Lecture 1

Introduction to Artificial Intelligence

CS 180 – Intelligent Systems

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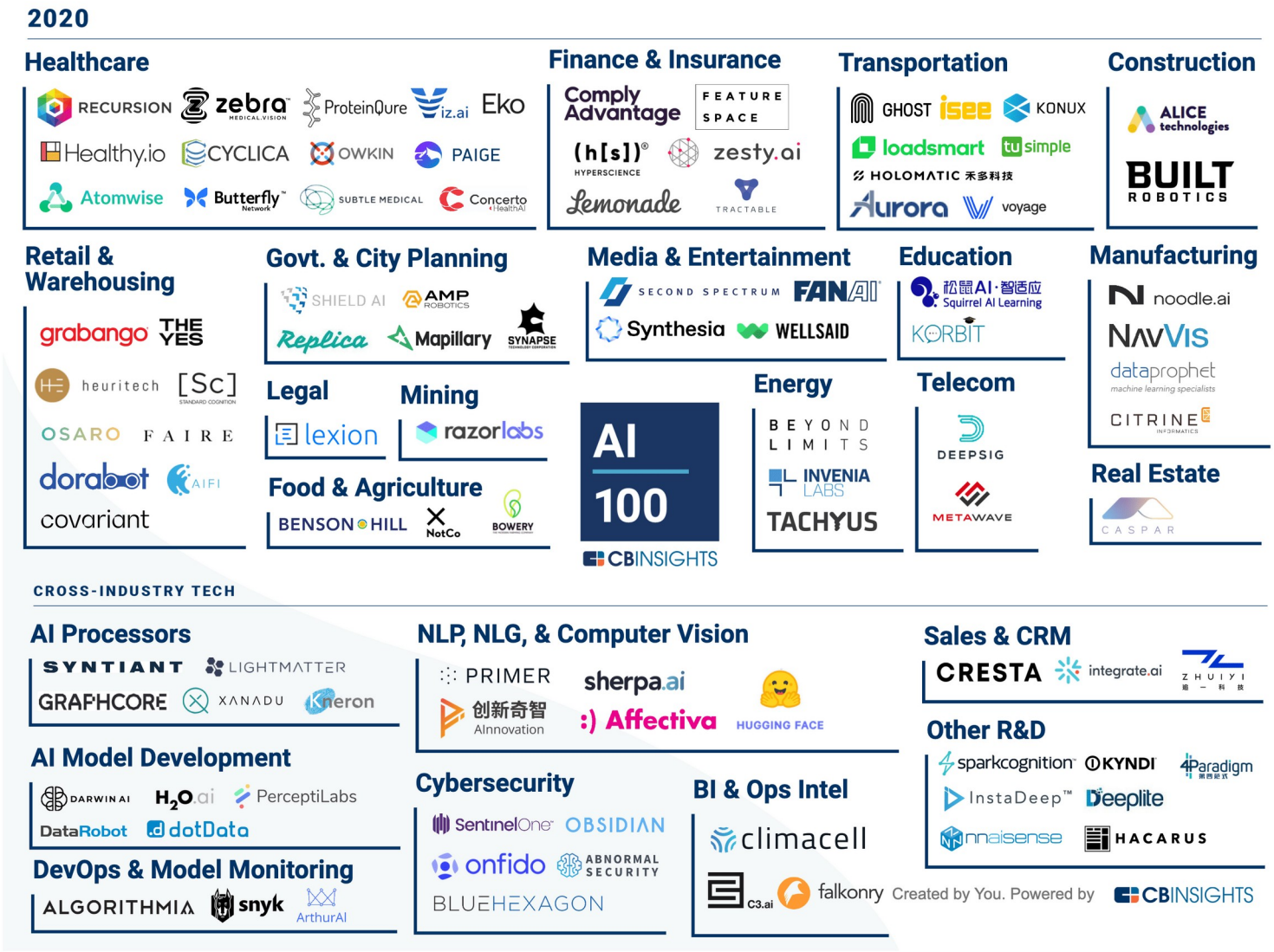
Spring 2021

