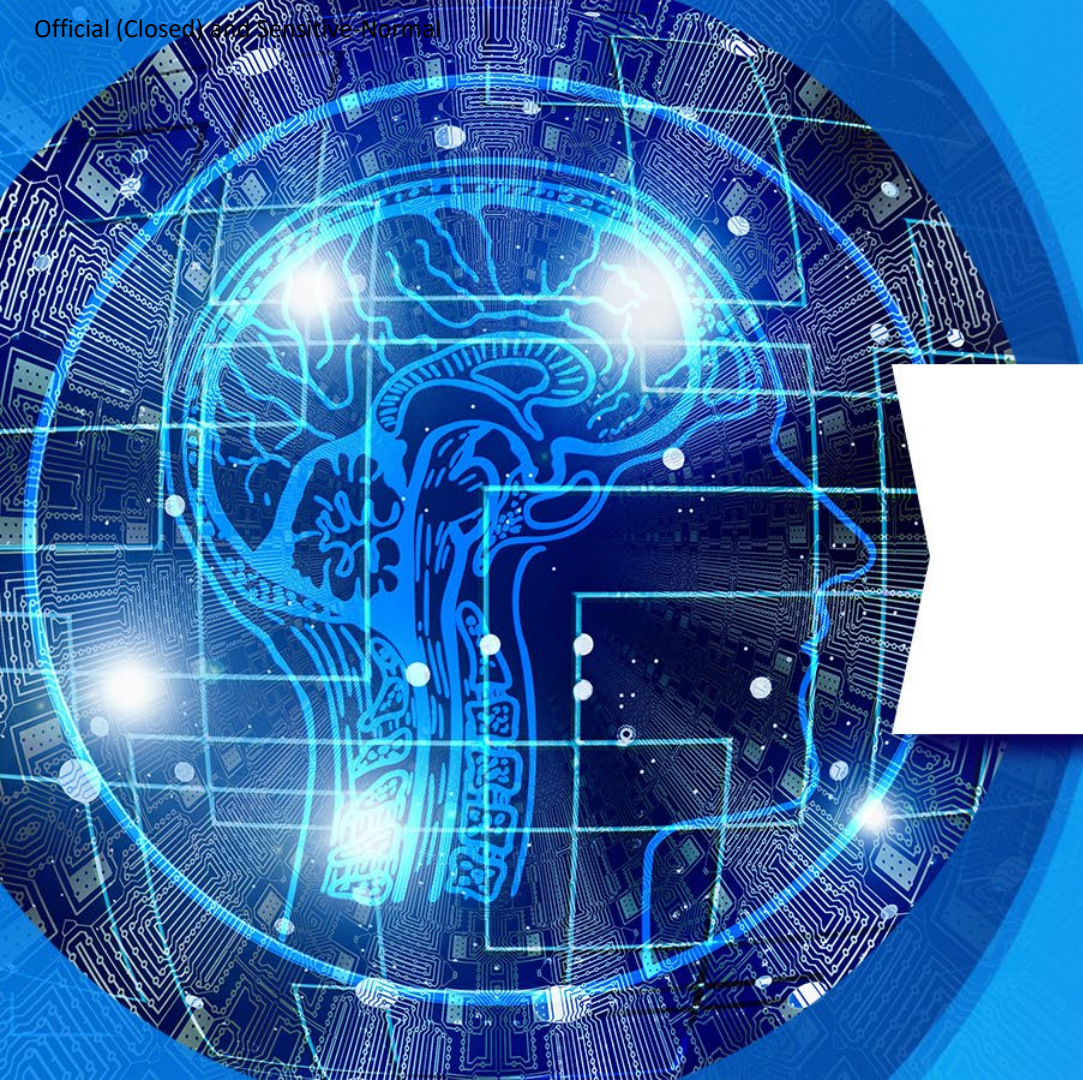

NANYANG
THE INNOVATIVE POLYTECHNIC

Introduction to Artificial Intelligence and Machine Learning

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Introduction to Artificial Intelligence and Machine Learning

