CSCE 4613/5613
Artificial Intelligence

Class Overview

Spring 2026

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Introduction

Teaching staff & background

What is A.I?

Course materials and logistics

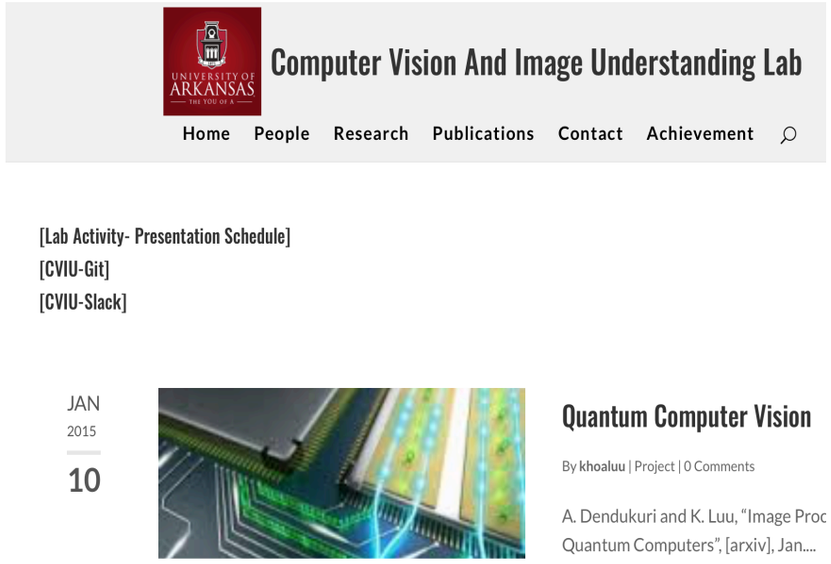
Questions

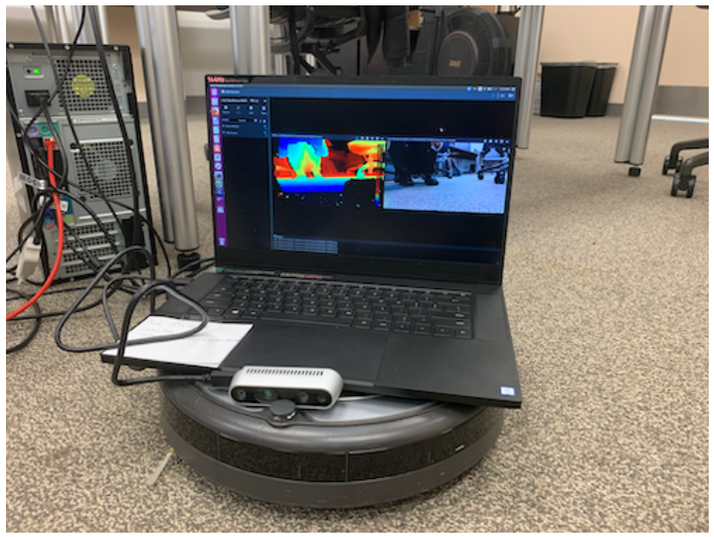
How many students have known/used:

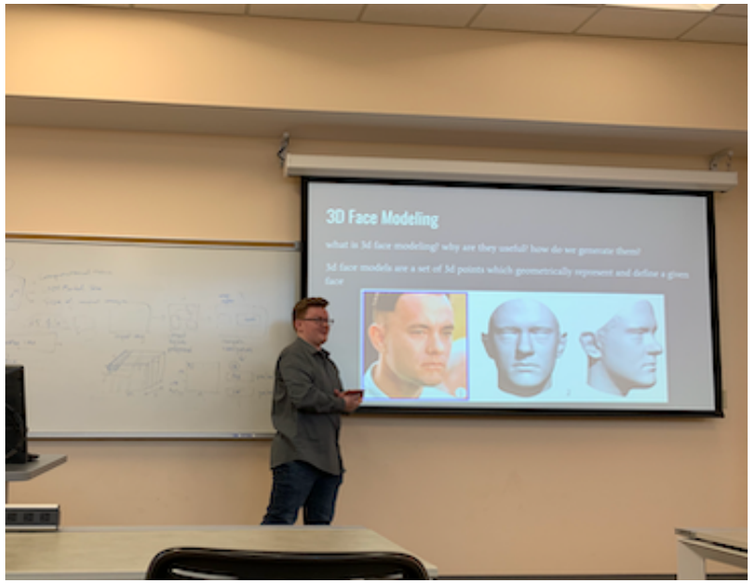
- Python
- Google Colab
- Latex
- AI

CVIU Overview

https://uark-cviu.github.io/







CVIU Overview

ECCV 2018 – 2nd Unconstrained Face Detection and Open Set Recognition Challenge (link)

We are the Winner #1 in both two tracks: Face Detection and Face Recognition

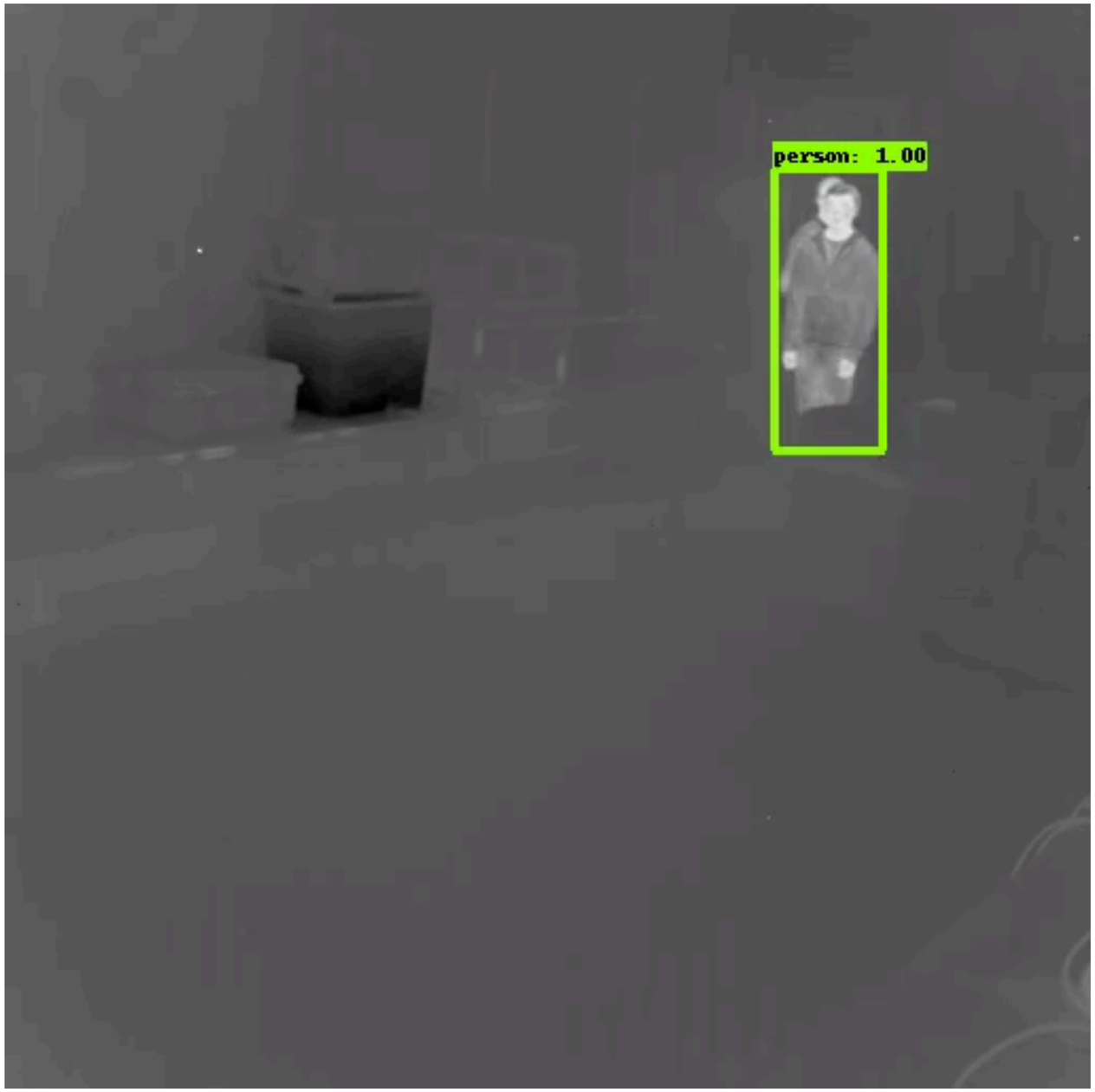
Example images of the UCCS dataset. Note that not a single face in these two images is frontal and without occlusion – some have small occlusion, others large; some have significant yaw and pitch angles; and many are blurred.