Overview

- What is AI?
- AI history
- AI Applications
- Smart Agent
- PEAS model

100 most promising AI startups redefining industries

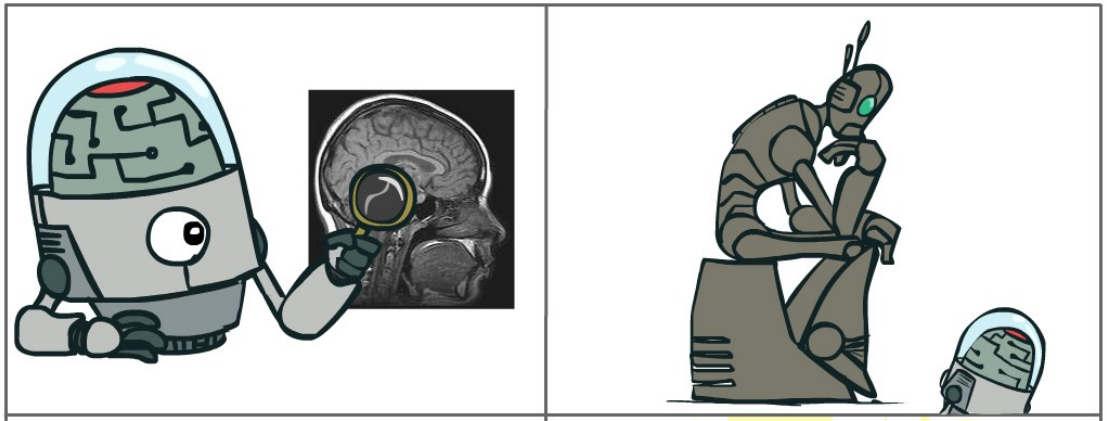


https://www.cbinsights.com/research/artificial-intelligence-top-startups/

What is AI ?

- A study on how to program computers to solve **hard problems** that traditionally require human intelligence to solve

Thinking humanly



Acting humanly

Thinking rationally

Acting rationally

History of AI to the present day

1980s Expert systems boom

Late 1980s Expert system bust; the AI winter

Mid-1980s Neural networks, backpropagation

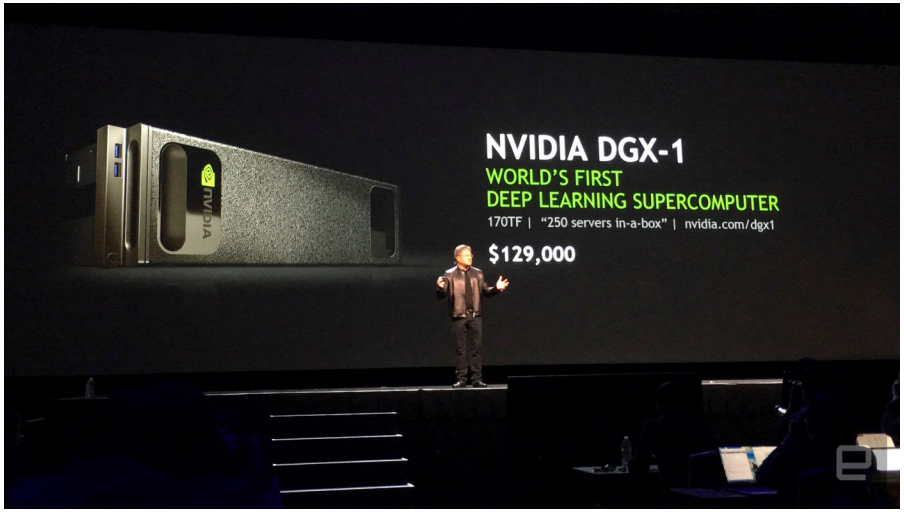
Late 1980s Uncertain/Probabilistic knowledge reasoning

