TABLE(B, So) ^CLEAR (A, S_{0})

If wanted to UNSTACK(A,B), the operation is expressed as:

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>x, y-any blocks

S-any state

Do () - specifies that a new state result from the given action.

The result of applying this to state S_0 to give S_1 by applying UNSTACK is

HOLDING (A, S1) CLEAR (B, S1)

One problem with this approach is, B is still on the table.

➤ This needs to be encoded into frame axioms that describe components of the state not affected by the operator.

➤ So, it must be,

ONTABLE (Z, S) → ONTABLE (Z, Do(UNSTACK (x, y), s))

If want to color the blocks, an axiom used is,

COLOR (x, c, s) → COLOR (x, c, Do(UNSTACK (y, z), s))

11.With a neat diagram explain the architecture of Expert system

[CLEAR(x, S) ^ ON(x, y, S)]→ [HOLDING(x, Do(UNSTACK(x, y), S)) ^ CLEAR(y, Do(UNSTACK(x, y), S))]

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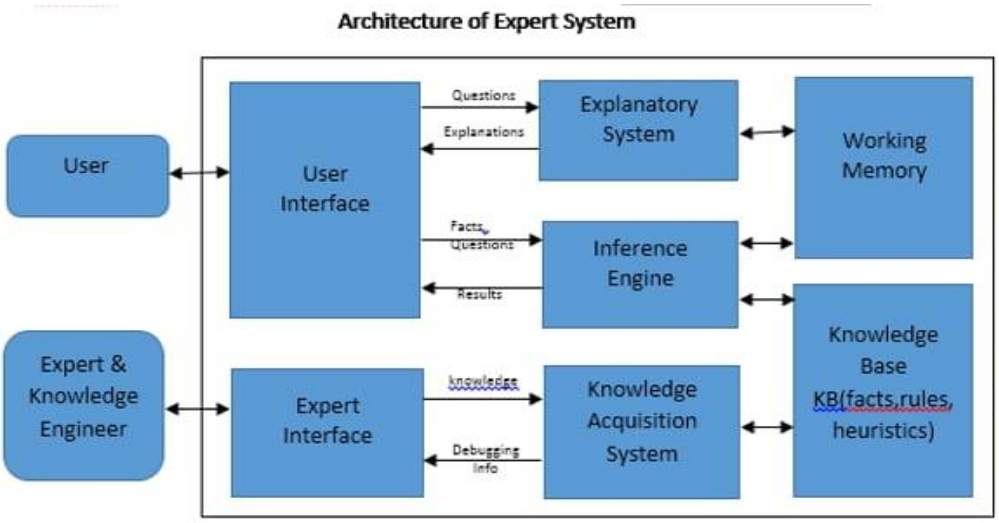

The Architecture of an Expert System (ES) consists of the following major components:

1. User Interface:

With the help of a user interface, the expert system interacts with the user, takes queries as an input in a readable format, and passes it to the inference engine. After getting the response from the inference engine, it displays the output to the user. In other words, it is an interface that helps a non-expert user to communicate with the expert system to find a solution.

2. Explanation Systems:

These systems are put into place to supply the information that helps in clarifying the problem domain and the structure. This has multiple use cases not only in the field of expert systems but otherwise as well.

3.Inference Engine:

The inference engine is known as the brain of the expert system as it is the main processing unit of the system. It applies inference rules to the knowledge base to derive a conclusion or deduce new information. It helps in deriving an error-free solution of queries asked by the user. With the help of an inference engine, the system extracts the knowledge from the knowledge base.

4. Memory Units:

It is the storage for the raw data, which is used as an input for models to train and function. The important aspect here is the variety of methodologies and techniques used to store the data for immediate access when required.

5. Knowledge Base:

The knowledgebase is a type of storage that stores knowledge acquired from the different experts of the particular domain. It is considered as big storage of knowledge. The more the knowledge base, the more precise will be the Expert System.

12.With an example, Explain reinforcement learning

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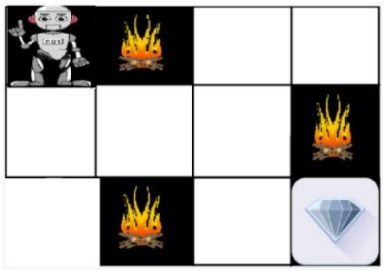
Reinforcement learning is an area of Machine Learning. It is about taking suitable action to maximize reward in a particular situation. It is employed by various software and machines to find the best possible behaviour or path it should take in a specific situation. Reinforcement learning differs from supervised learning in a way that in supervised learning the training data has the answer key with it so the model is trained with the correct answer itself whereas in reinforcement learning, there is no answer but the reinforcement agent decides what to do to perform the given task. In the absence of a training dataset, it is bound to learn from its experience.

