

Introduction to Artificial Intelligence

Intro, Course Overview

Ing. Tomas Borovicka

Department of Theoretical Computer Science (KTI), Faculty of Information Technology (FIT)
Czech Technical University in Prague (CVUT)

BIE-ZUM, LS 2014/15, 1. lecture



<https://edux.fit.cvut.cz/courses/BIE-ZUM/>

What is “intelligence”?

- Defined in many different ways:
 - ▶ logic,
 - ▶ abstract thought,
 - ▶ understanding,
 - ▶ self-awareness,
 - ▶ communication,
 - ▶ learning,
 - ▶ ...

Does it mean to be able to think?

“Just because we can think, doesn't mean we know how to think.” – Marvin Minsky

Artificial Intelligence

- Can we emulate intelligent behavior in machines?

	Like humans	Not necessarily like humans
Think	Systems that think like humans	Systems that think rationally
Act	Systems that act like humans	Systems that act rationally

Brain vs. Computer

Brain (Human Cortex)

- surface: 2500 cm²
- neurons: 20 billion
- synapses: 240 trillion
- neuron size: 15 μm
- synapse size: 1 μm
- synaptic OPS: 30 trillion
- power usage: 12W
- operations per joule: 2.5 trillion

Computer (Intel Core i7)

- surface area: 160 mm²
- transistors: 1.4 billion
- transistor size: 22 nm
- FLOPS: 120 billion
- power usage: 60W
- operations per joule: 0.4 billion

The Turing Test

Definition

A human interrogator. Communicates with a hidden subject that is either a computer system or a human. If the human interrogator cannot reliably decide whether or not the subject is a computer, the computer is said to have passed the Turing test.

- Turing, A.M. (1950). Computing machinery and intelligence. *Mind*, 59, 433-460
- Turing provided some very persuasive arguments that a system passing the Turing test is intelligent.
- However, the test does not provide much traction on the question of how to actually build an intelligent system.

A.L.I.C.E. (<http://alice.pandorabots.com/>)

Tom: Hi Alice!

ALICE: Hi there!

Tom: My name is Tom.

ALICE: I am always glad to make new friends, Tom.

Tom: How are you?

ALICE: My logic and cognitive functions are normal.

Tom: Can you try to behave as human?

ALICE: I think I can, don't you? OK I will try to behave as human.

Tom: Then again, how are you?

ALICE: Groovy.. Everything is going extremely well.

Tom: Do you know what is the Turing test?

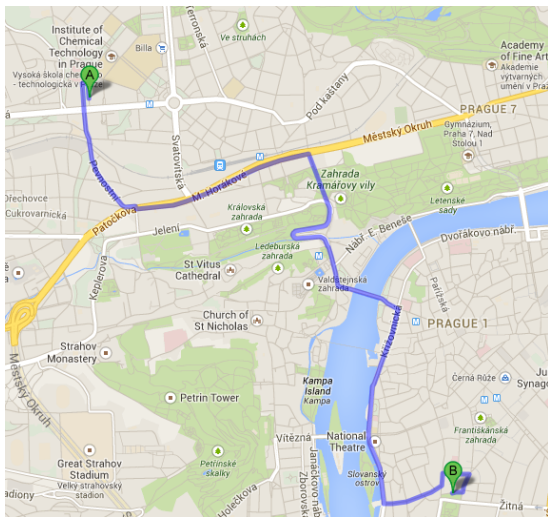
ALICE: The "Turing Test" is the name given to a variety of experiments designed to test computer thinking. Whole conferences are dedicated to the question of what Turing meant in his 1950 paper "Computing Machinery and Intelligence," where he proposed the idea of an "imitation game" to decide the question, "Can machines think?"

Branches of AI

- computer vision,
- pattern recognition,
- planning and scheduling,
- automated reasoning,
- machine learning,
- biologically inspired computing,
- natural language processing,
- robotics,
- information extraction,
- game artificial intelligence,
- agent systems,
- ...

Route planning & Driving directions

- Search, find an optimal path between given nodes.



