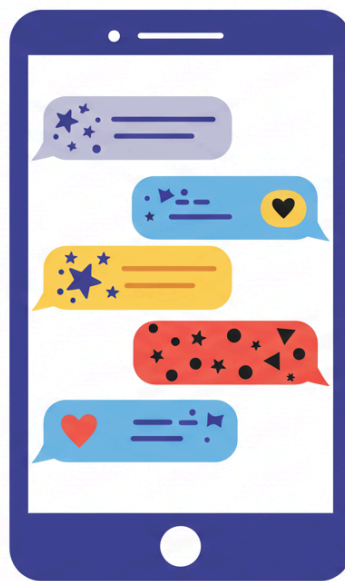


Artificial Intelligence

Textbook

Artificial Intelligence



Artificial Intelligence (AI) and robots are changing the world we live in. This section will discuss the background of AI and how we test it. We'll also look at the main ways AI and Machine Learning are used in areas like medicine, space, and cars. Lastly, we'll see how robots help solve problems for people

Looking Back at How Artificial Intelligence (AI) Started

Even though the idea of machines that can think has been around for a long time, AI officially began in 1956. In the beginning, AI used a set of rules to solve problems, such as playing chess. The Turing Test, created in 1950, was an important way to test AI. In this test, a judge would chat with both a human and a machine, and if they couldn't tell which was which, the machine passed the test.

As AI developed, so did its tests. After a period where not much happened, AI made a comeback thanks to powerful computers and new techniques like machine learning. Modern tests now do more than just check if AI can have a conversation. They also check AI's common sense (like the Winograd Schema Challenge), its ability to recognize images (ImageNet), and its understanding of language (GLUE). These newer tests show just how much AI has improved.

Main Ways AI and Machine Learning Are Used

AI and Machine Learning (ML), which is a way for computer systems to learn from information, are now used everywhere.

In healthcare, AI helps doctors find illnesses earlier and more accurately by looking at medical images. It also helps discover new medicines faster and can predict when disease outbreaks might happen.

For exploring space, AI helps guide rovers on Mars, assists them in finding interesting spots, and chooses samples to collect. AI also examines data from telescopes to find new planets and makes spacecraft travel more efficient.

In the car industry, AI is used for self-driving cars, helping them "see," understand traffic, and find their way around. Machine learning constantly makes these systems better. AI also predicts when car problems might occur and improves the experience inside the car for drivers and passengers.

Predictive Artificial Intelligence

Predictive AI uses information from the past to guess what might happen in the future or what trends might emerge. This helps us plan better.

In sports, it can predict how games will turn out and how players will perform, which helps coaches and people who play fantasy sports. For the stock market, AI looks at financial information and news to predict stock prices and opportunities to buy or sell. In weather forecasting, AI uses past weather patterns and data from sensors to make more accurate predictions, helping us get ready for storms and manage our resources better. Predictive AI helps reduce uncertainty so we can make smarter choices.

How Robots Help with Human Problems

Robots are used to do jobs that are dangerous, boring, dirty, or too complicated for people to do.

In healthcare, robots help doctors perform surgeries with very precise movements, which leads to patients recovering faster. Robots also deliver supplies and clean rooms to get rid of germs. In dangerous places, robots can disarm bombs, explore areas with radiation, or search collapsed buildings, keeping people safe. Robots can also do tasks in the deep sea and in space that humans can't.

In factories and shipping, robots handle repetitive lifting tasks, which speeds up making products and reduces injuries. In warehouses, robots move goods around and keep track of what's in stock, making deliveries quicker. Robots are also being developed to help older people or those with disabilities with their daily activities, which makes their lives better.

Major Branches of AI

AI has several major branches, each with a different focus.

- **Expert systems** were early AI programs designed to make decisions like a human expert using a set of rules.
- **Natural language processing (NLP)** helps computers understand, interpret, and create human language, powering things like voice assistants.
- **Machine perception** gives computers "senses," letting them understand information from images (computer vision) or sounds (speech recognition).
- **Machine learning** is a broad area where computers learn from data to find patterns and make predictions without being directly programmed. This includes deep learning.
- **Generative AI** is a newer field focused on creating new content, such as images, text, or music.

Algorithms and AI

Algorithms are the core of Artificial Intelligence (AI), acting as the step-by-step instructions that enable AI systems to perform tasks. When we talk about evaluating AI's effectiveness, we are fundamentally talking about assessing the performance of these underlying algorithms. In fact, many standard AI measurement tests, like those used to determine the accuracy of a facial recognition system or the fluency of a language model, are themselves sophisticated algorithms designed to compare an AI's output against a known correct answer or a set of performance benchmarks.

Algorithms are crucial for enhancing the effectiveness of AI. Advanced algorithms allow AI systems to learn more efficiently from vast amounts of data, recognize complex patterns, and make more accurate predictions or decisions. For example, machine learning algorithms like neural networks enable AI to "learn" human-like behaviors such as understanding speech or identifying objects in images. The continuous development of more refined algorithms, such as those used in deep learning and generative AI, allows AI to not only process information but also to create new content that models human creativity, pushing the boundaries of what computers can do to imitate and even extend human capabilities. This constant algorithmic improvement is key to AI's ongoing ability to mimic and, in some cases, surpass human performance in various domains.