JOLT Hackathon 2018
Awards (1st & 3rd)

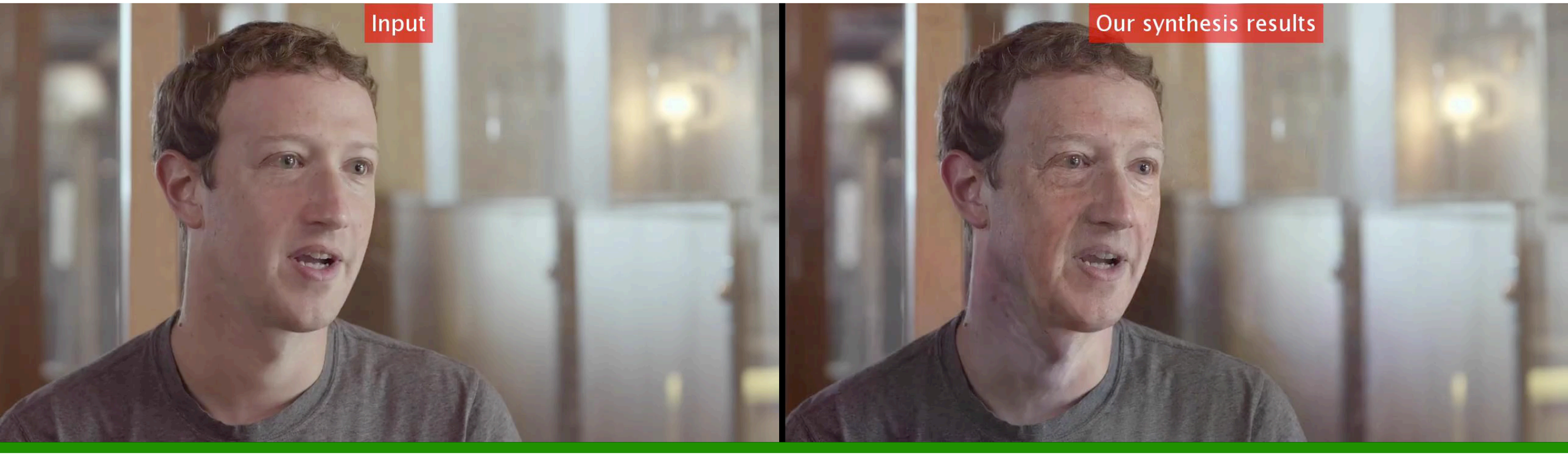
EmotioNet Challenge 2018 (link)

We are the 3rd in Track #2!