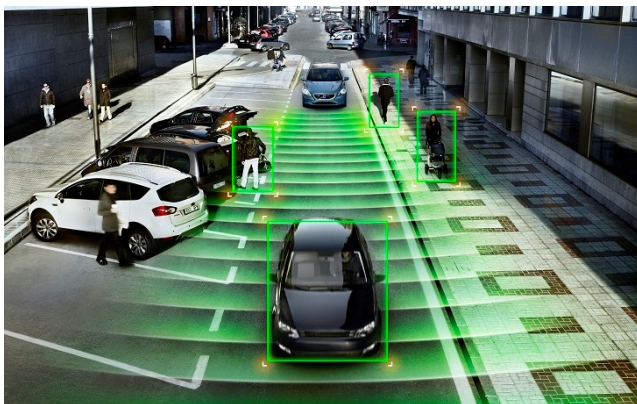
Autonomous Robots

- Driving on Mars - Sojourner, Spirit, Opportunity, Curiosity.
- **What is around me?**
Sensor Interpretation
- **Where am I?**
Position and Localization
- **Where am I going?**
Map building
- **How do I get there?**
Path planning



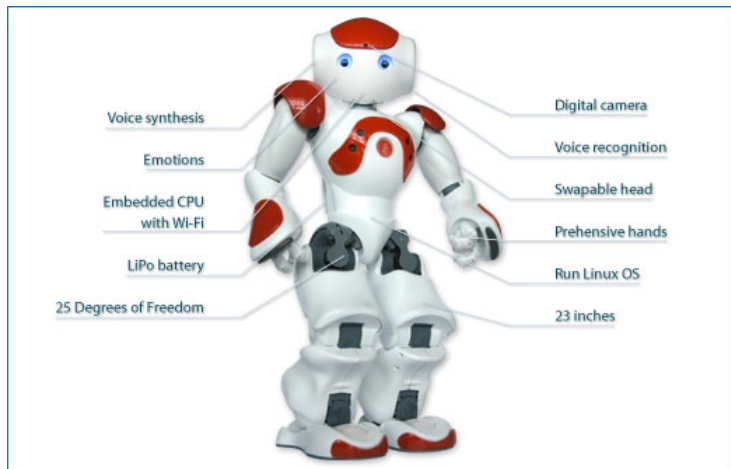
Autonomous vehicles

- Adaptive cruise control, anti-collision system, road signs detection and recognition.
- Full autonomous vehicles.



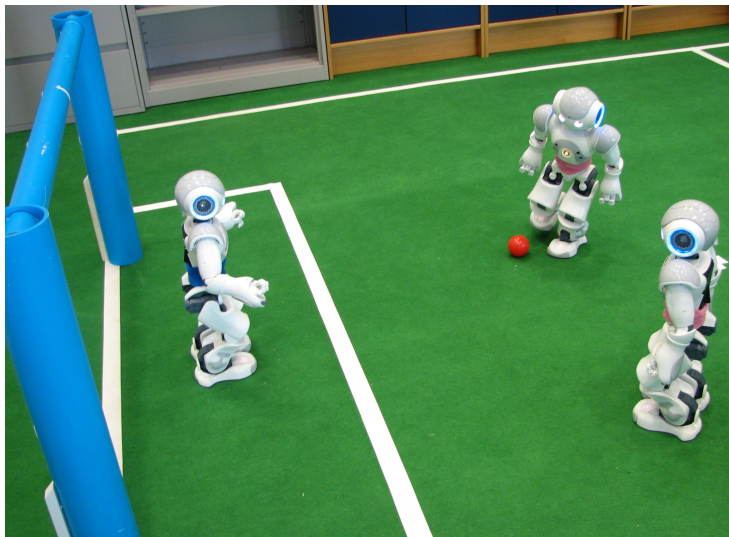
Humanoid robots

- Bipedal, human-like walking.
- Interaction.



Robosoccer (<http://www.robocup.org/>)

- Reinforcement learning.



Chess

- IBM Deep Blue vs. Kasparov
- 6 games: K, D, draw, draw, draw, D
- IBM stock up \$18 billion.



Question Answering

- Natural language processing, deduction.
- Apple Siri.