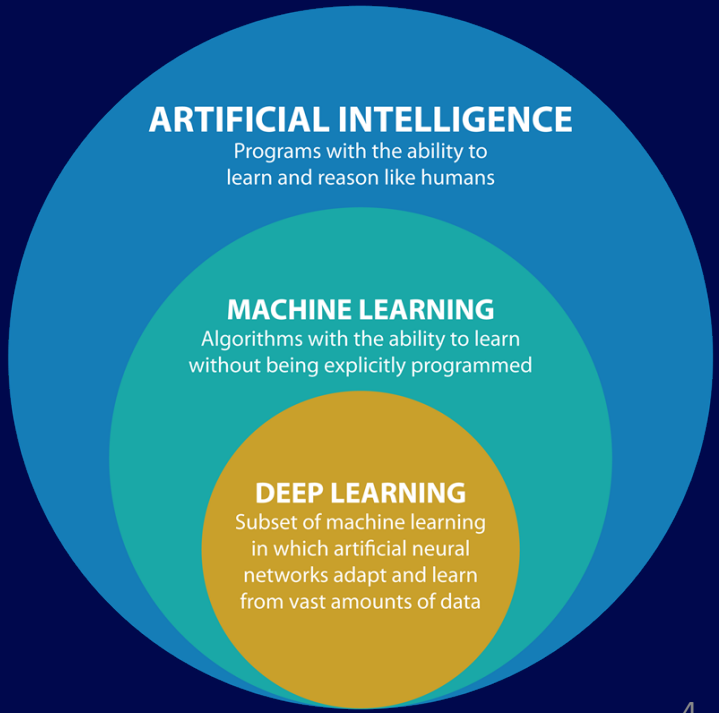
Outline

1 What is Artificial Intelligence (AI)

2 What is Machine Learning (ML)

3 What is Deep Learning (DL)

4 Applications of AI and ML



1 What is AI

Definition of AI

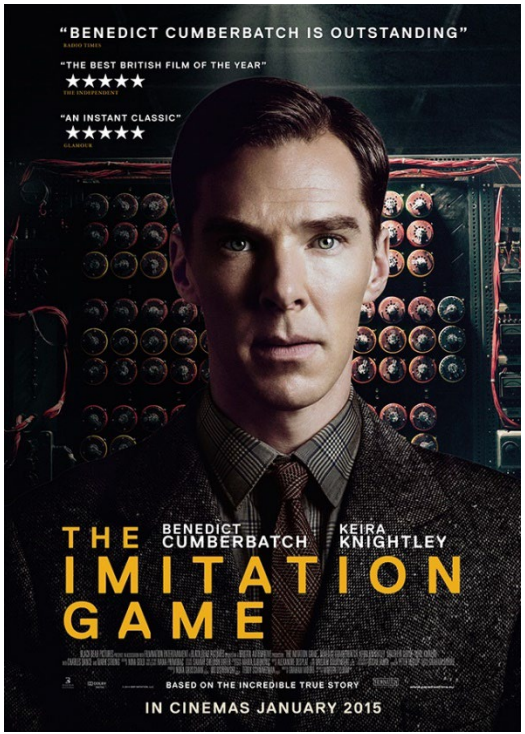
Artificial Intelligence is the ability of a program or machine to think and behave like a human.

Turing Test

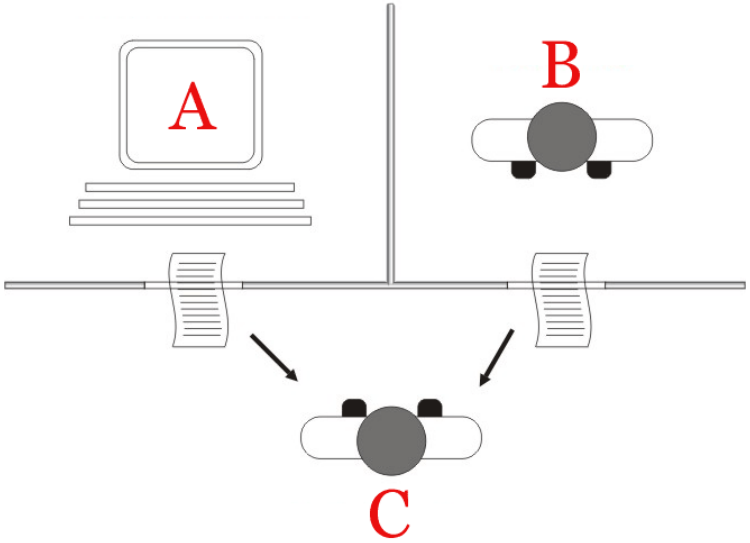
A machine is said to pass the Turing Test when it exhibits behaviour that is indistinguishable from that of a human.