Human Recognition



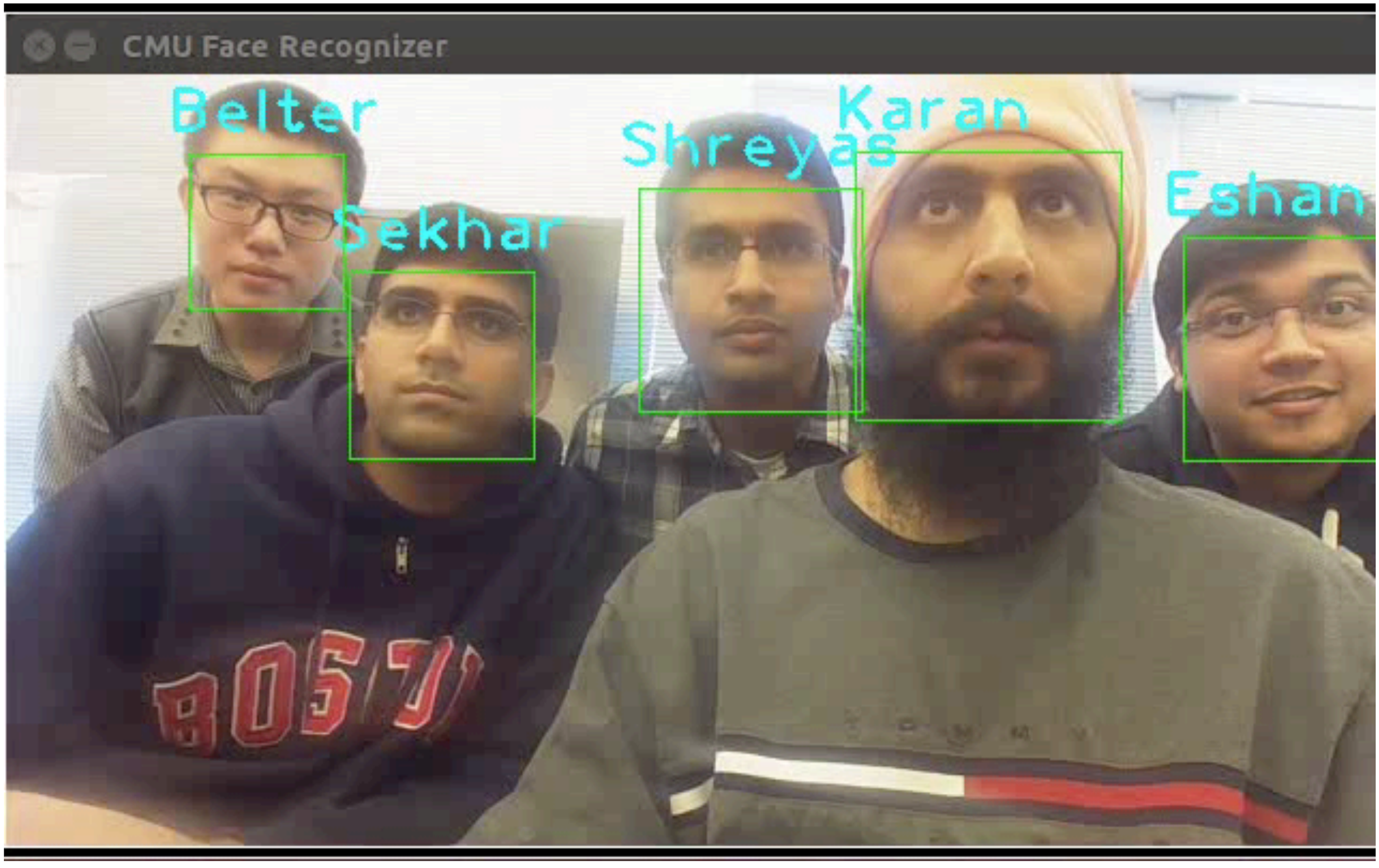
Human Face Precognition



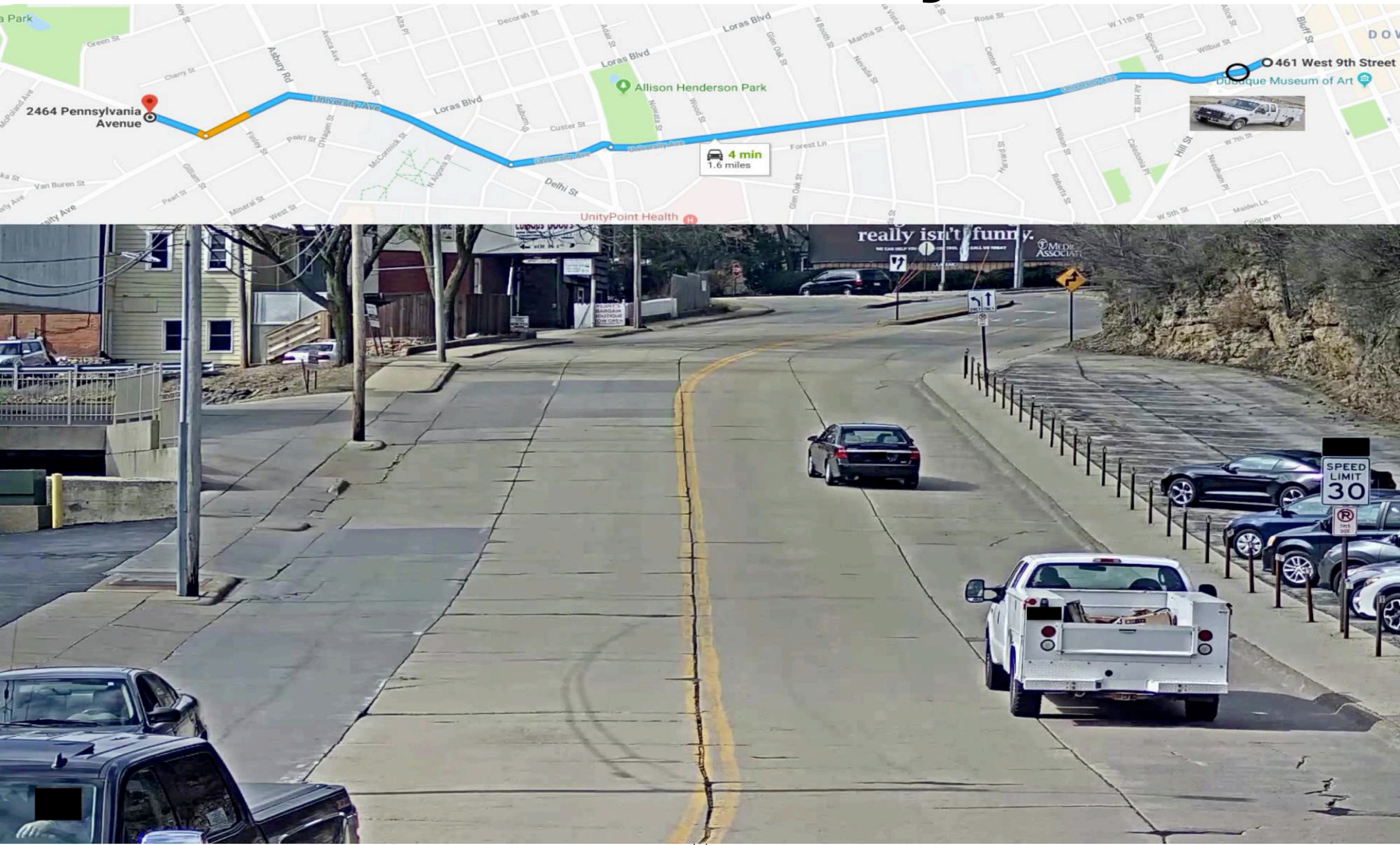
3D Face Modeling

3D Face Modeling

Face Recognition



Driver Safety



https://www.aicitychallenge.org

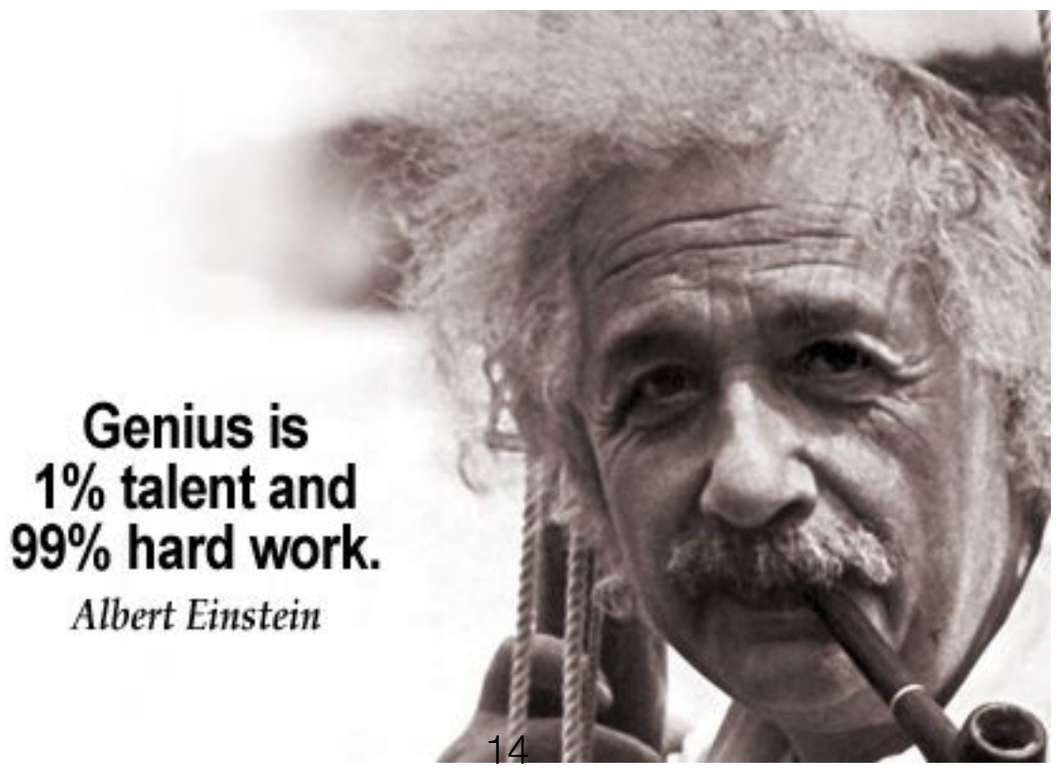
Course Materials and Logistics

Reading

Textbook
Homework
Research Papers

Assignments - Projects

reading
programming
debugging
writing
publishing



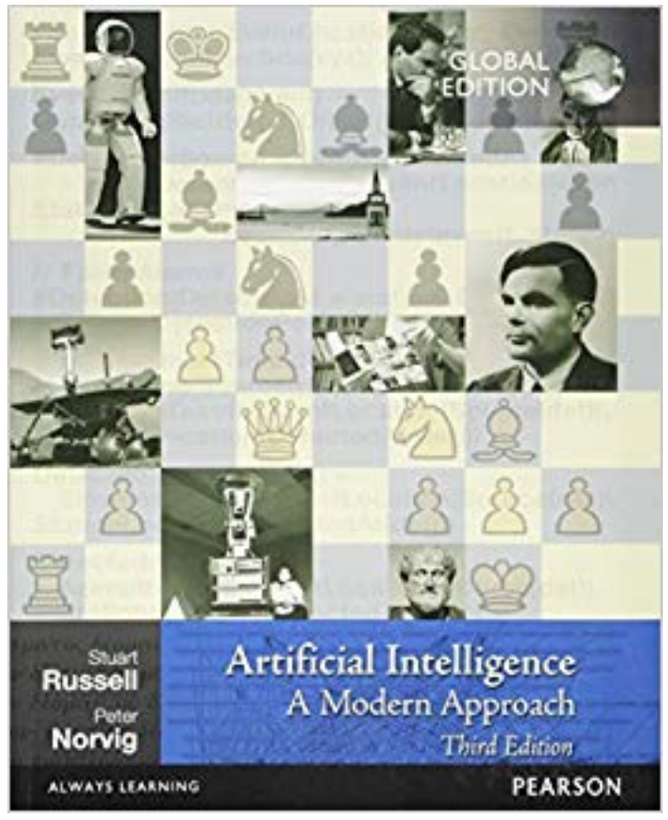
Course Requirements

- Submission Place: Blackboard
- Six/Seven (individual/group) Assignments
- Midterm Exam
- Final Exam
- Final Project (Presentation + Program + Report)
  (Encourage students to join!)
- Reports: Google Doc or AAAI template (Latex)
  https://aaai.org/Conferences/AAAI-20/aaai20call/

Textbook

- Most important materials will be covered in slides/lectures

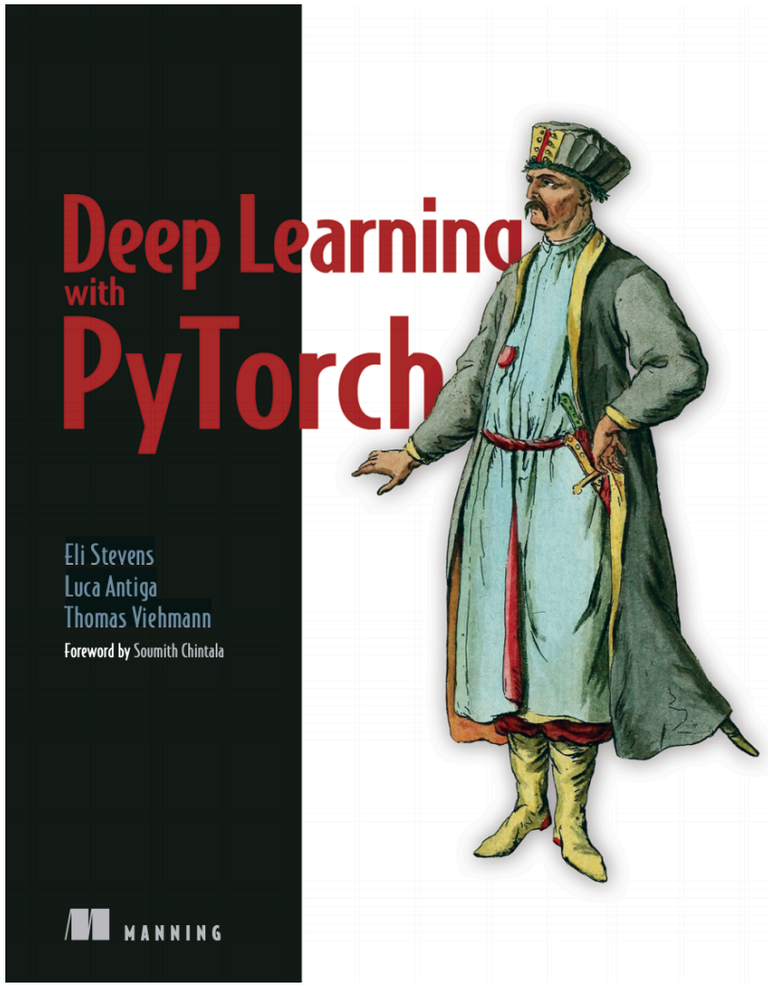
- **Artificial Intelligence: A Modern Approach,** Third Edition, Pearson Publisher, 2010
  by Stuart Russell and Peter Norvig
  http://aima.cs.berkeley.edu



Textbook

- Most important materials will be covered in slides/lectures

- **Deep Learning with Pytorch,** First Edition, 2020 (Free Online)
  by Eli Stevens, Luca Antiga & Thomas Viehmann
  https://pytorch.org/deep-learning-with-pytorch



Reference Materials

- THE ASSOCIATION FOR THE ADVANCEMENT OF ARTIFICIAL INTELLIGENCE http://www.aaai.org
- AAAI Conference: https://aaai.org/Conferences/AAAI-20/
- AI Magazine: https://www.aaai.org/ojs/index.php/aimagazine/issue/archive
- **Compendium of Vision**
    - http://homepages.inf.ed.ac.uk/rbf/CVonline/
- **IEEE Explore**
    - https://ieeexplore.ieee.org/Xplore/home.jsp
- **Journals**
    - https://ieeexplore.ieee.org/Xplore/home.jsp

Programming Languages

- Python (Mainly)
- Matlab

Grading

The grading in this course will be distributed as follow

- Participation: 5%
- Homework: 50%
- Midterm: 20%
- Final: 25%
- Bonus: 2%

Approach

- Grading based on absolute scale
- Getting an A v.s mastering the materials
- Take advantage of extra credits
- Build your resume with meaningful project experience

Late Days

- 5 late days in total (except for Midterm & Final exams)
- 3 days per assignment/project maximum use
- Use them wisely (save them for the last ones)

Learning Objectives

- Describe AI concepts, models, algorithms
- Model real-world problems using AI models
- Implement AI algorithms introduced in class
- Deliver written and oral presentation (bonus)

Pre-requisites

CSCE 3193 or CSCE 3193H or DASC 2103

Please see the instructors if you are unsure whether your background is suitable for the course.

Major Topics In This Course (15w)

(Subject to change)

1. Introduction to AI (1 Week)
2. AI Programming Reviews (Python & Google Colab) (1 Week)
3. Search & Heuristics (2 Weeks)
4. Satisfiability (1 Week)
5. Deterministic/symbolic reasoning (1 Weeks)
6. Knowledge representation (2 Weeks)
7. Probabilistic reasoning (1 Weeks)
8. Sequential Decision Making (1 Weeks)
9. Neural Networks (1 Weeks)
10. Deep Learning Basics (2 Weeks)
11. A.I Applications (1 Week)

Disability Accommodations

If you have a disability and have an accommodations letter from the Disability Resources office, we encourage you to discuss your accommodations and needs with us as early in the semester as possible.

