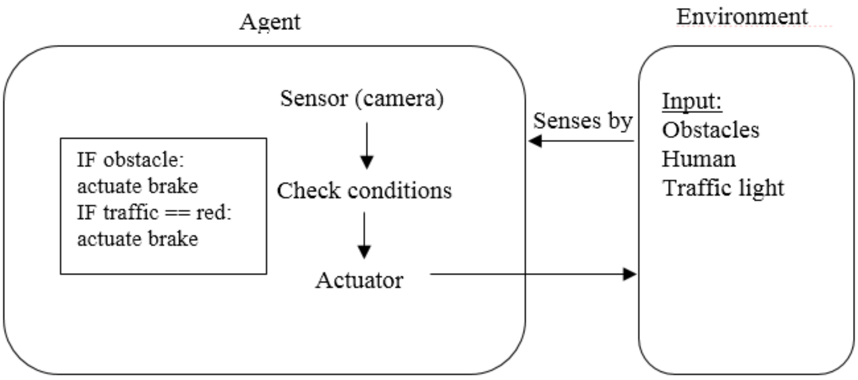
responsible for carrying out physical actions in response to the system's decisions. In this context, the actuators come into play by releasing chilled gas to cool the environment. The "Environment" depicted in the diagram signifies the physical space where the temperature is continuously monitored and regulated by the air-conditioning system.

Input:

1. Room temperature
2. Desired temperature
3. humidity

<u>Agent of autonomous driving car</u>



This agent of an intelligent autonomous driving car system is responsible for making decisions based on the information. It consists of sensor (camera and others): This icon represents the camera sensors equipped on the autonomous vehicle, responsible for capturing images of the surroundings, including obstacles, pedestrians, and traffic lights. This information will be sent into condition evaluation stage (IF-else rule). This stage involves the decision-making process in which the system assesses the data received from the sensors. It encompasses two conditional statements:

1. If an obstacle is detected, the system triggers the braking mechanism.
2. In the event of a red traffic light signal, the system also initiates the braking action. (not limit to only 2 rules)

Finally, it will trigger the actuator to activate of the braking system if needed, effectively avoiding potential collisions or complying with traffic signals.

Input:

1. Sensor data from cameras, lidar, radar, and other perception systems.
2. GPS and mapping data for navigation.
3. Real-time traffic and obstacle information.

Students can provide any other relevant answers

<u>**Tutorial 2**</u>

Instead of asking, "Can machines think?", Alan Turing said we should ask, "Can machines pass a behavior test for intelligence?". Turing predicted that by the year 2000, a computer could be programmed to have a conversation with a human interrogator for five minutes and would have a 30% chance of deceiving the interrogator that it was a human. (Negnevitsky, 2002).

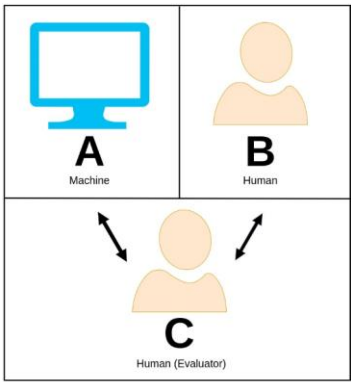
1. Explain Turing Test. Illustrate your answer with appropriate diagram.

Answer:

The Turing Test typically involves three participants:

1. A human judge (interrogator): This person conducts the test by engaging in a conversation with both a human and a machine.
2. A machine: The AI being tested for its ability to exhibit intelligent behavior.
3. A human: To provide a baseline for comparison with the machine's responses.

The judge communicates with both the human and the machine via a text-based interface, such as a computer keyboard and screen, so the judge cannot see or hear them directly. This ensures that the evaluation is based solely on the responses and not on physical appearance or voice. During the test, the judge asks questions and engages in a conversation with both the human and the machine. The machine's goal is to respond in a manner that is indistinguishable from the human participant. If the judge cannot consistently tell which participant is the machine, the machine is considered to have passed the Turing Test (Intelligent)



2. Criticize Turing's criteria for judging a computer's intelligence.

Answer:

Lack of Contextual Understanding The Turing test falls short in assessing machine intelligence because machines do not possess a true grasp of word meanings; instead, they depend on prior experiences or predefined rules to formulate responses. Consider sarcasm as an example—a form of communication where words are used to mock, tease, or humorously convey a message. Imagine your friend finishes their assignment ahead of schedule, and you respond with, "Wow, great job! So clever!" On the surface, this statement may seem like praise or a positive remark, but in reality, you are concealing negative emotions like unhappiness and jealousy over your friend's accomplishment. This illustrates how machines can struggle to genuinely comprehend the subtleties of human language and emotions.