Alan Turing (1912–1954)

The Turing Test



A computer passes the test if a human interrogator, after posing some written questions, cannot tell whether the written responses come from a person or from a computer



Artificial Intelligence - The **Turing test**, developed by Alan Turing in 1950

History of AI

Workshop on AI at Dartmouth College

"… every aspect of learning or any other feature of intelligence can be so precisely described that machine can be made to simulate it."

- John McCarthy

Knowledge engineering
Expert systems
Computer vision
Natural language understanding
Lisp machines
Japan's fifth generation computer project

Microsoft released the first individual intelligent assistant Microsft Cortana in the world.

Watson won Jeopardy game

Deep Blue beat world chess champion

Google BERT

ChatGPT

AlphaGo won Go champion

Generative AI

The golden years | First AI winter | AI boom | Second AI winter | AI renaissance | AI revolution ……

1943 | 1956 | 1974 | 1980 | 1987 | 1993 | 1997 | 2011 | 2016 | 2020 | 2023 …

Artificial neurons (McCullouch and Pitts)

Symbolic processing
Formal representation (logic, …)
Reasoning, inference
Search and problem solving
Connectionism (neural networks)

… within a generation the problem of creating artificial intelligence will be substantially solved.

- Marvin Minsky

Data mining
knowledge discovery
Machine learning
Cognitive computing
Mathematical/statistical methods
Supercomputers

Big data
Data analytics
Massively distributed computing
Big data distributed databases
Cloud
IOT

AI Resurgence

Computing performance & Cloud

IOT

Big data

Internet technologies & Social Media

\+

AI / Machine Learning

Advanced data analytics

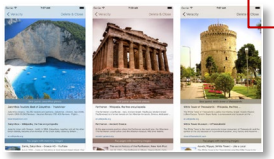
Deep learning

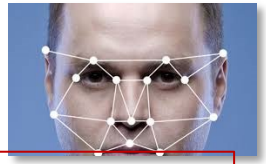
Deep neural networks

BIG DATA, HIGH-PERFORMANCE COMPUTING AND CLOUD, HAS TRANSFORMED AI

AI is All Around Us

Image search





Facial recognition

Smart IoT devices

Self-driving vehicles

Recommendation engines

Spam filters

First chess, then Jeopardy, then Go. Now poker too has fallen to AI

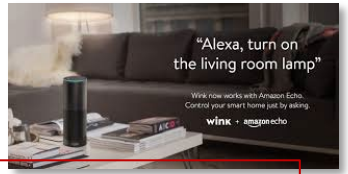
Gemini

Meta

Drones, UAV

ChatGPT

Generative AI



Virtual smart assistants

Language translation

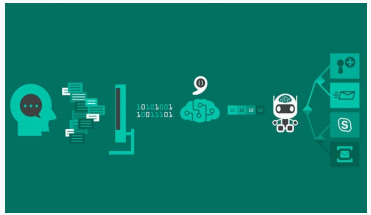
Chatbots

Robo-advisors

AI Technologies

Computer vision: a science of how to make computers "see"

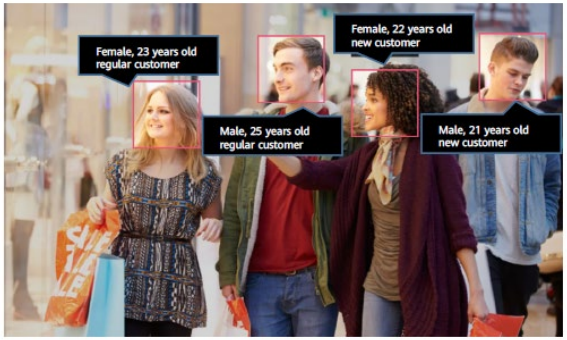
Speech processing: a general term for various processing technologies used to research the voicing process, statistical features of speech signals, speech recognition, machine-based speech synthesis, and speech perception



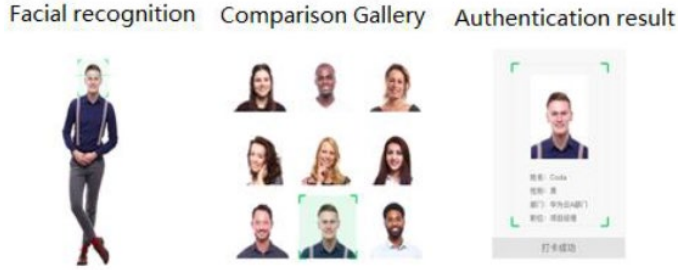
Natural language processing (NLP) and Large Language Model (LLM): is the use computer technologies to understand and process human language for a range of applications, including machine translation, sentiment analysis, and text analytics.