Reinforcement Learning (RL) is the science of decision making. It is about learning the optimal behaviour in an environment to obtain maximum reward. In RL, the data is accumulated from machine learning systems that use a trial-and-error method. Data is not part of the input that we would find in supervised or unsupervised machine learning.

There are two types:

1. Positive 2.Negative

Example-

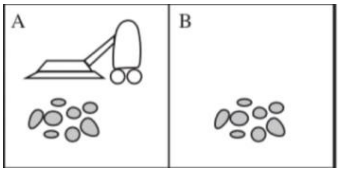


The above image shows the robot, diamond, and fire. The goal of the robot is to get the reward that is the diamond and avoid the hurdles that are fired. The robot learns by trying all the possible paths and then choosing the path which gives him the reward with the least hurdles. Each right step will give the robot a reward and each wrong step will subtract the reward of the robot. The total reward will be calculated when it reaches the final reward that is the diamond.

||| Answer any four questions. Each questions carries eight marks

13.With an neat diagram explain the vacuum-cleaner world example

To illustrate these ideas, we use a very simple example-the vacuum-cleaner world shown in Figure.



Let's suppose that the world has just two rooms. The robot can be in either room and there can be dirt in zero, one, or two rooms.

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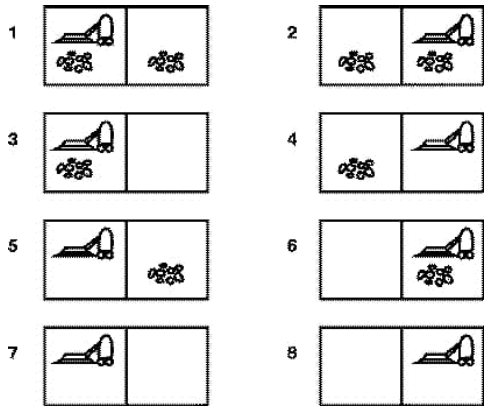
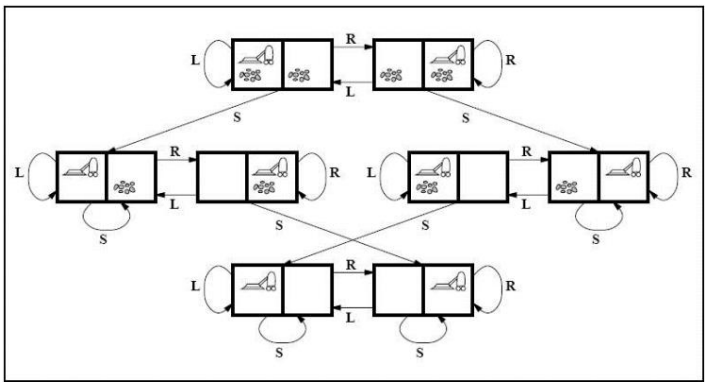


Goal formulation: intuitively, we want all the dirt cleaned up. Formally, the goal is { state 7, state 8 }.

Problem formulation: (Actions): Left, Right, Suck, No Op

State Space Graph:



14.With an example. Explain Mean End Analysis in AI

Means end analysis (MEA) is an important concept in artificial intelligence (Al) because it enhances problem resolution. MEA solves problems by defining the goal and establishing the right action plan. This technique is used in Al programs to limit search.

Example:

We want to apply the concept of means end analysis to establish whether there are any adjustments needed. The first step is to evaluate the initial state, and compare it with the end goal to establish whether there are any differences between the two states.

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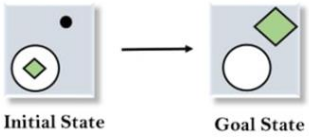
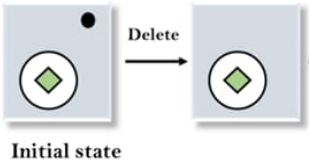
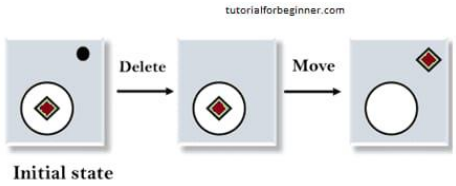


The image above shows that there is a difference between the current state and the target state. This indicates that there is a need to make adjustments to the current state to reach the end goal.

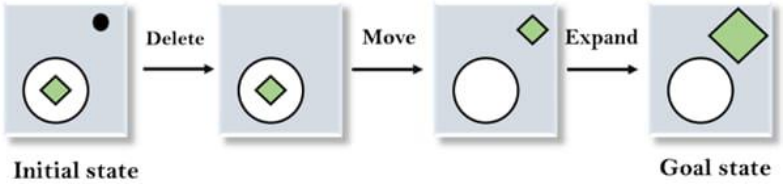
Delete operator: The dot symbol at the top right corner in the initial state does not exist in the goal state. The dot symbol can be removed by applying the delete operator.