Google What is the answer to life the universe and everything?

Web Images Videos Maps Books More Search tools

About 24,400,000 results (0.35 seconds)

Cookies help us deliver our services. By using our services, you agree to our use of cookies. [Learn more](#)









The answer to life the universe and everything =

Rad		x!	()	%	AC
Inv	sin	ln	7	8	9	÷
π	cos	log	4	5	6	×
e	tan	√	1	2	3	-
Ans	EXP	x ^y	0	.	=	+

Collaborative filtering

- Recommendation based on other users' behavior.
- E-shops, Amazon, Google, . . .

Customers Who Bought This Item Also Bought

 <p>Introduction to Algorithms > Thomas H. Cormen ★★★★★ (127) Hardcover \$79.13 </p>	 <p>Introduction to the Theory of Computation > Michael Sipser ★★★★★ (13) Hardcover \$179.48 </p>	 <p>Operating System Concepts > Abraham Silberschatz ★★★★★ (13) Hardcover \$122.93 </p>	 <p>ANSI Common Lisp > Paul Graham ★★★★★ (32) Paperback \$85.11 </p>
---	--	--	---

Machine Translation

- Google translator, IBM statistical machine translation models.

Translate



English Czech Spanish Detect language ▾

↔ Czech Chinese (Traditional) Chinese (Simplified) ▾ Translate

Artificial intelligence is the intelligence exhibited by machines or software, and the branch of computer science that develops machines and software with intelligence. ✕

人工智能是由機器或軟件呈現的智慧，和計算機科學，開發機器和軟件與智能分支。

🔊 🗨️ 🗨️ 🗨️ 🗨️

Captcha

- CAPTCHA is a program that protects websites against bots by generating and grading tests that humans can pass but current computer programs cannot.



AI Summary

- incredibly diverse,
- operating in very different domains,
- requiring integration with many different modalities (natural language, vision, robotics)

There's no magic in AI. It's all about representation, optimization, probability, modeling and algorithms.

BIE-ZUM: Course objectives

- The goal is to give an overview of Artificial Intelligence methods and techniques to equip you with a knowledge you can use in solving a real problems you might encounter in your life.
- To give you a comprehensive and full theoretical background is not possible within one course.

BIE-ZUM: Syllabus

- 1 **The search space and the heuristic methods for search space exploration.**
 - ▶ Problem formalization and how to represent it.



BIE-ZUM: Syllabus

2 Evolutionary Algorithms

- ▶ Evolutionary computation techniques.
- ▶ Range of problem-solving techniques based on principles of biological evolution (Darwinian principles), such as natural selection and genetic inheritance.
 - ★ Genetic algorithm, operators of initialization, crossover, mutation, and reproduction.



BIE-ZUM: Syllabus

3 Automated planning

- ▶ Predicate representation of states. Planning graph.
- ▶ Planning, reasoning and tactics in games.



BIE-ZUM: Syllabus

4 Multi-agent systems and architectures

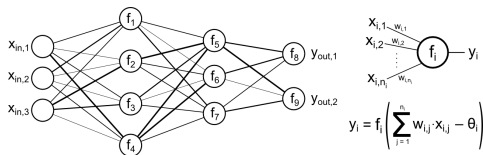
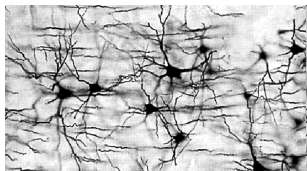
- ▶ Multiple interacting intelligent computational entities that are able to communicate and cooperate in order to reach some objectives.



BIE-ZUM: Syllabus

5 Machine Learning and Data Mining

- ▶ Unsupervised, supervised and Semi-Supervised learning.
 - ★ Clustering, classification, regression.
- ▶ **Artificial Neural Networks** - models inspired by biological neural system.



BIE-ZUM: Syllabus

6 Robotics

- ▶ Robot control and information processing.
 - ★ Human-like bipedal walk.
 - ★ Speech recognition, image and sensor data processing, robot interaction.
- ▶ Simulation and practical evaluation with NAO robot in our lab.