Generative AI generate new, unique data samples that are similar to the examples it was trained on such as images.

Computer Vision

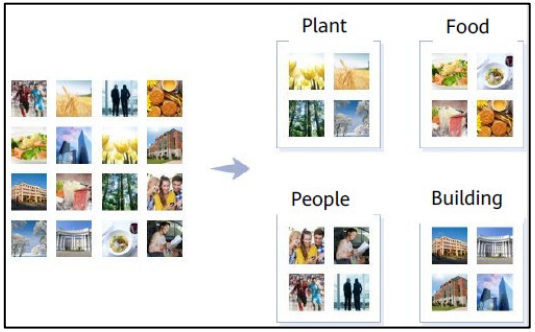


Traffic Analysis



Electronic Attendance

Common applications include image classification, target detection, image segmentation, target tracking, optical character recognition (OCR), and facial recognition.



Smart Album

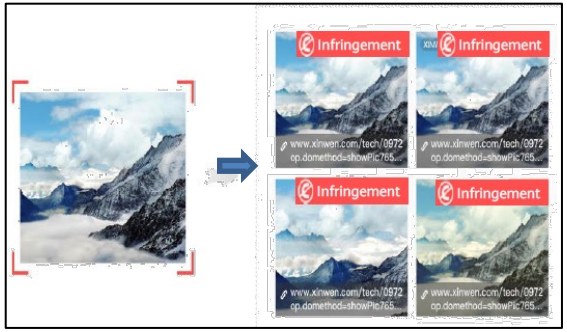
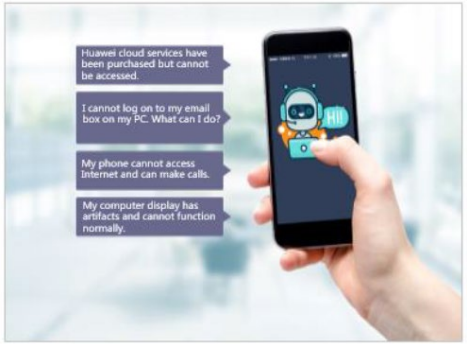


Image Search

Authentication

Action Analysis

Voice/Speech Processing



Question Answering Bot (QABot)

Voice Navigation

Common applications include voice recognition, voice synthesis, voice wakeup, voiceprint recognition, and audio-based incident detection.

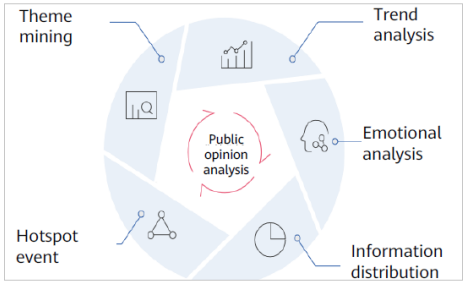
Intelligent Education

Other applications:

- Spoken language evaluation
- Diagnostic robot
- Voiceprint recognition
- Smart sound box
- …

Real-time Conference Records

Natural Language Processing & Large Language Models

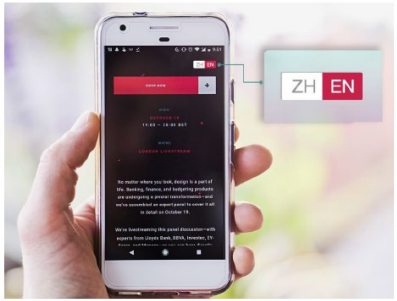


Public Opinion Analysis

Evaluation Analysis

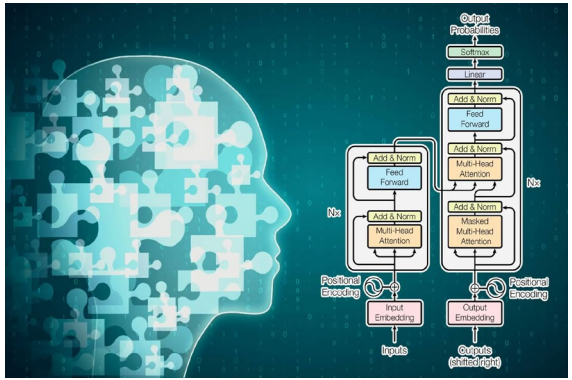
Text Classification

Chatbots



Machine Translation

Common applications include machine translation, text mining, content creation, chatbot, text summarization, and sentiment analysis.