We will work with you to ensure that accommodations are provided as appropriate.

If you suspect that you may have a disability and would benefit from accommodations but are not yet registered with the Office of Disability Resources, we encourage you to contact them at

Academic Integrity

- Strict honor code with severe punishment for violators. UA's academic integrity policy can be found here: https://honesty.uark.edu/policy/

- You may discuss assignments with other students as you work through them, but writeups must be done alone.

- No downloading / copying of code or other answers is allowed.

- If you use a string of at least 5 words from some source, you must cite the source

Student Well-Being

- Start early! Avoid last-minute panic.
- UA services and resources are available, and treatment does work

  https://registrar.ua.edu/student-services/
- Take care of yourself

What is “AI”?

Some classic definitions

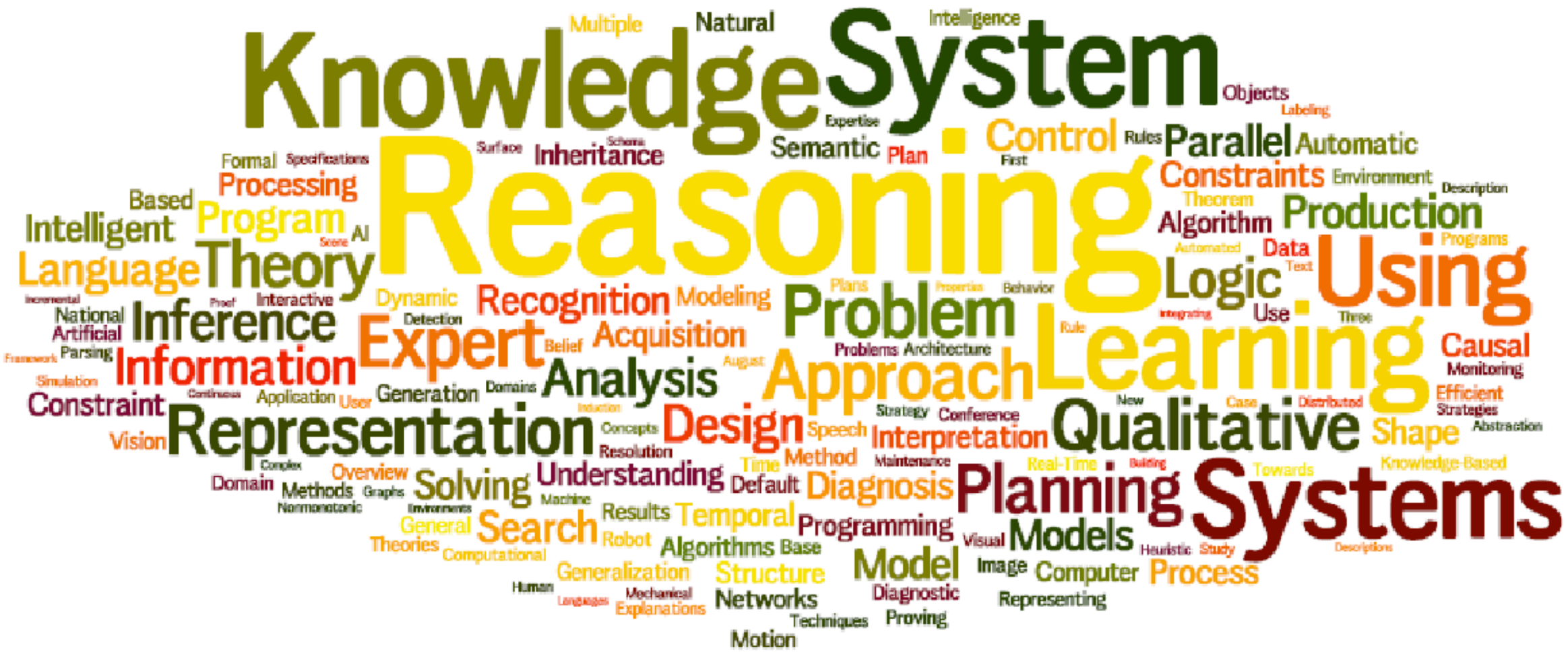
Building computers that...

Think like humans	**Think rationally**
• cognitive science / neuroscience • e.g., General Problem Solver (Newell and Simon, 1961)	• logic and automated reasoning • but not all problems can be solved just by reasoning
Act like humans	**Act rationally**
• Turing test • ELIZA, Julia, chatbots, Loebner prize	• basis for intelligent agent framework • unclear if this captures the current scope of AI research

The pragmatist's view

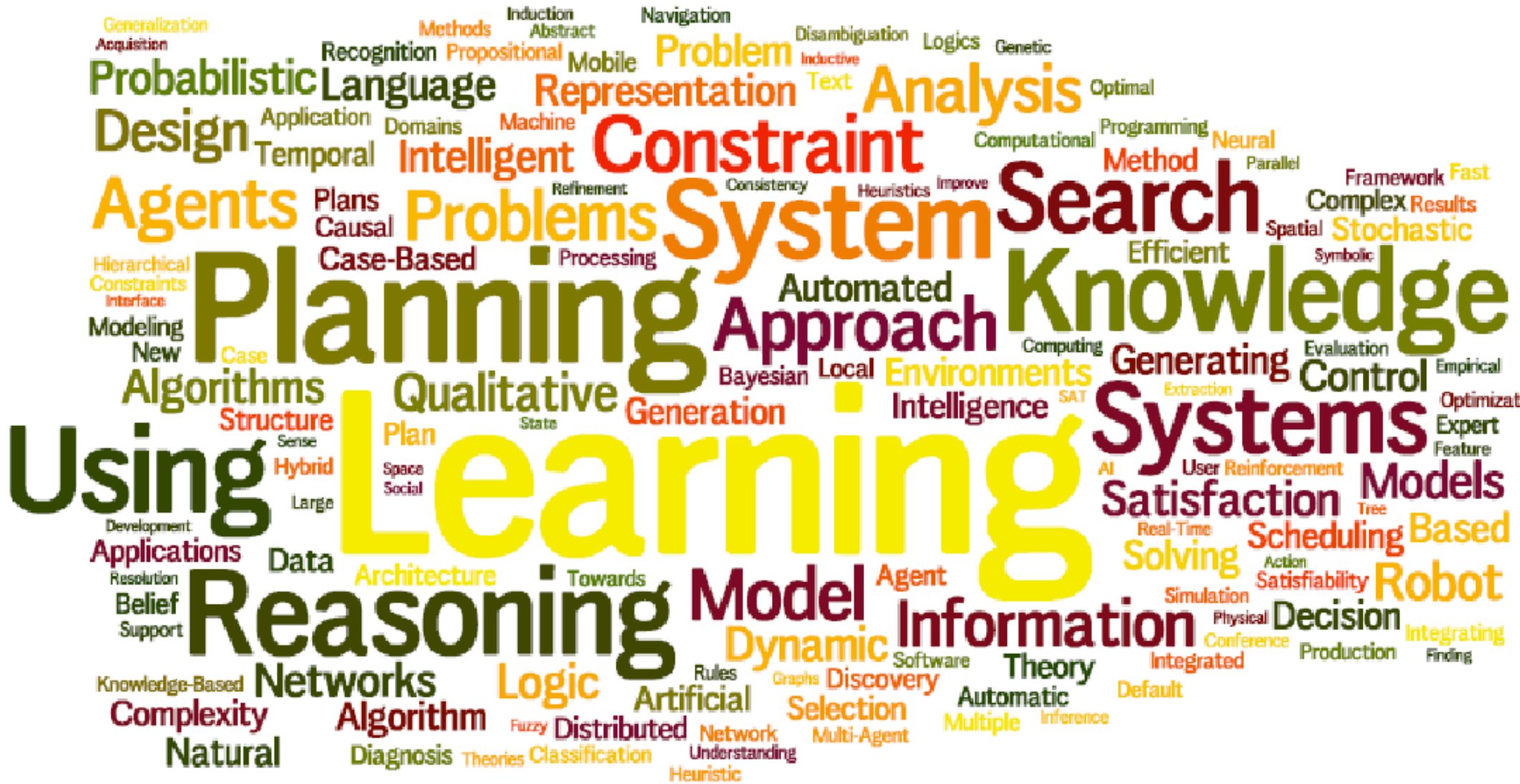
AI is that which appears in academic conferences on AI ...