Move operator: We will then compare the new state with the end state. The green diamond in the new state is inside the circle while the green diamond in the end state is at the top right corner. We will move this diamond symbol to the right position by applying the move operator.



Expand operator: After evaluating the new state generated in step 2, we find that the diamond symbol is smaller than the one in the end state. We can increase applying the expand operator. the size of this symbol by applying the expand operator.



15.With an example, Explain FOL in AI

• First-Order Logic (FOL) is a logical way of allowing us to use statements to express relationships between things. It goes beyond fundamental logic by allowing us to talk about individual items by using variables and quantifiers. Based on what we already know, First-Order Logic helps us discover new knowledge or facts about a family. First-Order Logic is widely used in the field of Artificial Intelligence as a critical tool for tackling real-world issues.

• First-Order Logic, also known as First-Order Predicate Calculus or First-Order Predicate Logic, adds quantifiers, variables, and predicates to propositional logic.

Imagine having a magical language that allows you to explain and understand things in a very structured manner. In Artificial Intelligence, this magical language is known as First-Order Logic.

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Basic Elements of First Order Logic

- Constants KingJohn, 2, NUS,...
- Predicates Brother, >,...
- Functions Sqrt, LeftLegOf,...
- Variables x, y, a, b,...
- Connectives ¬, ⇒, ∧, ∨, ⇔
- Equality =
- Quantifiers ∀, ∃

Example: **Parent (x, y): Indicates that x is the parent of y.**

Statements addressing the family:

Parent (Ram, Riya): Ram is Riya's father.

Parent (Riya, Aarav): Riya is Aarav's mother.

By using First Order Logic, we can conclude

Parent (Ram, Aarav):

Because Ram is the father of Riya (Parent (Ram, Riya)) and Riya is the mother of Piter Parent (Riya, Aarav)), we can infer that Ram is also the father of Aarav.

(In this brief example, we used First Order Logic to conclude that Ram is Aarav's father based on the statements provided).

16.What do you mean by Image classification? Explain the step-by-step process.

Image Classification: Image classification is the simplest technique of Computer Vision. The main aim of image classification is to classify the image into one or more different categories. Image classifier basically takes an image as input and tells about different objects present in that image, such as a person, dog, tree, etc. However, it would not give you other more information about the image data, such as how many persons are there, tree colour, item positions, etc., and for this, we need to go for any other CV technique.

Step-by-Step process:

a. **Pre-processing** - This step improves image data by eliminating undesired deformities and enhancing specific key aspects of the picture so that Computer Vision models can operate with this better data.

b**. Data cleaning**-sometimes called data cleansing-is an important step in preparing your data for training your model, as inaccuracies in data lead to inaccuracies in the image classification model.

c. **Object detection**: locating objects within the image set - This is the process of locating an object, which entails segmenting the picture and determining the location of the object.

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d. **Object recognition and training**: labelling located images - Deep Learning algorithms discover patterns in the picture and characteristics that may be unique to a certain label. The model learns from this dataset and becomes more accurate in the future.

e. **Object classification:** your model is ready to classify your images - This is the final step in the process-you've built an Al model that classifies fashion images by several different criteria.

f. **Connecting to an Al workflow** - After completing this process, you can now connect your image classifying Al model to an Al workflow. This defines the input-where new data comes from, and output-what happens once the data has been classified. For example, data could come from new stock intake and output could be to add the data to a Google sheet.

17.With a neat diagram differentiate between backward chaining and forward chaining in Inference Engine.

Forward chaining	Backward chaining
In forward chaining, the decision is taken based on in given data.	backward chaining, the process starts from the goal state and reaches the initial state.
It is a data-driven technique	It is a goal-driven technique.
It uses a breadth-first search strategy	It uses a depth-first search strategy.
Its only goal is to reach a conclusion	Its goal is to validate the facts
It operates in the forward direction (initial state to It goal state)	operates in the backward direction (goal state to initial state)
It may include multiple ASK questions from the information source	Backward chaining includes fewer ASK questions compared to forward chaining.
It is a bottom-up approach	It is a top-down approach
It is a slow process	It is a fast process.

18.Difference between Deep learning and Machine learning.

Deep Learning	Machine Learning
Uses artificial neural network architecture to learn the hidden patterns and relationships in the dataset.	Apply statistical algorithms to learn the hidden patterns and relationships in the dataset.
Requires the larger volume of dataset compared to machine learning	Can work on the smaller amount of dataset
Better for complex task like image processing, natural language processing, etc.	Better for the low-label task.
Takes more time to train the model.	Takes less time to train the model.
Relevant features are automatically extracted from images. It is an end-to-end learning process.	A model is created by relevant features which are manually extracted from images to detect an object in the image.
More complex, it works like the black box interpretations of the result are not easy.	Less complex and easy to interpret the result.
It requires a high-performance computer with GPU.	It can work on the CPU or requires less computing power as compared to deep learning.

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