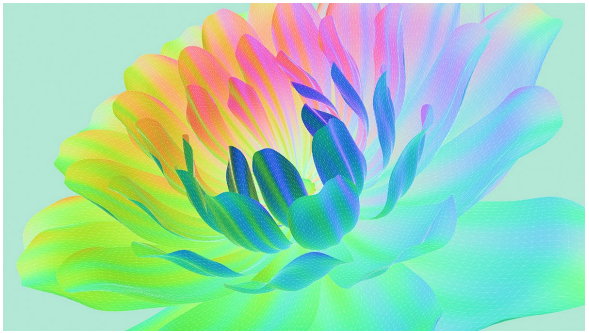
Large Language Model

- Text Generation
- Summarization
- Coding
- Translation
- Chatbots

Generative AI

Video Generation
Google's Imagen video (https://imagen.research.google/video/) can produce short high-definition video clips using a similar technique to the one it uses to make images. (Photo by Google AI)

Data Augmentation



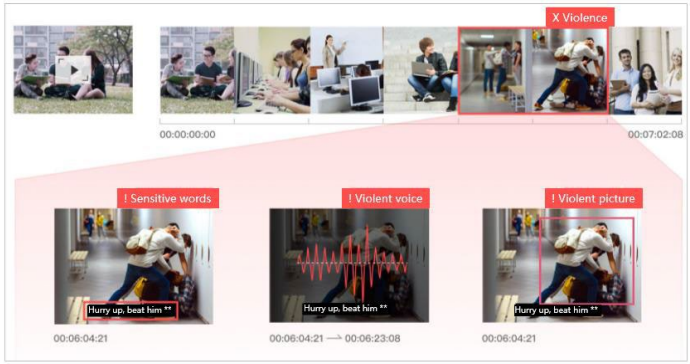
Art Generation

AI-Generated Music

AI Application Fields- Security

Application scenarios:

- **Police use**: suspect identification, vehicle analysis, suspect tracking, suspect search and comparison, and access control at key places
- **Civil use**: facial recognition, warning against potential danger, and home protective measure deployment



Intelligent Security / Security Protection

Face recognition identifying criminals

AI Application Fields - Retail

Unmanned supermarkets of Amazon and Alibaba, use sensors, cameras, computer vision, and deep learning algorithms to completely cancel the checkout process, allowing customers to pick up goods and "just walk out".

Unmanned Store: Amazon Go

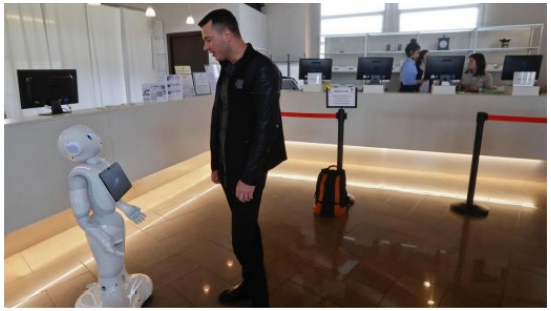
Unmanned store : Alibaba

AI Application Fields – Hospitality and Smart Hotel/Home

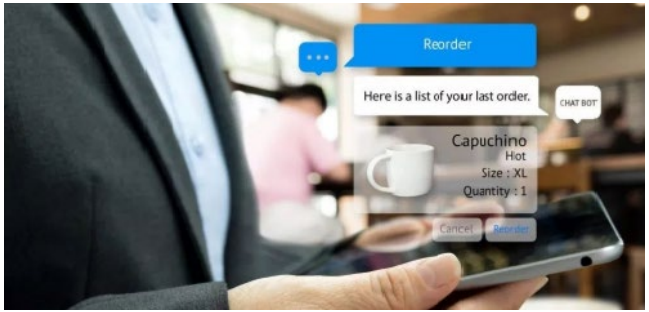
Control smart home products with voice processing such as air conditioning temperature adjustment, curtain switch control, and voice control on the lighting system.

Implement **home security protection**with computer vision technologies, for example, facial or fingerprint recognition for unlocking, real-time intelligent camera monitoring, and illegal intrusion detection.

Develop user profiles and recommend content to users with the help of machine learning and deep learning technologies and based on historical records of smart speakers and smart TVs.