The pragmatist's view



1980s

The pragmatist's view



1990s

The pragmatist's view

2000s

The pragmatist's view

2010s

A broader definition

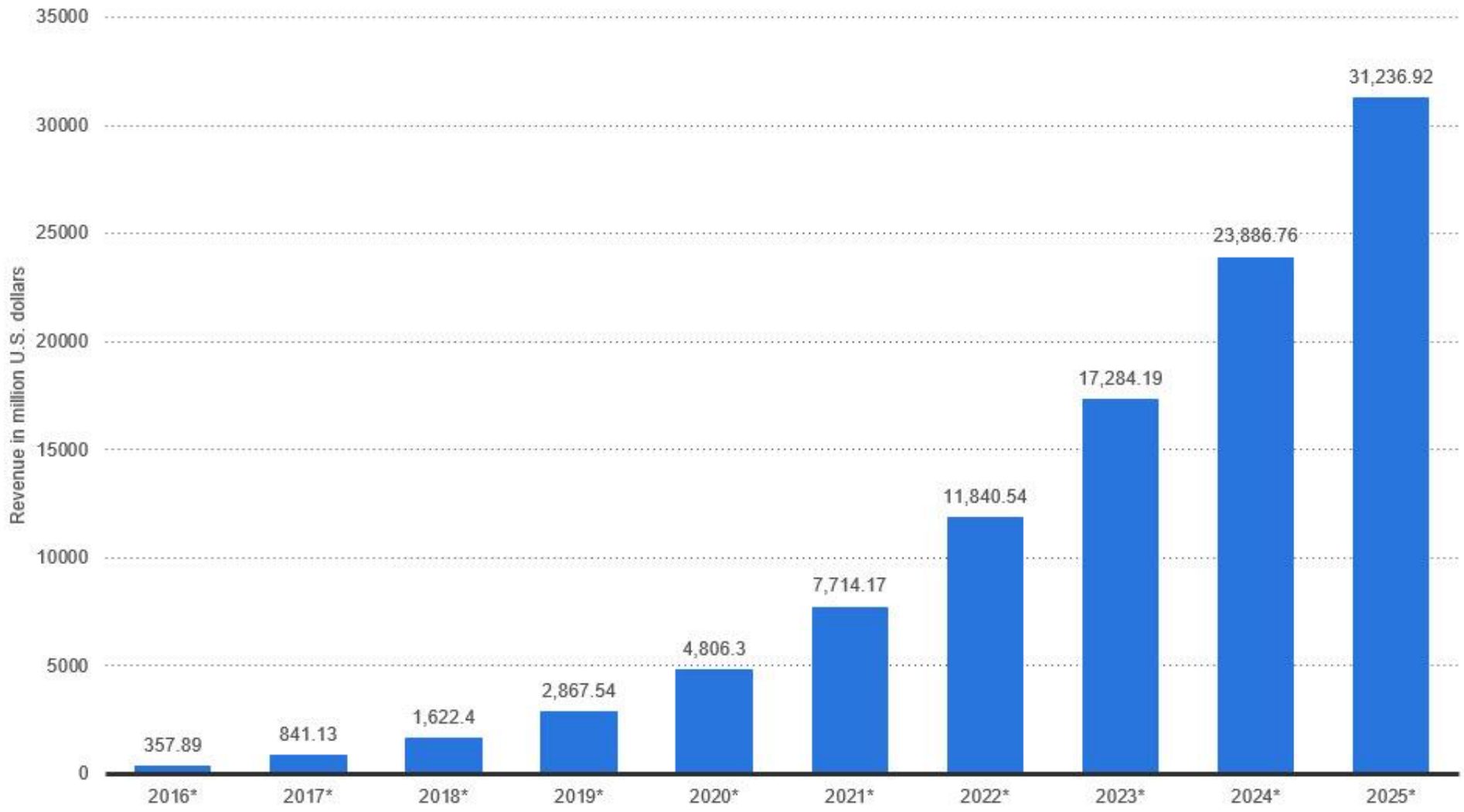
We won't worry too much about definitions of AI, but the following will suffice:

Artificial Intelligence is the development and study of computing systems that address a problem typically associated with some form of intelligence

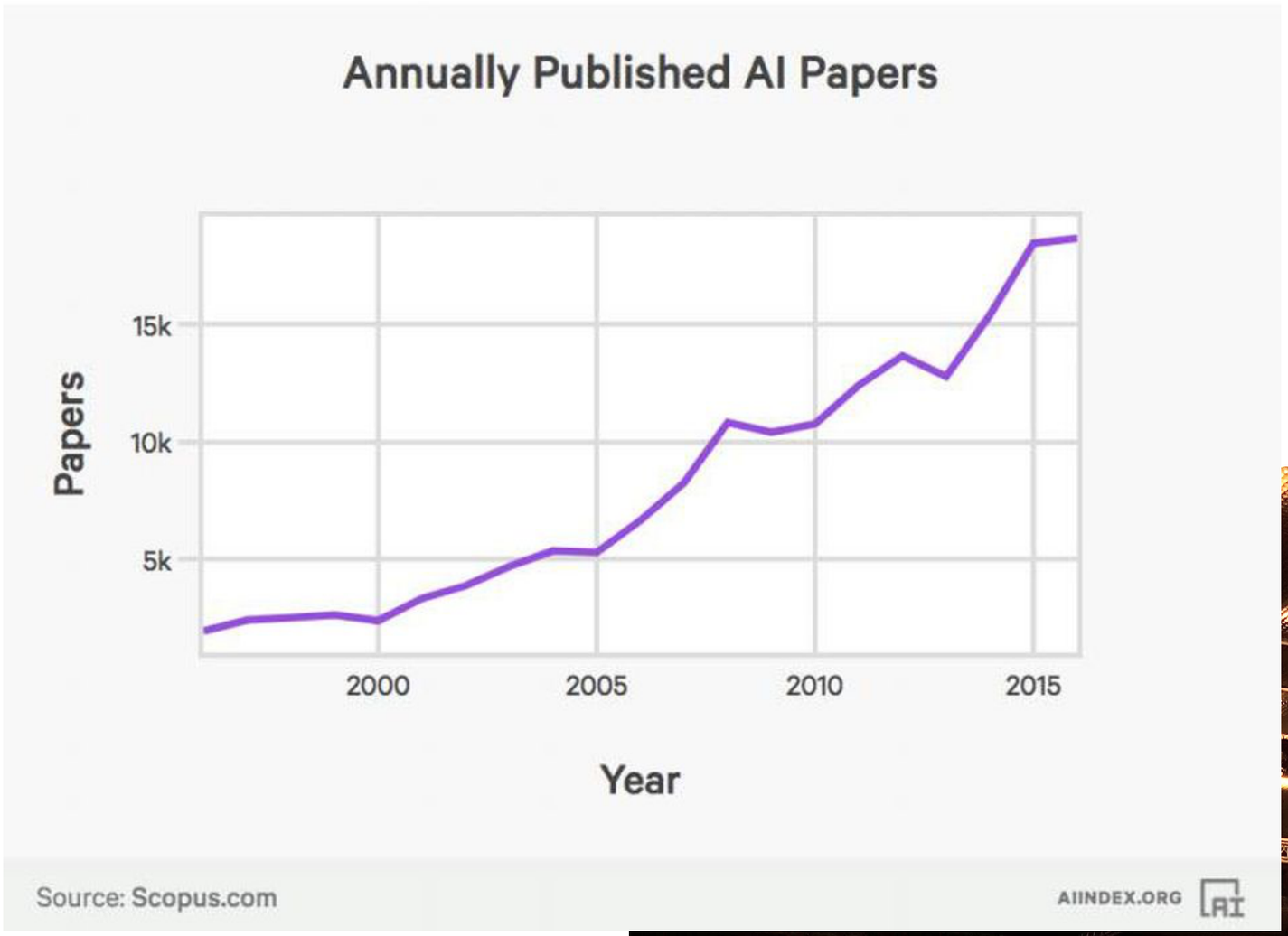
Why A.I now?

Enterprise artificial intelligence market revenue worldwide 2016-2025

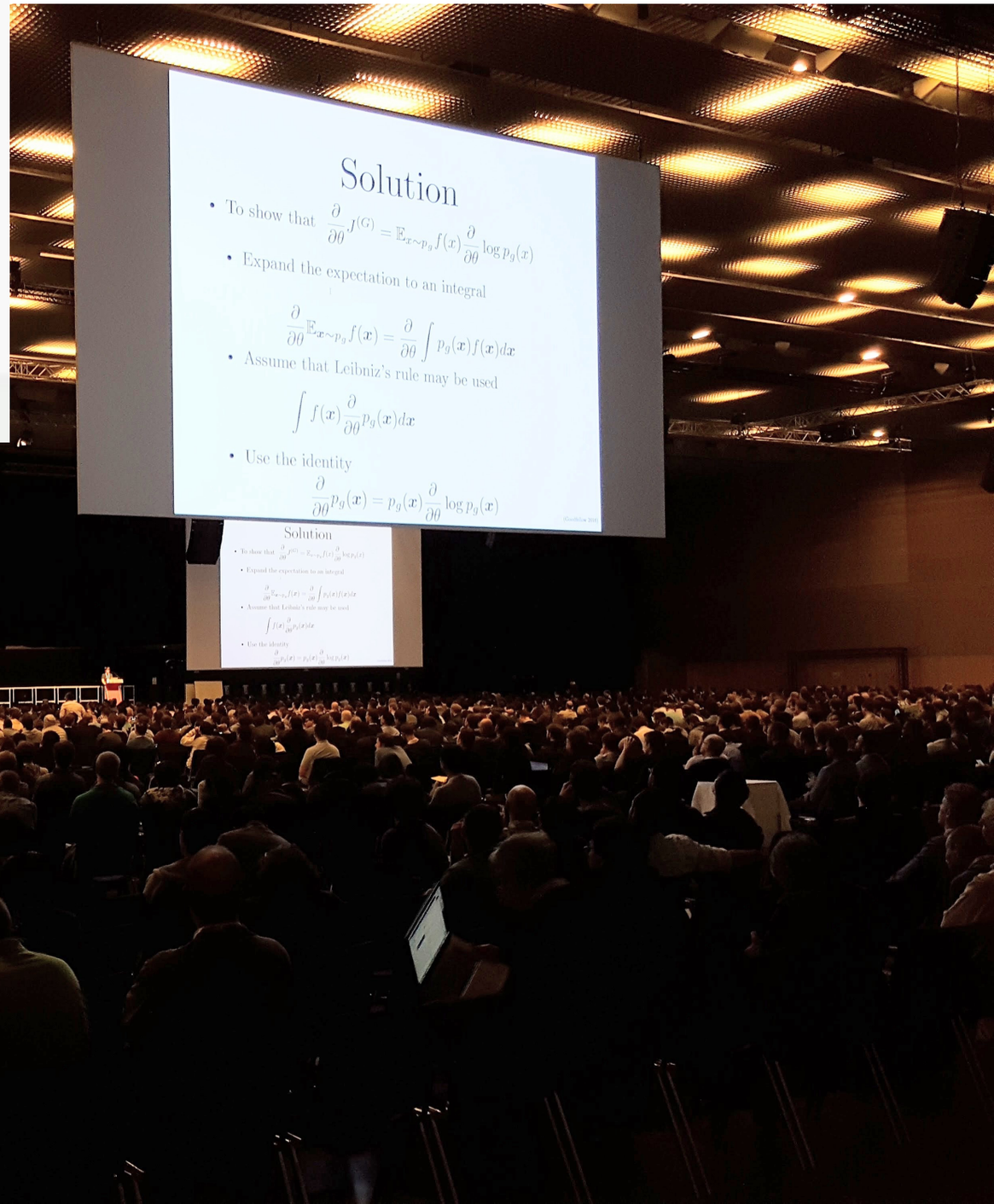
Revenues from the artificial intelligence for enterprise applications market worldwide, from 2016 to 2025 (in million U.S. dollars)



