



Posts and Telecommunication Institute of Technology  
Faculty of Information Technology 1

## Introduction to Artificial Intelligence

### Introduction

Ngo Xuan Bach



# What can AI do? (1 / 14)

## Web page ranking (Information Retrieval-IR)



A screenshot of a Google search results page. In the top left corner is the traditional red Chinese-style Google logo. The search query "artificial intelligence" is entered into the search bar. Below the search bar are navigation links for "All", "Images", "News", "Videos", "Books", "More", and "Tools". A message indicates "About 695,000,000 results (0.57 seconds)".

Artificial intelligence is **the simulation of human intelligence processes by machines**, especially computer systems. Specific applications of AI include expert systems, natural language processing, speech recognition and machine vision.

<https://searchenterpriseai.techtarget.com/definition/AI-...>

**What is artificial intelligence (AI)? - AI definition and how it works**



# What can AI do? (2 / 14)

## Machine Translation (MT)

≡ Google Translate

Text Documents

Detect Language English Vietnamese Spanish ▾ VIETNAMESE ENGLISH SPANISH ▾

Artificial intelligence (AI) is intelligence demonstrated by machines, as opposed to the natural intelligence displayed by humans or animals. Leading AI textbooks define the field as the study of "intelligent agents": any system that perceives its environment and takes actions that maximize its chance of achieving its goals. Some popular accounts use the term "artificial intelligence" to describe machines that mimic "cognitive" functions that humans associate with the human mind, such as "learning" and "problem solving".

X Trí tuệ nhân tạo (AI) là trí thông minh được thể hiện bởi máy móc, trái ngược với trí thông minh tự nhiên được hiển thị bởi con người hoặc động vật. Các sách giáo khoa hàng đầu về AI định nghĩa lĩnh vực này là nghiên cứu về "tác nhân thông minh": bất kỳ hệ thống nào nhận thức được môi trường của nó và thực hiện các hành động nhằm tối đa hóa cơ hội đạt được mục tiêu của nó. Một số tài khoản phổ biến sử dụng thuật ngữ "trí tuệ nhân tạo" để mô tả các máy móc bắt chước các chức năng "nhận thức" mà con người liên kết với tâm trí con người, chẳng hạn như "học tập" và "giải quyết vấn đề".

Microphone Speaker X Microphone Speaker

527 / 5000

http://www.ptit.edu.vn

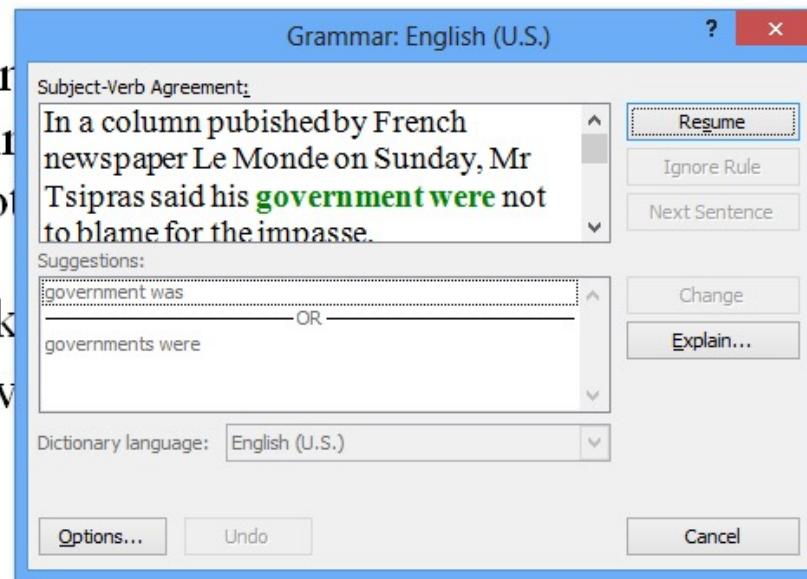
# What can AI do? (3 / 14)

## Grammar and Spelling Check

In a column published by French newspaper Le Monde on Sunday, Mr Tsipras said his government were not to blame for the impasse.

"It is due to the insistence of the French government and displaying the Greek people," he wrote.

After the meeting, a spokesman for the quintet agreed to work in "close contact".