Critical Thinking Questions

1. The Turing Test was an early way to check if AI was intelligent.²⁵ Given today's advanced AI, like chat programs, do you think this test is still good enough? What new tests would be better for AI now, and why?
2. Choose one major use of AI (medicine, space, or cars). Describe a specific problem that AI solves in that area. Then, consider any ethical concerns or potential risks to society as AI becomes more common in that field.
3. Predictive AI uses old information to make guesses about the future.²⁶ How could unfairness or mistakes in that old information lead to wrong or biased predictions when AI is used for things that affect people's lives, such as getting a loan, a job, or being involved in the justice system? What steps could be taken to correct these biases and ensure fairness?

Questions (5)

1. In 1950, Alan Turing proposed a test where a human judge converses with a human and a machine. If the judge cannot tell them apart, the machine passes. What is this test called?

MULTIPLE CHOICE

Choose the correct answer:

- A. The Winograd Schema Challenge
- B. The ImageNet Test
- C. The Turing Test
- D. The GLUE Benchmark

2. Modern AI tests go beyond simple conversation. Which of the following tests specifically evaluates an AI's common sense understanding?

MULTIPLE CHOICE

Choose the correct answer:

- A. Turing Test
- B. Winograd Schema Challenge
- C. ImageNet
- D. GLUE

3. In the field of medicine, how does AI and Machine Learning primarily assist doctors in diagnosing diseases?

MULTIPLE CHOICE

Choose the correct answer:

- A. By conducting surgeries autonomously without human supervision.
- B. By replacing human doctors entirely in patient consultations.
- C. By analyzing medical images to help detect diseases earlier and more accurately.
- D. By predicting which patients will not recover from an illness.

4. A company uses AI to analyze historical sales data and current market trends to forecast future product demand, allowing them to optimize production schedules. What type of AI is being utilized here?

MULTIPLE CHOICE

Choose the correct answer:

- A. Conversational AI
- B. Generative AI
- C. Predictive AI
- D. Robotic Process Automation (RPA)

5. Robots are deployed to explore a radiation-contaminated zone after a nuclear incident, collecting data that would be too dangerous for humans to gather. This is an example of robots addressing which type of human challenge?

MULTIPLE CHOICE

Choose the correct answer:

- A. Repetitive tasks
- B. Dirty tasks
- C. Dangerous tasks
- D. Complex tasks (requiring high precision)

Answer Keys & Solutions

Questions

1. In 1950, Alan Turing proposed a test where a human judge converses with a human and a machine. If the judge cannot tell them apart, the machine passes. What is this test called?

MULTIPLE CHOICE

Correct Answer:

- | | |
|----------------------------------|-------------|
| A. The Winograd Schema Challenge | ✗ Incorrect |
| B. The ImageNet Test | ✗ Incorrect |
| C. The Turing Test | ✓ Correct |
| D. The GLUE Benchmark | ✗ Incorrect |

Explanation:

Recall the foundational test for machine intelligence named after its creator.

2. Modern AI tests go beyond simple conversation. Which of the following tests specifically evaluates an AI's common sense understanding?

MULTIPLE CHOICE

Correct Answer:

- | | |
|------------------------------|-------------|
| A. Turing Test | ✗ Incorrect |
| B. Winograd Schema Challenge | ✓ Correct |
| C. ImageNet | ✗ Incorrect |
| D. GLUE | ✗ Incorrect |

Explanation:

Look for the test that focuses on nuanced language understanding requiring common sense.

3. In the field of medicine, how does AI and Machine Learning primarily assist doctors in diagnosing diseases?

MULTIPLE CHOICE

Correct Answer:

- A. By conducting surgeries autonomously without human supervision. ✗ Incorrect
- B. By replacing human doctors entirely in patient consultations. ✗ Incorrect
- C. By analyzing medical images to help detect diseases earlier and more accurately. ✓ Correct
- D. By predicting which patients will not recover from an illness. ✗ Incorrect

Explanation:

Think about how AI processes visual data in healthcare.

4. A company uses AI to analyze historical sales data and current market trends to forecast future product demand, allowing them to optimize production schedules. What type of AI is being utilized here?

MULTIPLE CHOICE

Correct Answer:

- A. Conversational AI ✗ Incorrect
- B. Generative AI ✗ Incorrect
- C. Predictive AI ✓ Correct
- D. Robotic Process Automation (RPA) ✗ Incorrect

Explanation:

Think about AI that uses past data to make educated guesses about the future.

5. Robots are deployed to explore a radiation-contaminated zone after a nuclear incident, collecting data that would be too dangerous for humans to gather. This is an example of robots addressing which type of human challenge?

MULTIPLE CHOICE

Correct Answer:

- A. Repetitive tasks ✗ Incorrect

B. Dirty tasks

✗ Incorrect

C. Dangerous tasks

✓ Correct

D. Complex tasks (requiring high precision)

✗ Incorrect