Source: https://www.forbes.com/sites/louiscolumbus/2018/01/12/10-charts-that-will-change-your-perspective-on-artificial-intelligences-growth


Annually Published AI Papers
Papers
15k
10k
5k
2000
2005
2010
2015
Year
Source: Scopus.com
AIINDEX.ORG

RESEARCH

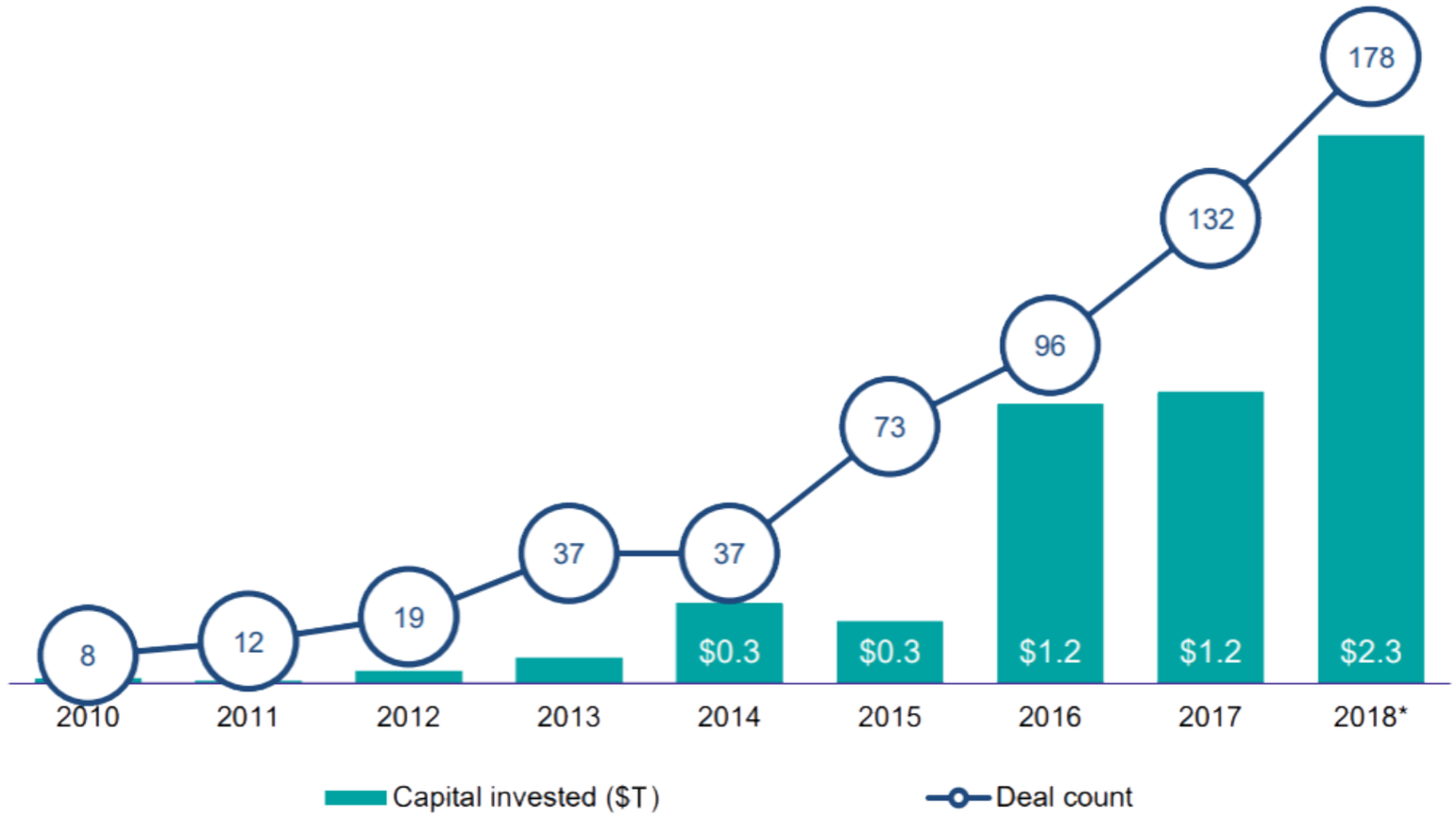

Solution
To show that $\frac{\partial}{\partial\theta}J^{(G)} = \mathbb{E}_{x\sim p_g} f(x)\frac{\partial}{\partial\theta}\log p_g(x)$
Expand the expectation to an integral
$\frac{\partial}{\partial\theta}\mathbb{E}_{x\sim p_g} f(x) = \frac{\partial}{\partial\theta}\int p_g(x)f(x)dx$
Assume that Leibniz's rule may be used
$\int f(x)\frac{\partial}{\partial\theta}p_g(x)dx$
Use the identity
$\frac{\partial}{\partial\theta}p_g(x) = p_g(x)\frac{\partial}{\partial\theta}\log p_g(x)$