# What can AI do? (4 / 14)

Automatic Speech Recognition (ASR)  
Speech to Text (STT)



# What can AI do? (5/14)

Speech Synthesis - Text to Speech (TTS)



**Watson™** Text to Speech / Text to Speech Demo

<https://text-to-speech-demo.mybluemix.net/>

**DÂN TRÍ**

Hà Nội siết chặt việc đi lại, yêu cầu thêm các loại giấy tờ khi ra đường



0:00/0:00



Phía Bắc ▾

# What can AI do? (6/14)

## Question Answering (QA)



# What can AI do? (7 / 14)

## Chatbot



### Intents

An intent performs an action in response to natural language user input

### Utterances

Spoken or typed phrases that invoke your intent

### Slots

Slots are input data required to fulfill the intent

### Fulfillment

Fulfillment mechanism for your intent

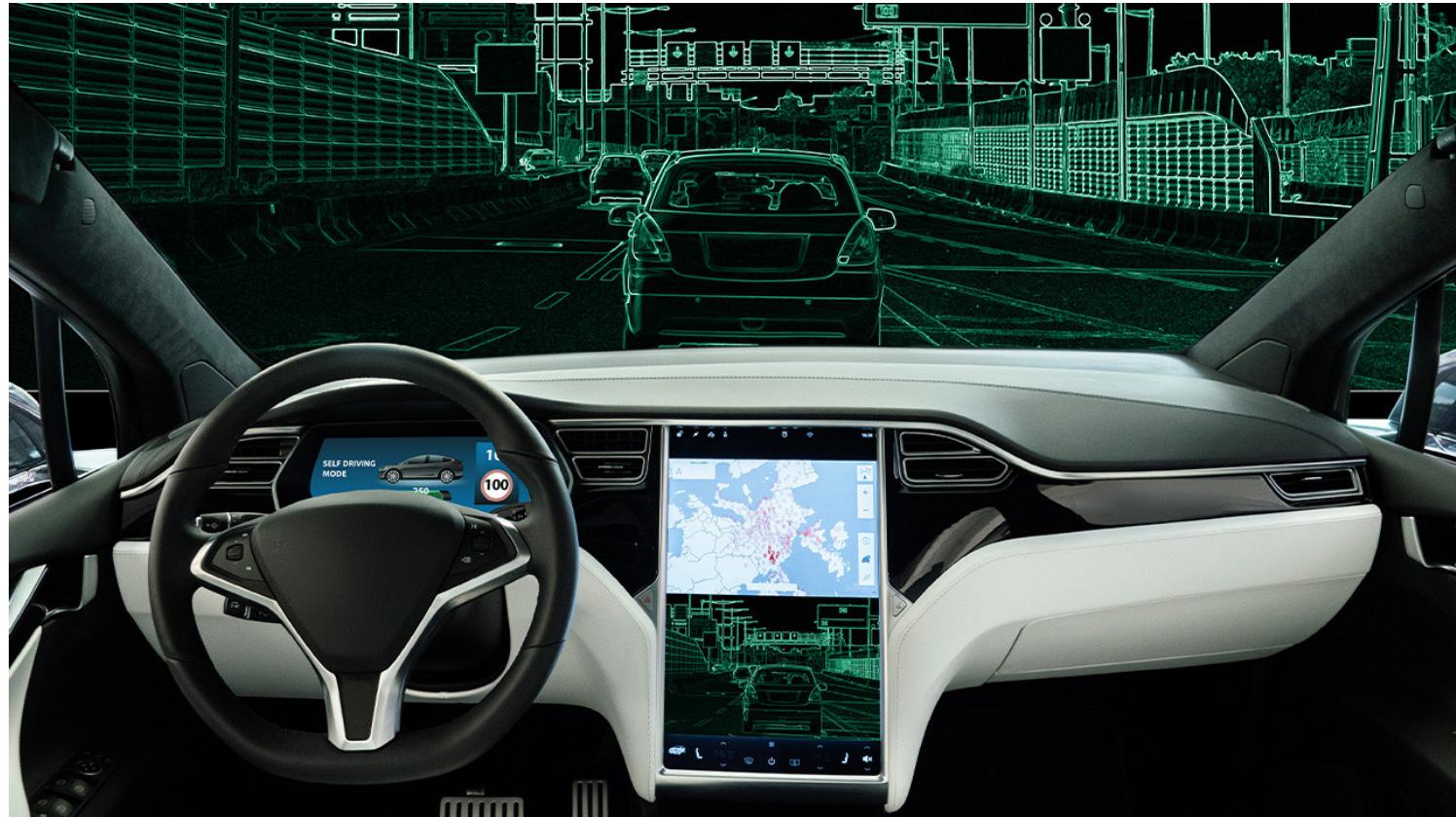
# What can AI do? (8 / 14)