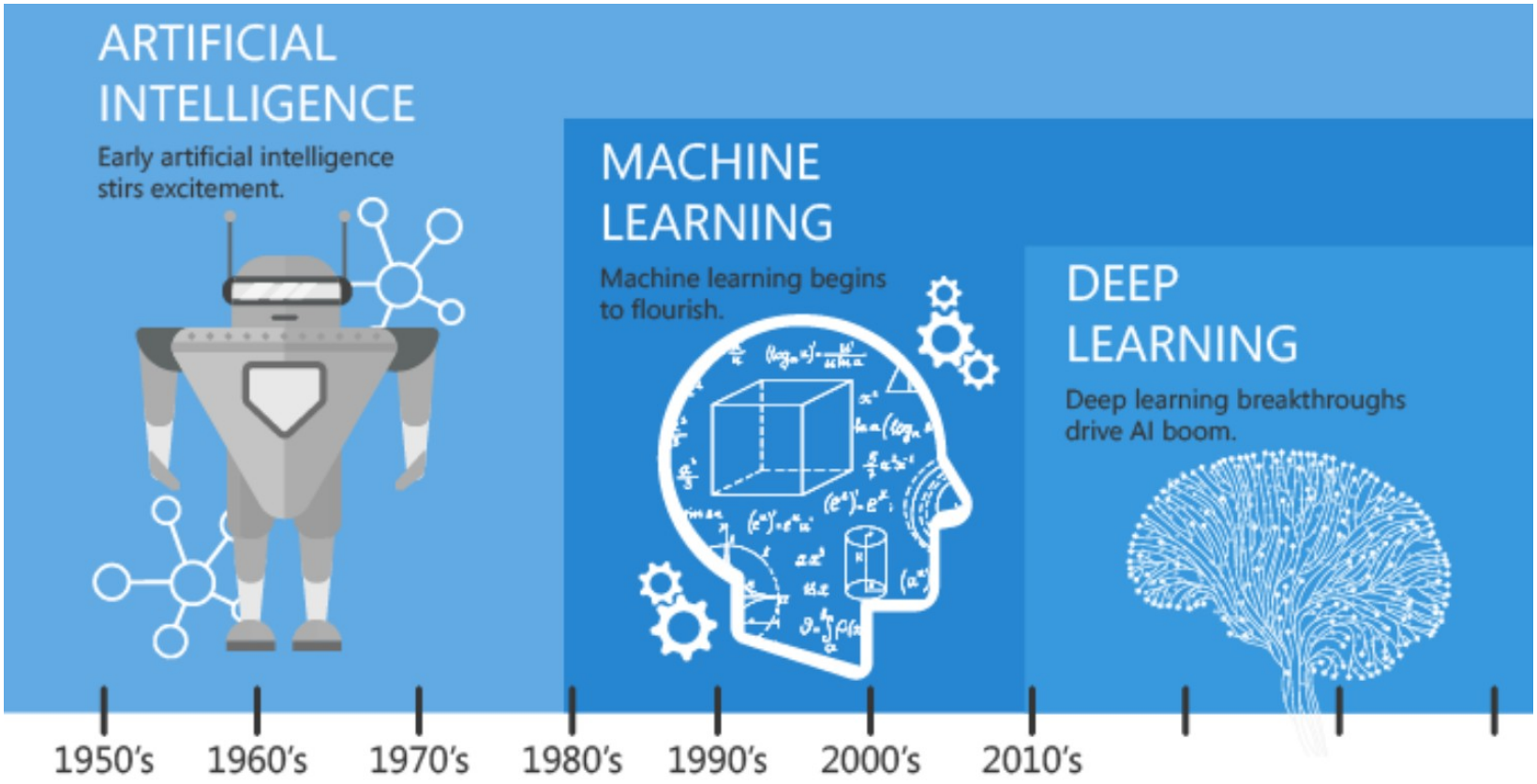
1990s Machine learning becomes dominant, begins to flourish

Late 2000s Big data come to the stage

2010s Deep learning started to flourish everywhere

New industry boom




ARTIFICIAL INTELLIGENCE
Early artificial intelligence stirs excitement.
MACHINE LEARNING
Machine learning begins to flourish.
DEEP LEARNING
Deep learning breakthroughs drive AI boom.
1950's
1960's
1970's
1980's
1990's
2000's
2010's

AI Applications: Self-driving cars

TRANSPORTATION AND LOGISTICS BRIEFING: Consumers ...
Business Insider - 3 hours ago
TRANSPORTATION AND LOGISTICS BRIEFING: Consumers apprehensive about **self-driving cars** — Update on self-driving regulations ...