Limited Scopes: In the Turing Test, the interrogator can only communicate with the machine through language, without any visual or physical cues. Having language skills alone is not enough to prove that a machine has human-level intelligence. We cannot definitively establish that a machine possesses human-like intelligence solely based on its capacity to mimic intelligent behavior. Additionally, it's important to note that the Turing Test primarily evaluates whether a machine acts like a human, but not all human behaviors necessarily reflect intelligence. For example, being sensitive to insults, the tendency to lie, or even making frequent typing errors are not reliable indicators of intelligence.

Ignores Different Modes of Intelligence: The Turing Test primarily focuses on linguistic and conversational intelligence. It doesn't account for other forms of intelligence, such as problem-solving, creativity, or emotional intelligence. This limited scope may not capture the full spectrum of human intelligence.

Students can provide any other relevant answers

3. Suggest how could this test be used (or modified) to assess other kind of artificial intelligence besides a chatbot. Provide an example to elaborate your answer.

Answer:

CAPTCHA

The primary goal of CAPTCHA is to distinguish between humans and automated bots on the internet. It presents a challenge or puzzle that is relatively easy for humans to solve but difficult for automated programs to pass. This challenge typically involves tasks such as recognizing distorted characters, selecting specific images, or solving puzzles. In a sense, CAPTCHA is a reverse Turing test, as it assesses whether a user is human or a machine rather than testing the machine's ability to mimic human intelligence. It relies on the assumption that certain tasks are inherently easier for humans due to their cognitive abilities, while automated bots struggle with them. So, while CAPTCHA shares the idea of testing the capabilities of a computer system against human abilities, its purpose and execution are different from the traditional Turing test used to evaluate conversational or general artificial intelligence.

Modified Turing Test for Autonomous Vehicles

a) In this scenario, an "Autonomous Vehicle Turing Test" aims to assess the intelligence of self-driving cars. The test could be structured as follows:
b) Simulation Environment: Create a simulated driving environment that replicates real-world scenarios, including traffic, pedestrians, weather conditions, and unexpected events.
c) Human Observer: Appoint a human observer or evaluator who will interact with the autonomous vehicle's control system.
d) Control System Interaction: The evaluator communicates with the autonomous vehicle's control system through a computer interface, similar to how a chatbot is evaluated in the traditional Turing Test. The evaluator provides instructions or scenarios to the autonomous vehicle, such as requesting it to change lanes, slow down in response to traffic, or handle unexpected obstacles.
e) Performance Assessment: The autonomous vehicle's control system processes the evaluator's instructions and operates the virtual vehicle within the simulated environment. The evaluator assesses the vehicle's performance based on its ability to make safe and intelligent driving decisions.
f) Pass or Fail: The autonomous vehicle is considered to have passed the test if it can consistently make appropriate driving decisions, navigate complex scenarios, and prioritize safety in a manner that closely resembles human intelligence. It fails if it consistently makes unsafe or irrational choices.

Students can provide any other relevant answers

4. The Loebner Prize is an annual competition in artificial intelligence that awards those computer programs considered by the judges to be the most human-like, using format of a standard Turing Test. The conversation scope between the programs and the judges has been unrestricted since 1995, and the duration of the conversation has been increased from 5 minutes to 25 minutes since 2010 (http://www.loebner.net/).
   a) Discuss **TWO** (**2**) reasons why Turing Test is considered **not effective enough** in assessing machine intelligence.
   b) Discuss **TWO** (**2**) challenges to build a computer program that can win the Grand Loebner Prize, in which judges totally cannot distinguish it from a real human.