STARTUPS

Exploring AI Investing

Global venture financing of artificial intelligence companies, 2018

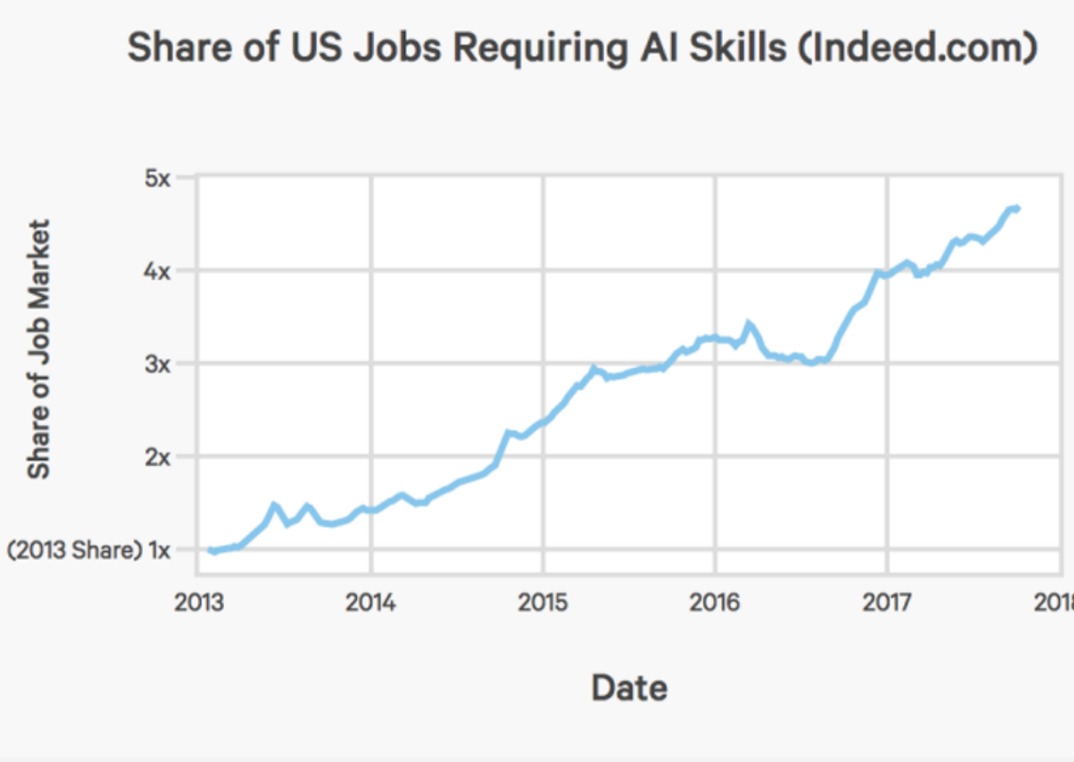
2010–2018*

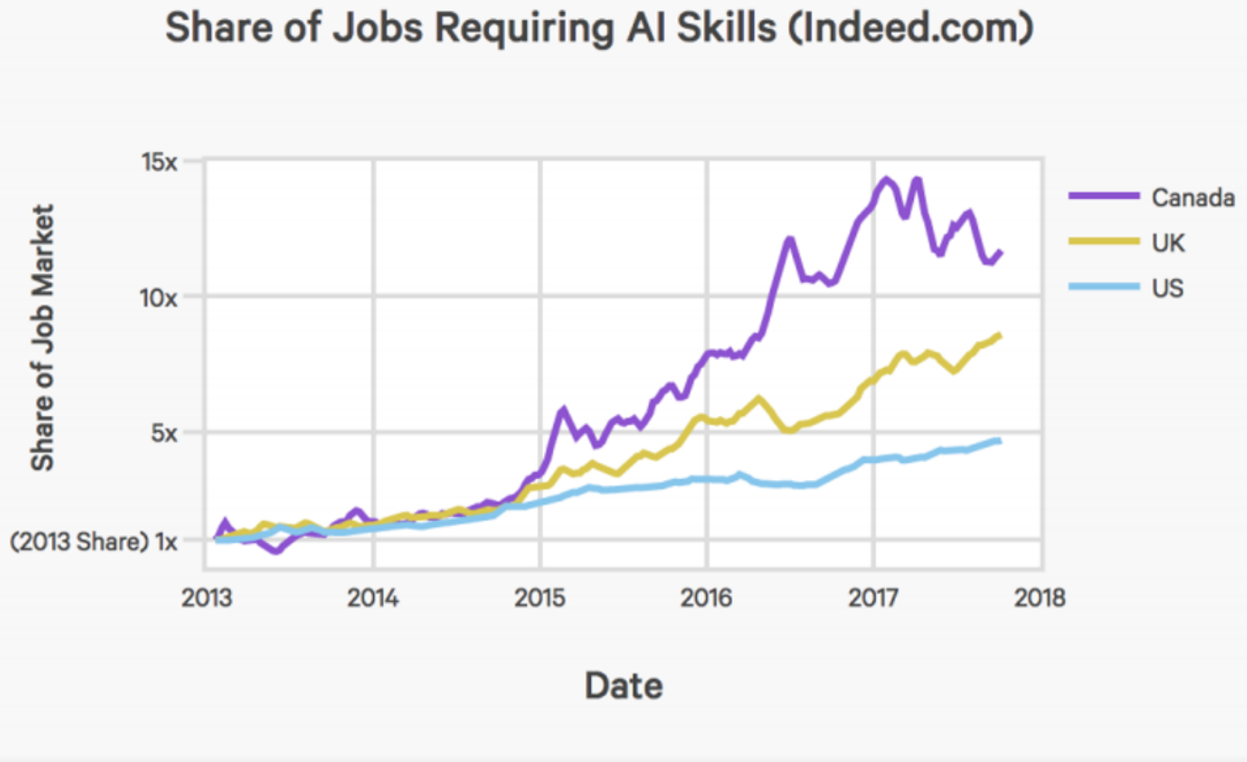


Source: Venture Pulse, Q4'18, Global Analysis of Venture Funding, KPMG Enterprise. *As of 12/31/18. Data provided by PitchBook, January 15, 2019

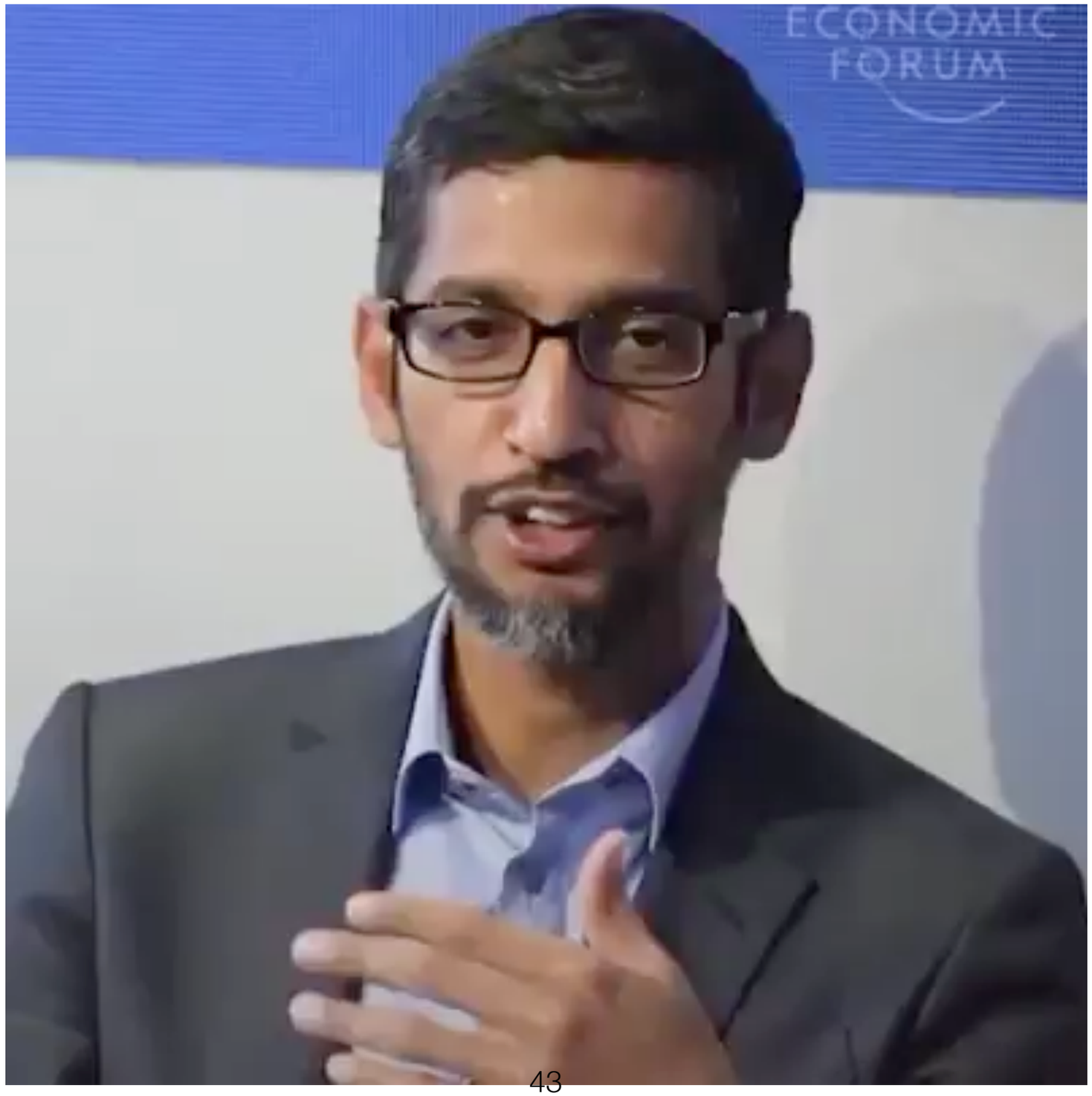
Source: https://medium.com/swlh/top-10-expected-unicorn-ai-startups-to-watch-in-2019-dec38bc5f2ef

AI Job Markets





Could #AI be the most important thing that humankind has worked on? What's your thoughts?



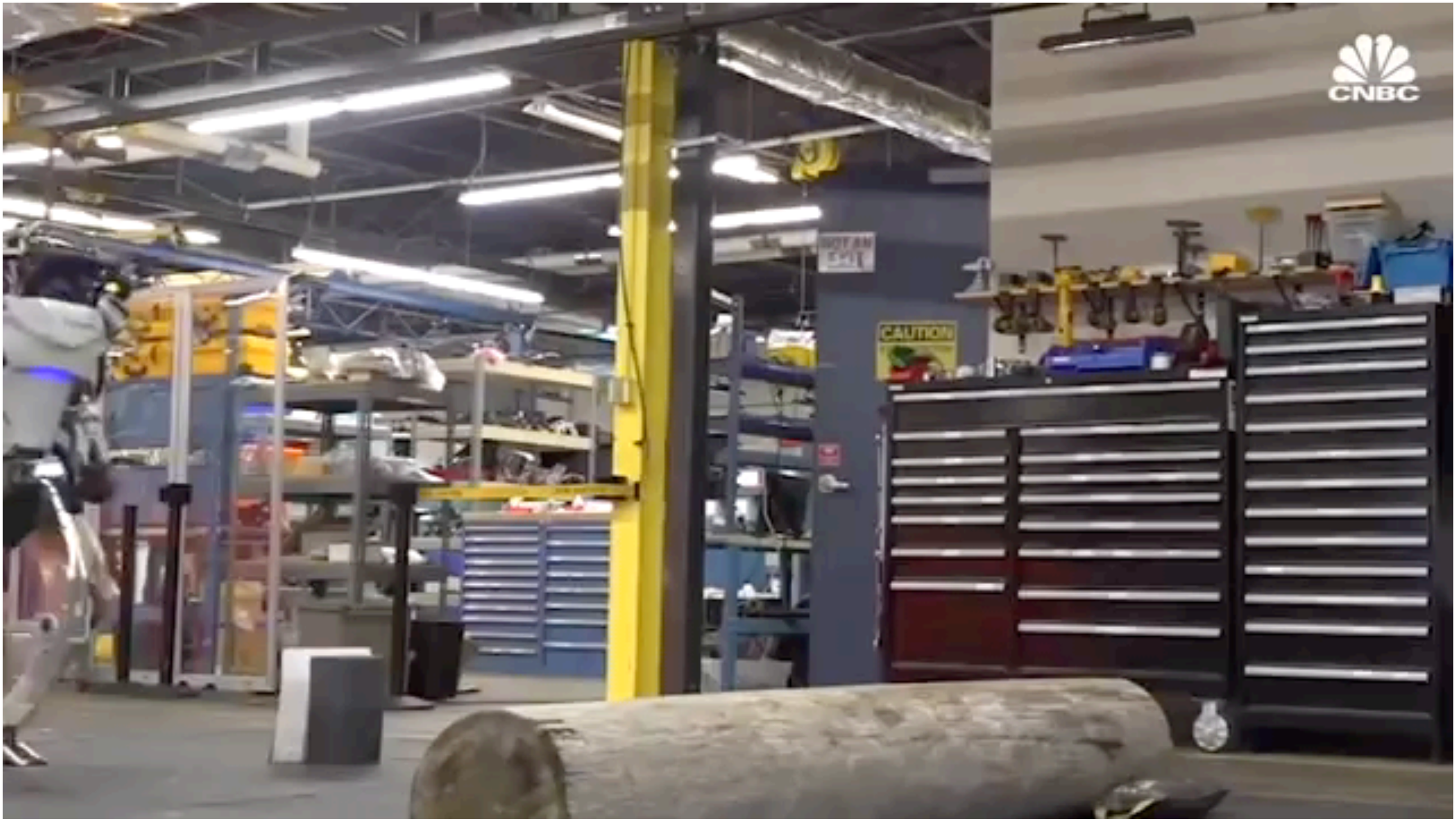
#Microsoft Program Aimed to empower people and organizations to solve environmental challenges using #AI