Why Hollywood Could Make Billions From **Self-Driving Cars**
Hollywood Reporter - 45 minutes ago
In March 2016, GM spent $1 billion to acquire **self-driving car** startup Cruise Automation. More than 10 automakers, including Tesla, Audi and ...

There is a ton of people who still don't want to ride in **self-driving** ...
CNBC - Aug 24, 2017
For those reluctant to hand the reins over entirely, the potential for technological failures or security issues in **self-driving cars** are top concerns.

When will **driverless cars** come to the UK, how do self-driving ...
The Sun - Aug 25, 2017
DRIVERLESS cars could soon be rolling off the factory line – allowing us to read, watch films, and even take a nap as we are ferried to our ...

When will **self-driving cars** hit your streets?
Automotive News - 12 hours ago
The sight of **self-driving cars** cruising down the street may be familiar to lucky residents of California, Michigan or Pittsburgh, but when will the ...

Google Is Using A Virtual World To Test **Self-Driving Cars** Called ...
Jalopnik - 5 minutes ago
The Atlantic's piece is a massive undertaking that offers new insight into how Waymo is working on **self-driving cars**, but the Carcraft world is ...

What Will it Take for People To Trust **Self-Driving Cars**?
Government Technology - 11 minutes ago
(TNS) -- With tech and **car** companies throwing lots of money and manpower behind **autonomous** vehicles, Intel Corp. wanted to know what it ...

Ford, Argo eye new possibilities for **autonomous cars**
The Detroit News - 13 hours ago
San Francisco — Jim Hackett doesn't want to be handcuffed on how Ford's first fully **self-driving** vehicles might be deployed in 2021.

Apple Scales Back Its Ambitions for a **Self-Driving Car**
New York Times - Aug 22, 2017
Apple has reduced the ambitions of its **driverless car** project. ... Apple Is Said to Be Rethinking Strategy on **Self-Driving Cars** SEPT. 9, 2016.

Apple scales back its ambitions to create a **self-driving** after internal ...
In-Depth - Daily Mail - Aug 23, 2017