## Face Detection & Recognition



# What can AI do? (9 / 14)

## Autonomous/Self-Driving/Driverless Cars



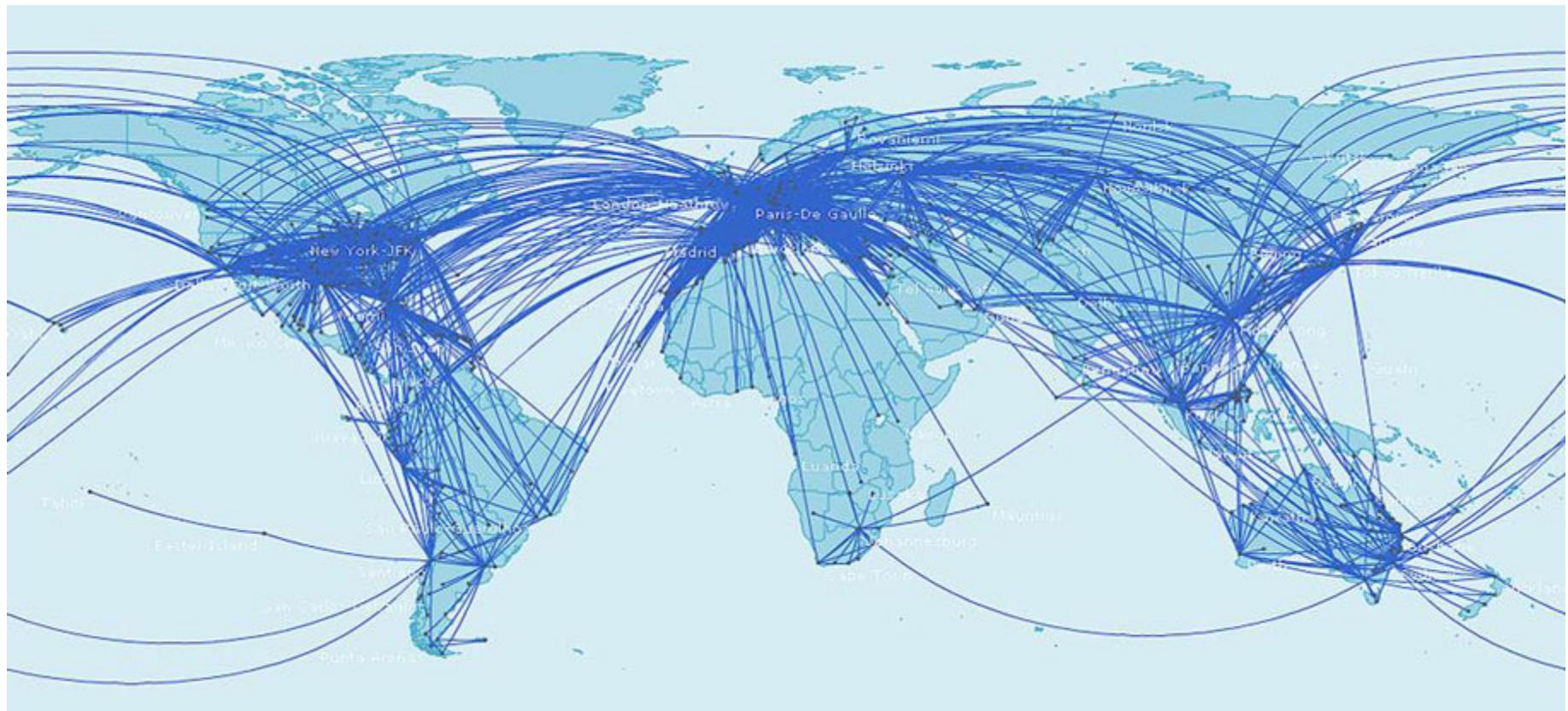
# What can AI do? (10 / 14)

## Recommender Systems



# What can AI do? (11 / 14)

## Planning



# What can AI do? (12/14)

## Robotics



# What can AI do? (13 / 14)

## AI and Games



- ▶ Chess: 1997 (Deep Blue of IBM)
- ▶ Go: 2016 (AlphaGo of Google)
- ▶ Poker: 2017 (Poker Computer of CMU)



# What can AI do? (14/14)

and many other applications

...