Answer:

a)

1. Emphasis on Imitation, not Understanding:

The Turing Test primarily focuses on a machine's ability to imitate human conversational behavior, rather than genuinely understanding the content or meaning of the conversation. A machine can pass the test by producing responses that mimic human language and behavior without possessing true comprehension or intelligence. This means that the test may not effectively differentiate between machines that simulate understanding and those that actually understand the information they are processing. In essence, it places more importance on surface-level mimicry rather than deep comprehension or intelligence.

2. Lack of Objective Measurement:

The Turing Test relies on human judges to determine whether a machine's responses are indistinguishable from those of a human. This introduces subjectivity into the assessment, as the judgment may vary from one human evaluator to another. Additionally, there are no clear and objective criteria for passing the test. The lack of a quantifiable measure makes it challenging to establish a standardized benchmark for machine intelligence. As a result, the test's outcomes can be inconsistent, and it may not provide a robust and reliable way to assess and compare the intelligence of different machines.

Any other acceptable answer

b)

1. Natural Language Understanding and Contextual Awareness:

One of the foremost challenges is developing natural language understanding capabilities that allow a computer program to comprehend and respond to a wide range of conversational topics, nuances, and context. Human language is incredibly complex, often involving idiomatic expressions, cultural references, sarcasm, humor, and ambiguity. To pass as a human convincingly, a program must possess the ability to grasp not only the surface-level meaning of words but also the deeper contextual implications. Achieving this level of language understanding requires advanced natural language processing (NLP) techniques, large datasets, and machine learning algorithms. Even with these tools, building a program that can consistently handle a diverse array of conversational scenarios and maintain contextual coherence is a substantial challenge.

2. Emotional and Empathetic Responses:

Humans often convey emotions and empathy in their conversations, which can be crucial for creating a lifelike conversational AI. Developing a computer program that can generate authentic emotional responses is a complex task. It involves not only recognizing emotional cues in the input but also generating empathetic and contextually appropriate responses. While sentiment analysis techniques can help identify emotions in text, conveying empathy and emotions in a way that resonates with human judges is a formidable challenge. It requires understanding the emotional context of a conversation and crafting responses that reflect genuine empathy, care, or other emotional states. Achieving this level of emotional authenticity without overstepping ethical boundaries or appearing insincere is a delicate balancing act.

3. Passing the Total Turing Test:

The Grand Loebner Prize requires a computer program to pass not just a text-based Turing Test, but a Total Turing Test. This means the program must be able to interact with the world in the same way a human does, including understanding and responding to visual and auditory input. This adds an additional layer of complexity to the challenge, as it requires the program to have capabilities in areas like computer vision and speech recognition, in addition to natural language processing and understanding

4. Complexity of human language:

The complexity of human language presents a multifaceted challenge. Different languages necessitate distinct grammatical structures, making language understanding and generation a demanding task. Moreover, humans continually invent new words and expressions, exemplified by recent additions like "Covid-19" and "yyds."

Any other acceptable answer

5. The Chinese room argument by John Searle is one of the best known and widely credited criticism of Turing Test. Explain John Searle's Chinese room concept.

Answer:

The Chinese room argument holds that a digital computer executing a program cannot be shown to have a "mind", "understanding" or "consciousness", regardless of how intelligently or human-like the program may make the computer behave.

Searle imagines himself alone in a room following a computer program for responding to Chinese characters. Searle understands nothing of Chinese, and yet, by following the program for manipulating symbols and numerals just as a computer does, he sends appropriate strings of Chinese characters back out under the door, and this leads those outside to mistakenly suppose there is a Chinese speaker in the room. John Searle describes that although a system is clearly running a program and passes the Turing Test, it does not equally understand anything of its inputs and outputs. In conclusion, running the right program does not necessarily generate understanding.