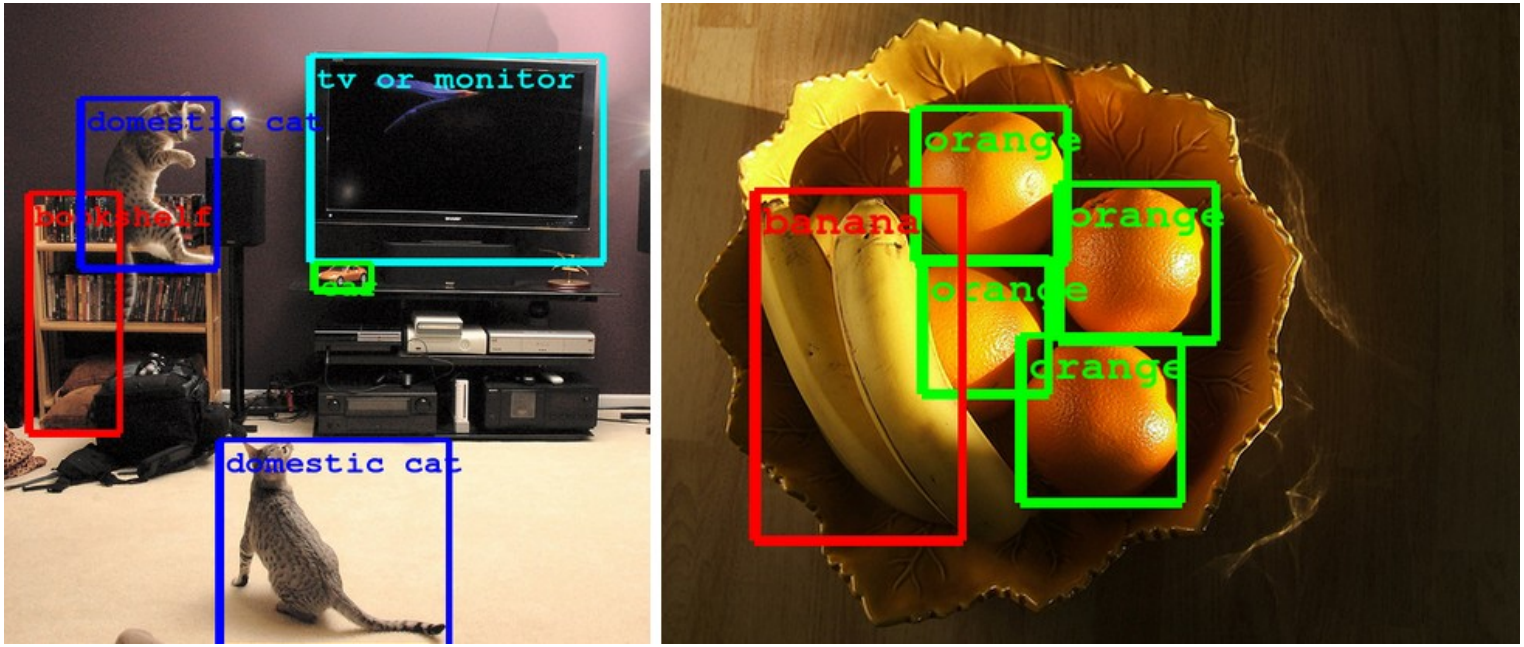
View all

Germany's **self-driving car** ethicists: All lives matter
Quartz - Aug 24, 2017
The German federal government will adopt new guidelines for **self-driving cars** inside the country, which will prioritize the value and equality of ...

Germany Drafts World's First Ethical Guidelines for **Self-Driving Cars**
Futurism - Aug 25, 2017

Video: A ride in a Waymo driverless car

AI Applications: Computer Vision



[Computer Eyesight Gets a Lot More Accurate](), NY Times Bits blog, August 18, 2014

AI Applications: Computer Vision

Facebook accessibility tools for the visually impaired

(convert images to captions)

AI beats human pathologists at detecting cancer

/tumor

AI Applications: Computer Vision

https://thing-translator.appspot.com/

https://quickdraw.withgoogle.com/

https://modeldepot.github.io/tfjs-yolo-tiny-demo/

https://experiments.withgoogle.com/imaginary-soundscape

AI Applications: Speech and natural language

Skype Translator

Break down the language barrier with your friends, family and colleagues.

Our online translator can help you communicate in 7 languages for voice calls, and in more than 50 languages while instant messaging.

Skype Translator uses machine learning. So the more you use it, the better it gets. Thanks for being patient as the technology graduates from Preview mode.

https://www.skype.com/en/features/skype-translator/

Google Translate App

- Translate between 103 languages by typing
- Offline: Translate 52 languages when you have no Internet
- Instant camera translation: **Use your camera to translate text** instantly in 30 languages
- Camera Mode: Take pictures of text for higher-quality translations in 37 languages
- Conversation Mode: Two-way **instant speech translation** in 32 languages
- Handwriting: **Draw characters** instead of using the keyboard in 93 languages

https://play.google.com/store/apps/details?id=com.google.android.apps.translate&hl=en

AI Applications: Games

- **1997:** IBM's Deep Blue defeats the reigning world chess champion Garry Kasparov
  - **1997: Deep Blue Beats Kasparov**