- Web search
- Speech recognition
- Handwriting recognition
- Machine translation
- Information extraction
- Document summarization
- Question answering
- Spelling correction
- Image recognition
- 3D scene reconstruction
- Human activity recognition
- Autonomous driving
- Music information retrieval
- Automatic composition
- Social network analysis

...

...

- Product recommendation
- Advertisement placement
- Smart-grid energy optimization
- Household robotics
- Robotic surgery
- Robot exploration
- Spam filtering
- Fraud detection
- Fault diagnostics
- AI for video games
- Character animation
- Financial trading
- Protein folding
- Medical diagnosis
- Medical imaging

...

(Liang, 2013)

# What is AI?

- ▶ A subfield of computer science that aims to create **intelligent entities**
  - What is an intelligent entity?

Thinking humanly	Thinking rationally
Acting humanly	Acting rationally

# A brief history of AI (1 / 3)

## ▶ Before the beginning (1943-1955)

- No concept/definition of AI; some research results related to AI
  - 1943: the first artificial neural network model
  - 1950: Alan Turing published a paper about machine intelligence, Turing test, machine learning, genetic algorithm, and reinforcement learning

## ▶ The birth of AI (1956)

- Ten scientists led by John McCarthy organized a two-month workshop at Dartmouth university that laid the first foundation and official name of AI

## ▶ The beginning stage (1952-1969)

- Some programs had the ability to prove mathematical theorems in a way similar to human thinking
- Some game programs had the ability to learn and beat amateur players
- 1958: John McCarthy proposed LISP language
- Artificial neural networks had some new achievements



## A brief history of AI (2/3)

- ▶ **Knowledge-based systems (1969-1979)**
  - Focus on using a lot of knowledge and information specific to the narrow field to solve the problem
    - DENDRAL (1967): Expert system for predicting molecular structures
    - MYCIN (1974): Expert system for predicting blood infections
    - Machine translation systems use knowledge to understand natural language
- ▶ **AI has commercial products (1980-now)**
  - Expert systems were commercialized, especially in the period 1980-1988
  - The return of the artificial neural networks, especially in the last 10 years, deep networks are receiving special attention



# A brief history of AI (3/3)

- ▶ AI becomes a science (1987-now)
  - AI has its own research methods, following the general requirements for scientific research methods
- ▶ AI winters
  - Periods of reduced funding and interest in AI research (1974 – 1980 and 1987 – 1993)
- ▶ Machine learning and Big data (2001-now)
  - The generated digitized data increases very rapidly
  - Many studies show that using the right data is more important than building complex algorithms
  - Big data: volume, variety, velocity (3V)
  - Deep learning (2011-now)

# AI research areas (1/2)

- ▶ A complete AI system usually has the following capabilities:
  - **Perception**
    - The system has a mechanism to receive information from the environment (camera, sensor, ...)
  - **Reasoning/Inference**
    - The system is capable of making conclusions about actions based on information obtained from the environment and internal knowledge
  - **Action**
    - The system is capable of reacting the environment (taking action or giving information)

# AI research areas (2/2)

- ▶ Perception
  - Computer vision
  - Natural language processing
- ▶ Reasoning/inference
  - Knowledge representation
  - Search
  - Reasoning/Inference
  - Machine learning
  - Planning
- ▶ Action
  - Robotics



# Course outline

- ▶ Part 1: Solving problems by searching
  - Uninformed search (blind search)
  - Informed search (heuristic search)
  - Local search
- ▶ Part 2: Knowledge representation and reasoning
  - Propositional logic
  - Predicate logic (First-order logic)
- ▶ Part 3: Probabilistic inference
  - Bayesian networks
- ▶ Part 4: Machine learning
  - Decision trees
  - Naïve Bayes classification
  - Example-based learning (KNN)

# Course information

## ▶ Lecturer

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## ▶ References

- Từ Minh Phương. Giáo trình Nhập môn trí tuệ nhân tạo. Nhà xuất bản Thông tin và truyền thông, 2016.
- Đinh Mạnh Tường. Trí tuệ nhân tạo. Nhà xuất bản Khoa học kỹ thuật. 2002.
- S. Russell, P. Norvig. Artificial intelligence: a modern approach. 3rd edition. Prentice Hall. 2010.

## ▶ Assessment

- Attendance (10%)
- Exercises (10%)
- Mid-term exam (10%)
- Final exam (70%)

Missing any component point or missing more than 20% of lectures will not be able to take part in the final exam!!!