6. Try to chat with the following chatbots within a few minutes. Then discuss what are the characteristics/behaviors of a chatbot should have in order to deceive any human.
   a) **Mitsuku**, the 5-time Loebner Prize winner - https://www.pandorabots.com/mitsuku/
   b) **Eliza**, the first chatbot - https://web.njit.edu/~ronkowit/eliza.html (not the original Eliza website)

Answer:

Mitsuku is an award-winning chatbot developed by Steve Worswick. Known for its advanced conversational abilities, Mitsuku possesses several key characteristics that contribute to its popularity and success:

1. Natural Language Understanding: Mitsuku demonstrates a strong ability to comprehend and interpret human language. It can understand context, extract meaning from complex sentences, and handle conversational nuances, allowing for more engaging and natural interactions.
2. Contextual Memory: Mitsuku has a robust memory that enables it to remember and recall previous conversations. This contextual memory allows it to maintain continuity in dialogues and provide personalized responses based on past interactions, creating a more personalized user experience.
3. Emotional Intelligence: One notable characteristic of Mitsuku is its emotional intelligence. It can recognize and respond to human emotions, showing empathy and understanding in its conversational style. This ability to empathize with users contributes to a more engaging and authentic interaction.
4. Conversational Depth: Mitsuku is capable of engaging in extended and meaningful conversations on a wide range of topics. It displays a substantial knowledge base, covering subjects such as general knowledge, trivia, news, and even personal questions, making it versatile and capable of providing informative responses.
5. Personality: Mitsuku exhibits a distinct personality, characterized by a friendly and conversational tone. It incorporates humor, wit, and occasionally playful responses, making interactions with the chatbot more enjoyable and engaging for users.
6. Continuous Learning: Mitsuku leverages machine learning techniques to continually improve its conversational abilities. It learns from user interactions, allowing it to adapt and refine its responses over time. This enables Mitsuku to grow and evolve, providing users with an increasingly refined conversational experience.
7. Multiple Language Support: Mitsuku supports multiple languages, including English, Spanish, French, German, and Italian. This multi-language capability extends its accessibility to a broader range of users, facilitating interactions with individuals from different linguistic backgrounds.

Overall, Mitsuku's key characteristics, including its natural language understanding, contextual memory, emotional intelligence, conversational depth, personality, continuous learning, and multi-language support, contribute to its reputation as a highly sophisticated and engaging chatbot.

Eliza is a classic chatbot developed in the 1960s by Joseph Weizenbaum. Although considered simplistic by today's standards, Eliza played a significant role in the history of chatbots and psychotherapy. Here are some of the key characteristics of Eliza:

1. Rule-Based Approach: Eliza operates on a rule-based approach, utilizing a set of predefined patterns and responses. It uses pattern matching techniques to identify keywords or phrases in user input and generates pre-programmed responses based on those patterns.
2. Reflection of User Input: One notable characteristic of Eliza is its ability to reflect user input. It achieves this by rephrasing or repeating certain parts of the user's statements as questions. This technique, known as "Rogerian psychotherapy," helps simulate a conversation by encouraging users to explore their thoughts and feelings further.
3. Lack of Genuine Understanding: Eliza does not possess genuine understanding or semantic comprehension. It primarily focuses on mimicking human-like conversation by utilizing generic and context-independent responses. It does not process or analyze the meaning of user input beyond simple pattern matching.
4. Minimal Context Awareness: Eliza lacks deep context awareness and does not maintain a memory of previous interactions. It treats each user input independently, without considering the larger conversation history. As a result, Eliza's responses do not evolve or adapt based on the ongoing conversation.
5. Limited Scope: Eliza's capabilities are confined to basic psychotherapy interactions. It aims to engage users in open-ended discussions about their feelings and concerns, employing techniques such as active listening, reflection, and probing questions. However, it lacks the ability to engage in conversations on diverse topics outside the scope of psychotherapy.
6. Text-Based Interface: Eliza operates through a text-based interface, where users input text messages that the chatbot responds to. It does not incorporate any visual or multimedia elements and solely relies on textual interactions to simulate a conversation.
7. Influence on Chatbot Development: Despite its limitations, Eliza has had a significant impact on the development of chatbot technology. Its rule-based approach and the concept of using reflective techniques to simulate conversation laid the foundation for subsequent chatbot iterations, inspiring further advancements in natural language processing and dialogue systems.

In summary, Eliza's key characteristics include its rule-based approach, reflection of user input, lack of genuine understanding, minimal context awareness, limited scope, text-based interface, and its historical significance in shaping the field of chatbot development.