- **2007:** Checkers is solved
  - AI programs have been beating the best humans

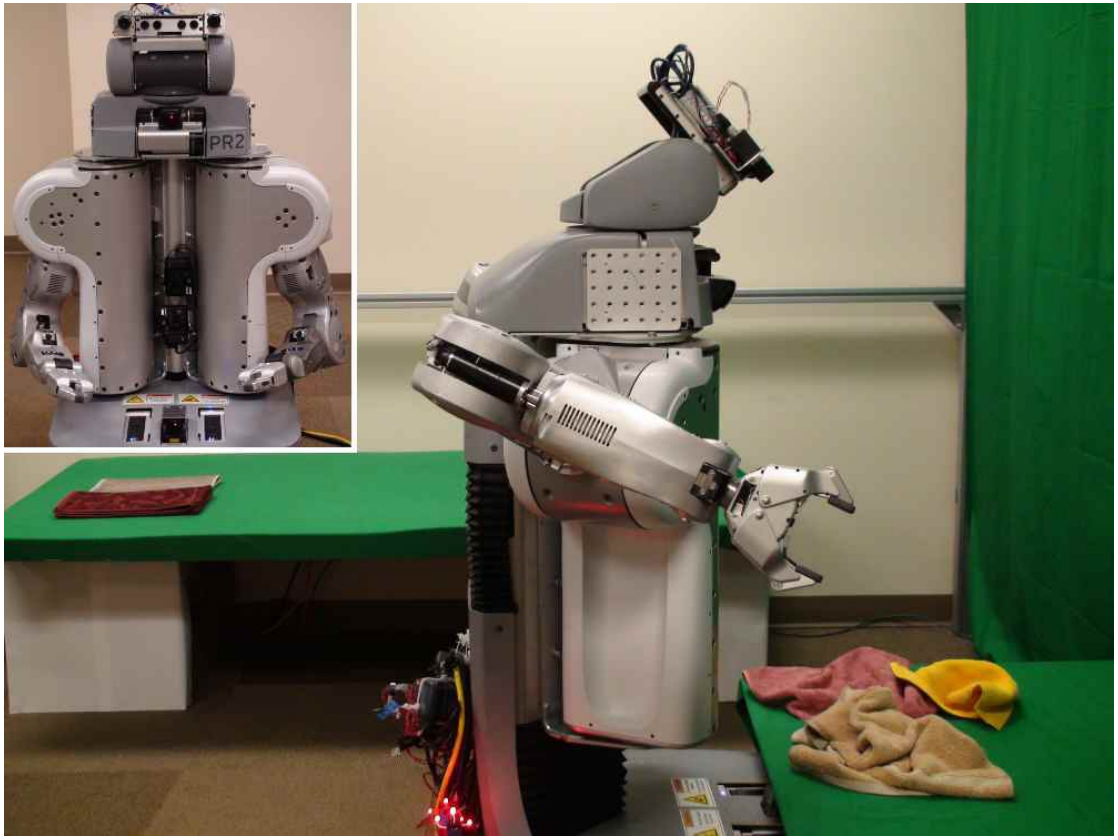
- **2016:** AlphaGo won against Go grand[illegible] 4-1

- **2017:**
  CMU's AI system beat the best human players at no-limit Texas Hold'em poker

AI Applications: Robotics

- Autonomous vehicles
  - Vehicles for exploring space, hazardous environments
  - Autonomous drones
- Soccer robots
  - RoboCup
- Personal robots
  - Humanoid robots
  - Robotic pets
  - Personal assistants?

