1. Choose six references of AI found in popular literature such as a magazine or web article. For each, explain whether AI is being described as THINKING HUMANLY, THINKING RATIONALLY, ACTING HUMANLY or ACTING RATIONALLY.

Answer:

a) NPCs in Video Games

It comes under Acting Rationally. Because NPCs in Video Games typically make decisions that will give them the best outcome in the current situation which might not be what humans will probably do if they are in that situation. For example in GTA V game if a we block the road using a truck, NPCs while trying to pass through the truck they will pass over the bridge into the water which a human will never do. Because NPCs are trying to do the best thing in that situation without noticing that they will be in water which humans can notice and avoid.

b) Facial Recognition

It comes under Thinking Humanly. Because, it is trying to mimic how humans recognize familiar faces by using the facial images stored in the brain. The systems achieves this task by using the training data that we provide to identify the features of people images that we provide and when a new image is given as input it uses the data that it learned to classify the new image into one of the people that it already knows. Just like how we can sometimes make mistakes in recognizing a person, the system can also do mistakes if the image is distorted or blurred.

c) Recommender Systems

It comes under Thinking Rationally. Because, in recommendation systems we use past purchases of users to recommend new products to users based on their purchases. It can be thought as using predicate calculus to form rules from the transaction history and using those calculus to find new recommendations. The resulting recommendations may not be a correct fit for each user. But the system assumes that they are the correct fit for every user with similar transaction history because of the predicate rules formed.

d) Self Driving Cars

It comes under Acting Rationally. Because, system always tries to drive the car in a way to get maximum reward points possible. While driving it tries to make decisions which will avoid accidents thereby achieving reward points.

e) Virtual Assistants

It comes under Acting Humanly. It can perform a lot of tasks that a person can do like responding to questions, creating events and reminders, sending messages. It tries to mimic the human actions by understanding what user is saying using natural language processing and then deciding what to do based on the input received.

f) Chatbots

It comes under Thinking Rationally. A chatbot is used to get information regarding the sector that it is being used like medical chatbot. It achieves that by forming predicate rules from the data and uses those rules to answer questions asked by the user.

2. **There are well-known classes of problems that are intractably difficult, and other classes that are provably undecidable. Does this mean that Machine Learning is impossible for these problems?**

For clarification, an undecidable problem cannot be algorithmically solved, whereas an intractable problem has no efficient solution.

Answer:

We can solve problems that are intractably difficult using machine learning. Because, even though there is no efficient solution, we can still solve the problem.

We can't solve problems that are provably undecidable using machine learning. Because, we can't solve them algorithmically and without that algorithm we can't build and train a machine learning model.

3. Samuel's Checkers Player was an early successful machine learning program. Research on your own to find three other successful machine learning programs that predate 1980 and give a two-paragraph report on the task solved (one paragraph) and method used (one paragraph). This should not be a rewording of a Wikipedia entry, which is plagiarism.

Answer:

1) Machines Playing Tic-Tac-Toe

With the help of 304 match boxes and beads, Donald Michie constructed the "Matchbox Educable Noughts and Crosses Engine," a mechanical computer that can compete against people in a game of tic-tac-toe. It was created to play humans by providing a move for each state and iteratively improving its tactics through reinforcement learning.

Each matchbox represented a single possible layout of a noughts and crosses board. The matchboxes contained colored beads that each signified a particular move in the current condition of the board. The amount of a certain hue in that matchbox determined the likelihood that playing a move would result in victory. Hundreds of games were played to train the program, and based on how each game turned out, the number of beads in each matchbox was updated.

2) Discovery of Perceptron

The Perceptron, or first computer neural network, was created by Frank Rosenblatt. It was built to receive visual inputs such as images and create outputs such as labels and categorizations in response.

In supervised learning, a perceptron is a machine learning technique that is used to address binary classification problems. It uses a linear predictor function, combining the feature vector and a set of weights, to produce predictions.

3) Discovery of Neocognitron

Kunihiko Fukushima discovered the neocognitron. It is a hierarchical, multilayered kind of artificial neural network that is mostly employed for pattern recognition tasks like learning to recognize handwritten characters.

The network is made up of numerous cell layers and varies in the connections it has with cells in neighboring layers. In the network, layers of S-cells and C-cells are alternately organized, with S-cells acting as feature extraction cells and C-cells allowing for position errors.

4. The development of self-driving cars is a very active area of machine learning investigation. Research the "state of the art" of self-driving cars, and report on at least

three issues or problems these methods have yet to resolve. An example: confusing a yellow traffic signal with the moon.

Answer:

Some of the issues or problems that a self-driving car has yet to solve are

a) Adapting to the unpredictable road conditions

Self-driving cars depend on the sensors connected to the car to know about their surroundings and steer accordingly. However, at present, the technology is not yet advanced to adapt to unpredictable road conditions. Road conditions can vary drastically from place to place. Some places have smooth and broad freeways. In other places there are no lane markings which might cause some difficulty for the system to accurately determine the position it's supposed be in. Some mountainous places have highly deteriorated roads where human experience plays a lot of crucial role on how to steer properly which can't be easily done by machines.

b) Adapting to the weather conditions

Self-driving cars depend on the sensors connected to the car to know about their surroundings and steer accordingly. However, if the weather is very foggy, it makes the job of sensors tough to accurately perceive their surroundings. Also, if it is raining or snowing friction between road and tyre will reduce a bit which might cause the cars to skid. The system must not only adapt according to the surrounding traffic but it should also steer depending on the current climatic conditions which is still a tough hurdle to tackle.

c) Radar Interference

Autonomous cars uses lasers and radars for navigation. Radar detects the objects surrounding the vehicle by using the reflections of radio waves. Cars will automatically emit radio waves in all directions which gets reflected from the surrounding objects or vehicles. Distance between the car and that object is determined by the system by using the time taken for the reflected radio wave to reach the radar and appropriate action is decided by the system. However, when hundreds of autonomous cars come into the world, it is tough for the car to differentiate between its own reflected signal and signal reflected from other vehicle. Even if we have multiple radio frequencies for the radar, this range will be insufficient when all autonomous vehicles come into existence.

5. For each of the following problems, specify a machine learning task <P, T, E>:

a) Detecting images that contain a cat

b) Playing Poker

c) The Traveling Salesman Problem

d) Robotic vacuum cleaner

e) Online shopping recommendations ("maybe you would like this too!")

f) English to Spanish translator

g) Self-driving car

Answer:

a) Detecting images that contain a cat

T: Detecting whether a cat is present in an image

P: Percentage of images correctly classified

E: Database of human-labeled images of cats and other animals

b) Playing Poker

T: Playing Poker game

P: Percentage of games won

E: Playing poker games against itself

c) The Traveling Salesman Problem

T: Visiting all cities only once and returning to original city

P: Shortest route possible to complete the task

E: Database of different tours possible

d) Robotic Vacuum Cleaner

T: Detecting the garbage items present on the floor

P: Percentage of items correctly classified

E: Database of images of home floor and images of items labeled garbage or not garbage

e) Online Shopping recommendations

T: Providing product recommendations to customers based on past purchases

P: Percentage of products correctly recommended by the system that matches the user needs

E: Database of purchase history, search history to find frequent item sets among the data

f) English to Spanish translator

T: Translating English sentences into Spanish

P: Percentage of sentences/words correctly translated

E: Database of English-to-Spanish vocabulary, grammar mapping

g) Self-driving car

T: Driving a car without any human intervention

P: Getting maximum reward points possible

E: Database of simulated world and training the system in that world using reinforcement learning