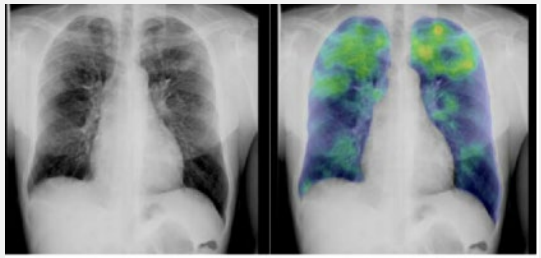


Frontdesk Robots

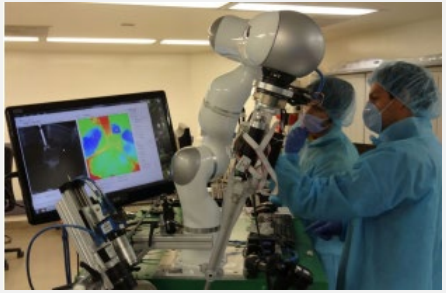


Chatbot for hotel/services

AI Application Fields – Healthcare

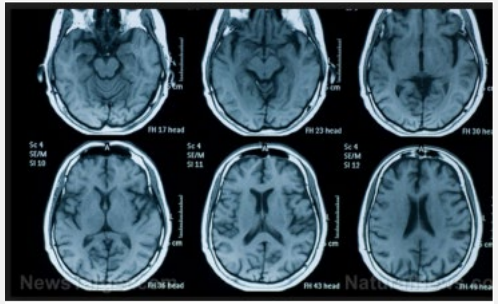


Identifying tuberculosis



Robotics-assisted surgery

Detecting brain bleeds

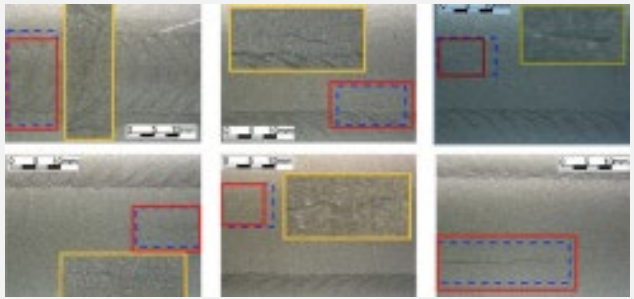


Detecting Alzheimer's disease

Other applications:

Medicine mining: quick development of personalized medicines by AI assistants
Health management: nutrition, and physical/mental health management
Hospital management: structured services concerning medical records (focus)
Assistance for medical research: assistance for biomedical researchers in research
Virtual assistant: electronic voice medical records, intelligent guidance, intelligent diagnosis, and medicine recommendation
Medical image: medical image recognition, image marking, and 3D image reconstruction
Assistance for diagnosis and treatment: diagnostic robot
Disease risk forecast: disease risk forecast based on gene sequencing

AI Application Fields – Smart Manufacturing



Defect Detection

AI in Pharmaceutical Manufacturing Process

Robots in Mfg

AI Robots in Amazon's Warehouse

AI Application Fields – Auto Industry

Automatic Vehicle Insurance and Loss Assessment

AI technologies help insurance companies optimize vehicle insurance claims and complete vehicle insurance loss assessment using deep learning algorithms such as image recognition.

Autonomous Driving

The Society of Automotive Engineers (SAE) in the U.S. defines 6 levels of driving automation ranging from 0 (fully manual) to 5 (fully autonomous). L0 indicates that the driving of a vehicle completely depends on the driver's operation. The system above L3 can implement the driver's hand-off operation in specific cases, L5 depends on the system when vehicles are driving in all scenarios.

Currently, only some commercial passenger vehicle models, such as Audi A8, Tesla, and Cadillac, support L2 and L3 Advanced driver-assistance systems (ADAS). L4 and L5 autonomous driving is expected to be first implemented on commercial vehicles in closed campuses. A wider range of passenger vehicles require advanced autonomous driving, which requires further improvement of technologies, policies, and infrastructure. It is estimated that L4 and L5 autonomous driving will be supported by common roads in 2025–2030.

Quiz

What is the Turing test?

A. A test to determine whether a machine can exhibit human-like intelligence
B. A test to determine whether a machine can understand natural language
C. A test to determine whether a machine can learn from data
D. A test to determine whether a machine can generate data

Quiz

Which of the following is NOT an example of AI?

A. Use of computer vision to do away with the grocery checkout process
B. Sorting department store items by bar code
C. Identifying tuberculosis in an x-ray image based
D. Recommend movies based on users' watching history

Quiz

Which of the following is NOT an application example of Large Language Models (LLMs)?

A. Chatbots
B. Code generation
C. Generate music
D. Text summarization

Discussion Question

- How could artificial intelligence transform your industry, and what are some concrete examples of its potential applications and impacts?

End of Chapter 1