Towel-folding robot

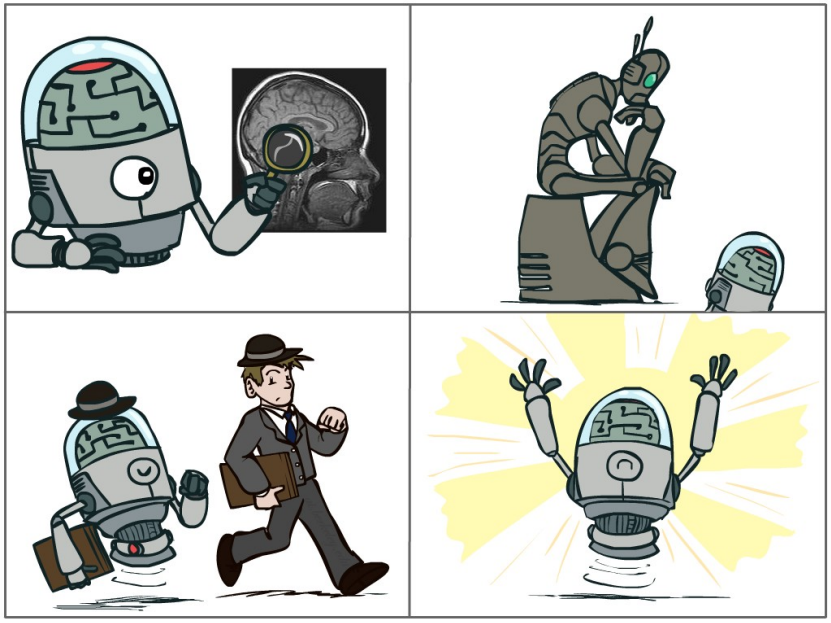


YouTube Video

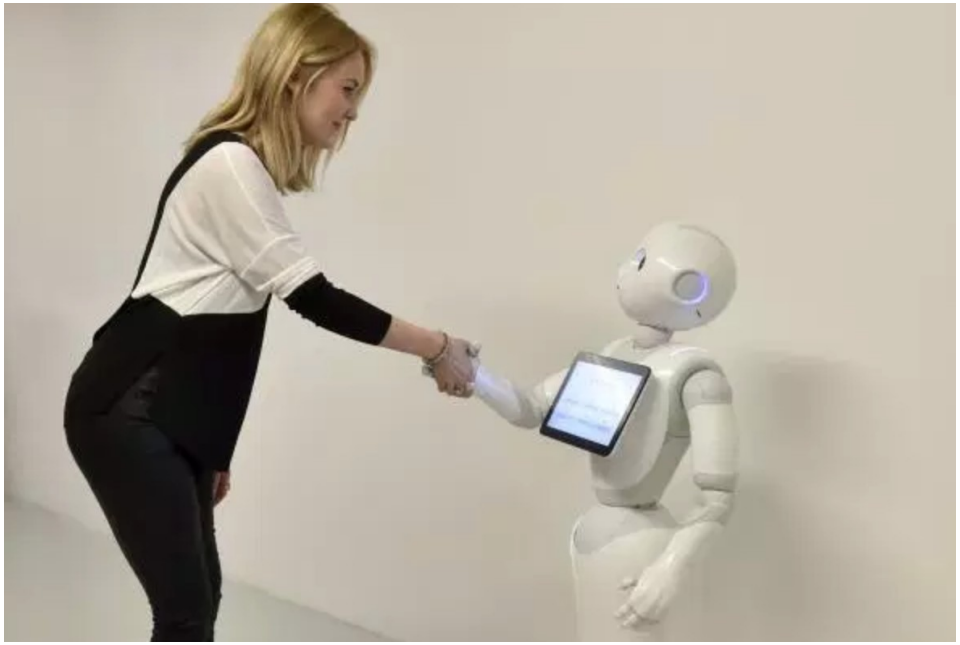
- J. Maitin-Shepard, M. Cusumano-Towner, J. Lei and P. Abbeel, Cloth Grasp Point Detection based on Multiple-View Geometric Cues with Application to Robotic Towel Folding , ICRA 2010

Focus of this class

- We will learn not only AI techniques but also how to implement them using popular Python AI packages.
- Thus, this class is a class emphasizing both theory and hands-on