A.I *Now* *and* *Then*

Self-driving Cars

Now a Disable Person mind Can control the Artificial Hand. This is the power of #AI

Robot Vision



History of AI and AI today

Pre-history (400 B.C. –)

Philosophy: mind/body dualism, materialism

Mathematics: logic, probability, decision theory, game theory

Cognitive psychology

Computer engineering

Birth of AI (1943–1956)

1943 – McCulloch and Pitts: simple neural network

1950 – Turing test

1955-56 – Newell and Simon: Logic Theorist

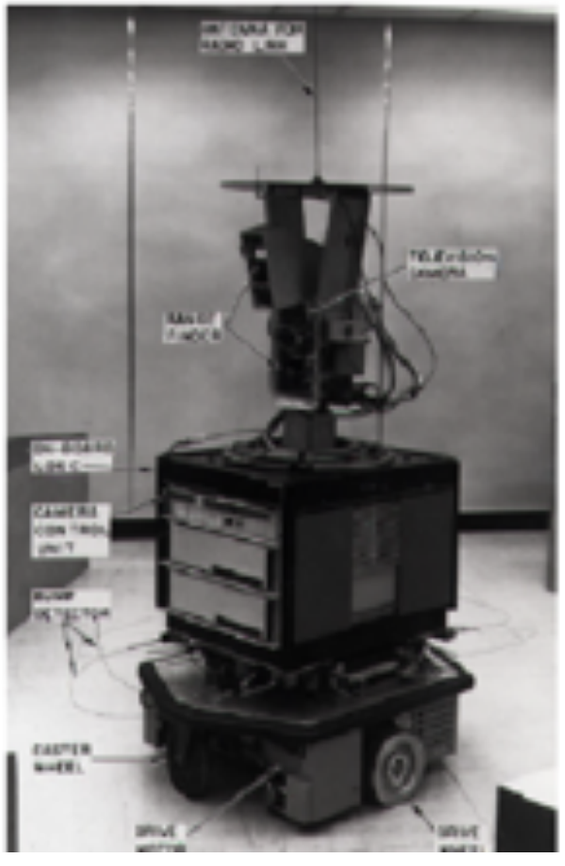
1956 – Dartmouth conference, organized by John McCarthy, Marvin Minsky, Nathaniel Rochester, Claude Shannon

Other attendees were Ray Solomonoff, Oliver Selfridge, Trenchard More, Arthur Samuel, Herbert A. Simon, and Allen Newell

Early successes (1950s–1960s)

1952 – Arthur Samuel develops checkers program, learns via self-play

1958 – McCarthy LISP, advice taker, time sharing



1958 – Rosenblatt's Perceptron algorithm learns to recognize letters

1968-72 – Shakey the robot -> A* algorithm

1971-74 – Blocksworld planning and reasoning domain

First "AI Winter" (Later 1970s)

Many early promises of AI fall short

1969 – Minsky and Pappert's "Perceptrons" book shows that single-layer neural network cannot represent XOR function

1973 – Lighthill report effectively ends AI funding in U.K.

1970s – DARPA cuts funding for several AI projects

Expert systems & business (1970s–1980s)

Move towards encoding domain expert knowledge as logical rules

1971-74 – Feigenbaum's DENDRAL (molecular structure prediction) and MYCIN (medical diagnoses)

1981 – Japan's "fifth generation" computer project, intelligent computers running Prolog

1982 – R1, expert system for configuring computer orders, deployed at DEC

Focus on applications (1990s-2010s)

Meanwhile, AI (sometimes under the guise of a subfield), achieved some notable milestones

1997 – Deep Blue beats Gary Kasparov

2001-2010 – $60 billion involved in combinatorial sourcing auctions

2005,2007 – Stanford and CMU respectively win DARPA grand challenge in autonomous driving

2011 – IBM's Watson defeats human opponents on Jeopordy

Reemergence of "AI" (2010s–??)

"AI" seems to be a buzzword again

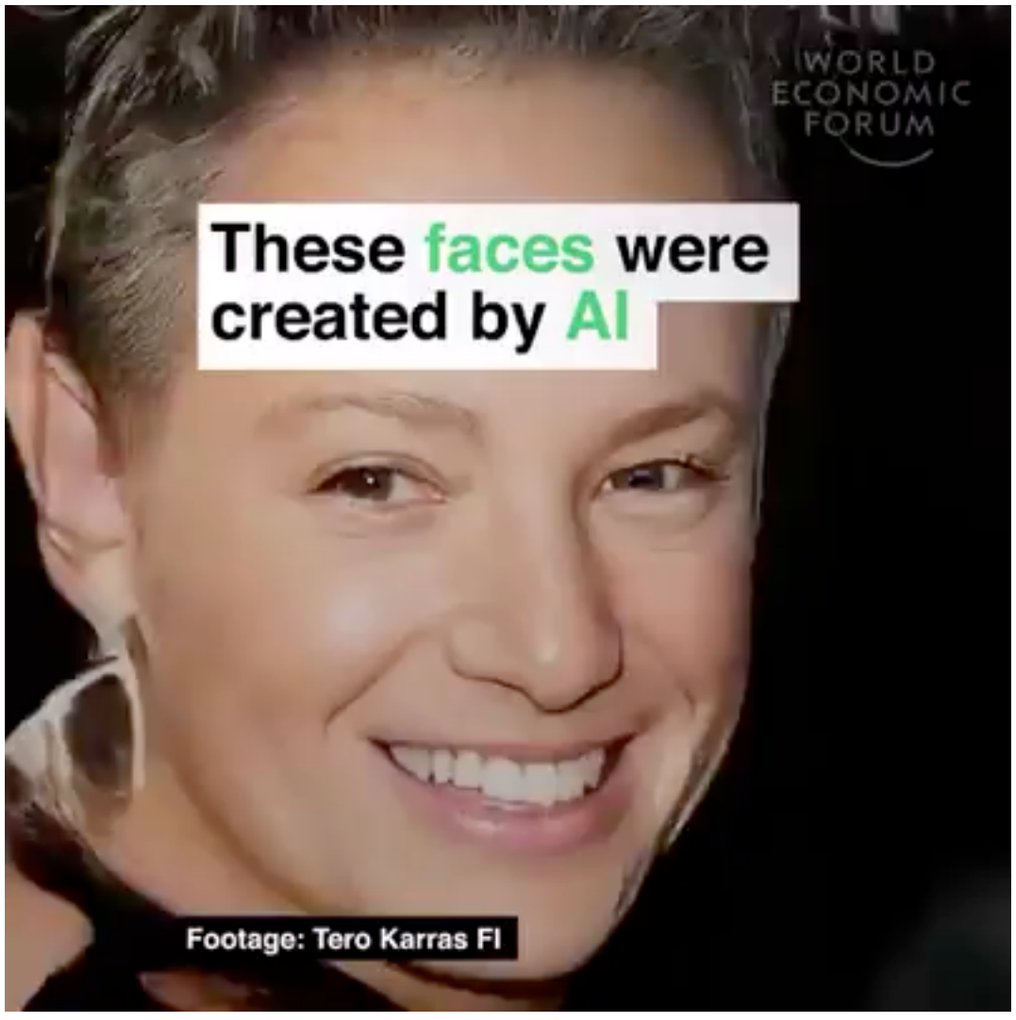
Google, Facebook, Twitter, etc, all have large AI labs, labeled as such

2012 – Deep neural network wins image classification contest

2013 – DeepMind shows computer learning to play Atari games

2015-2017 – superhuman speech understanding

This #AI is able to learn different faces from any picture it sees and generate new ones.



Kiki Understands Your feelings and tries to cheer you up. She Can be affectionate, Social and even moody. The power of #AI

Thoughts about Goals of AI

- AI has many different goals
  - This is nothing to avoid
  - E.g., OR has same “problem” and is not shy about it

- Shouldn’t define AI as that which still cannot be done
- Human-level intelligence just a milestone along the way

- Q: Will there be a super-human species?
- A: No, AIs will be tools for various purposes

Some potential new AI applications with huge positive impact on the world

- Better electricity markets
- Combinatorial CO_2 allowance / pollution credit markets
- Automated market making
- Campaign market for advertising
- Security games
  - Physical, information, malware protection, …
  - Sequential

- AI is a fast-moving exciting area

- We can directly make the world a better place

Homework:

- Reading: Eli Stevens et al., Chapters 1 & 2
- Reading: Russell & Norvig, Chapters 1 & 2