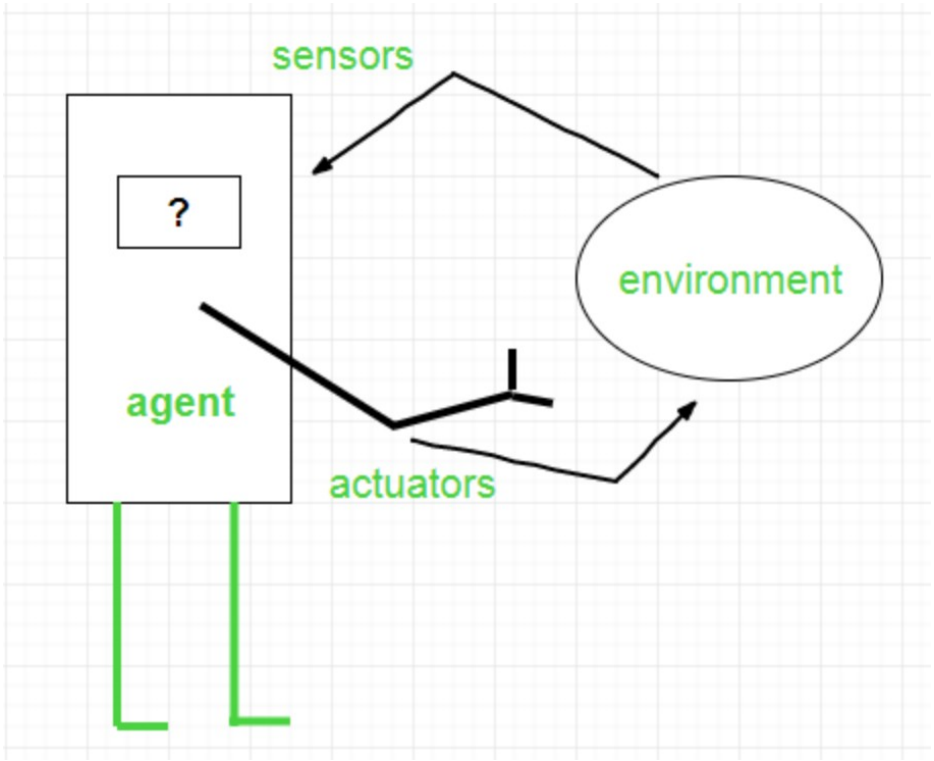


Smart Agent



Agents

An agent is a software which observes input through sensors and acts upon an environment using actuators



Smart agents

Given input from sensor, a **smart agent** should take an action that will **maximize** its **performance measure**.

- **Performance measure: utility objective function:**

PEAS model: on which most of AI agents work upon

PEAS: Performance measure, Environment states, Actuators, Sensors

P: an objective function the agent is maximizing (or minimizing)

E: a formal representation for *states*

- *A state = a group of* **variables**
  = a tuple of (var_1=val_1, var_2=val_2, … ,var_n=val_n)

A: actions that change the agent state according to a *transition model*

S: observations that allow the agent to infer the world state

PEAS Example: Autonomous taxi

Performance measure

- function for a safe, fast, legal, comfortable trip

Environment states

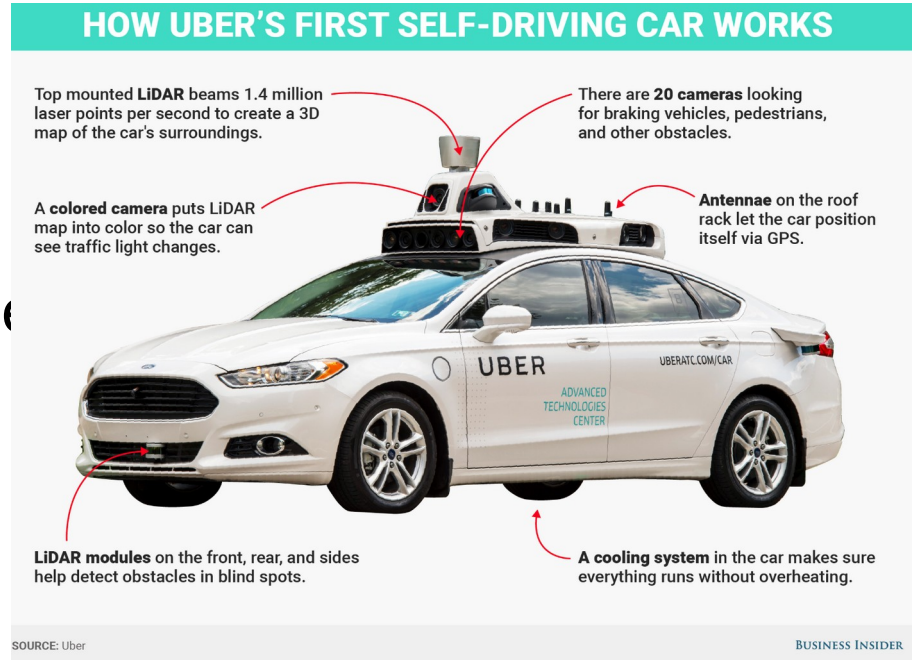
- Roads, traffic, pedestrians

Actuators

- Steering wheels, engine brake, signal,

Sensors

- Cameras, LIDAR, speedometer, GPS, odometer, engine sensors, keyboard



Another PEAS example: Email spam filter

Performance measure

- Minimizing false positives, false negatives

Environment states

- A user's email account, email server

Actuators

- Mark as spam, delete, etc.

Sensors

- Incoming messages, other information about user's account

Video

What AI can do today?

Video

Waymo (Google) self-driving cars get green light to carry passengers in California