Deep Learning

Lecture 1

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Introduction

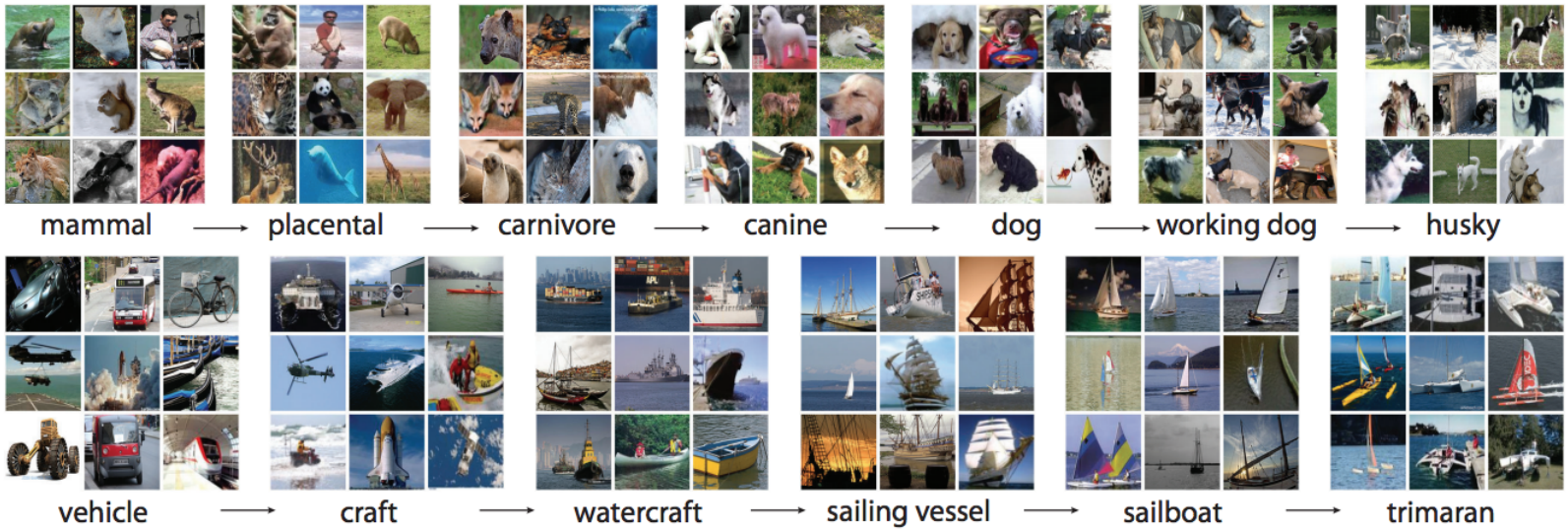

Figure 1: A snapshot of two root-to-leaf branches of ImageNet: the **top** row is from the mammal subtree; the **bottom** row is from the vehicle subtree. For each synset, 9 randomly sampled images are presented.

Deng, Jia, et al. "Imagenet: A large-scale hierarchical image database." Computer Vision and Pattern Recognition, 2009. CVPR 2009. IEEE Conference on. Ieee, 2009.

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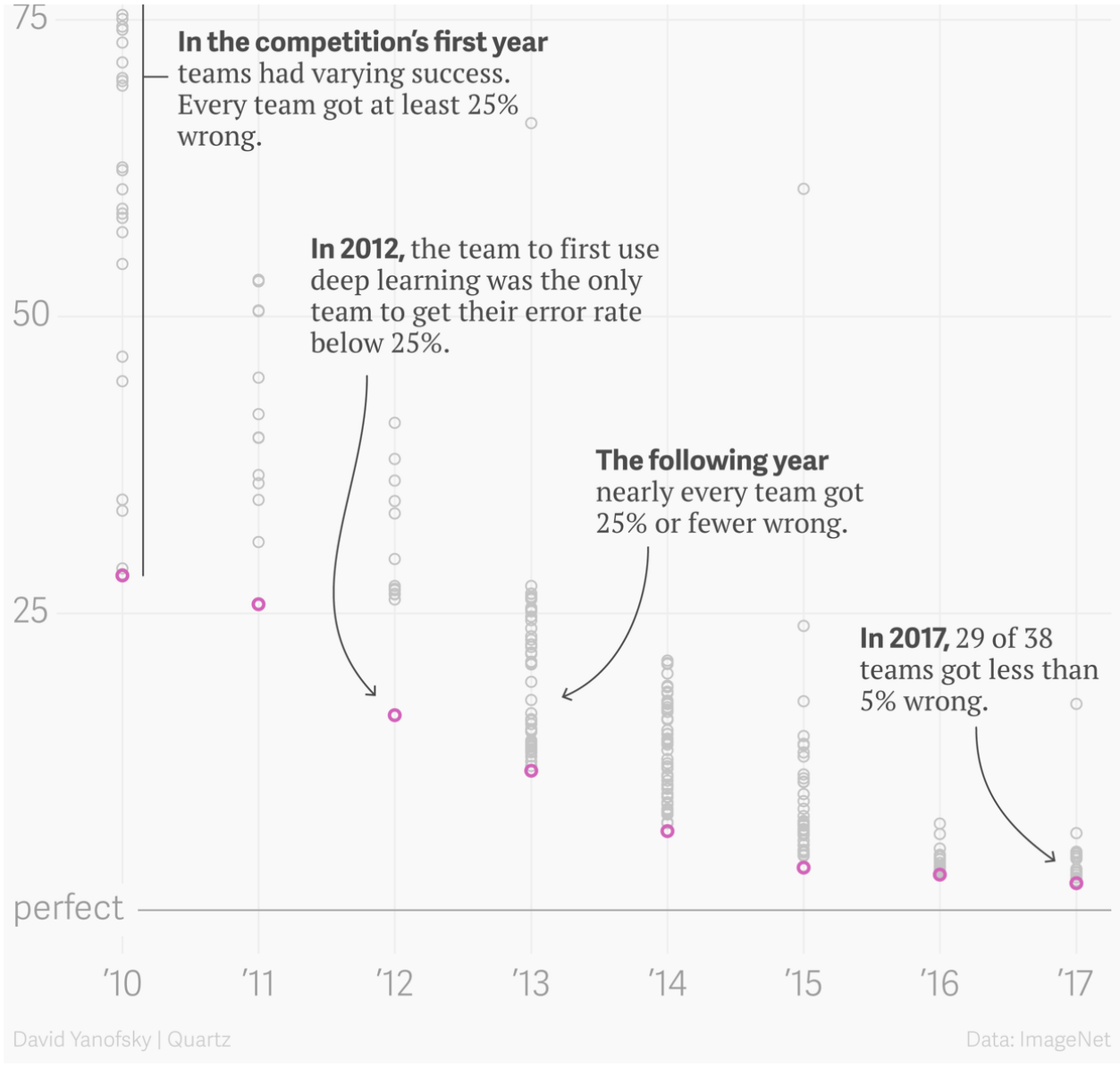

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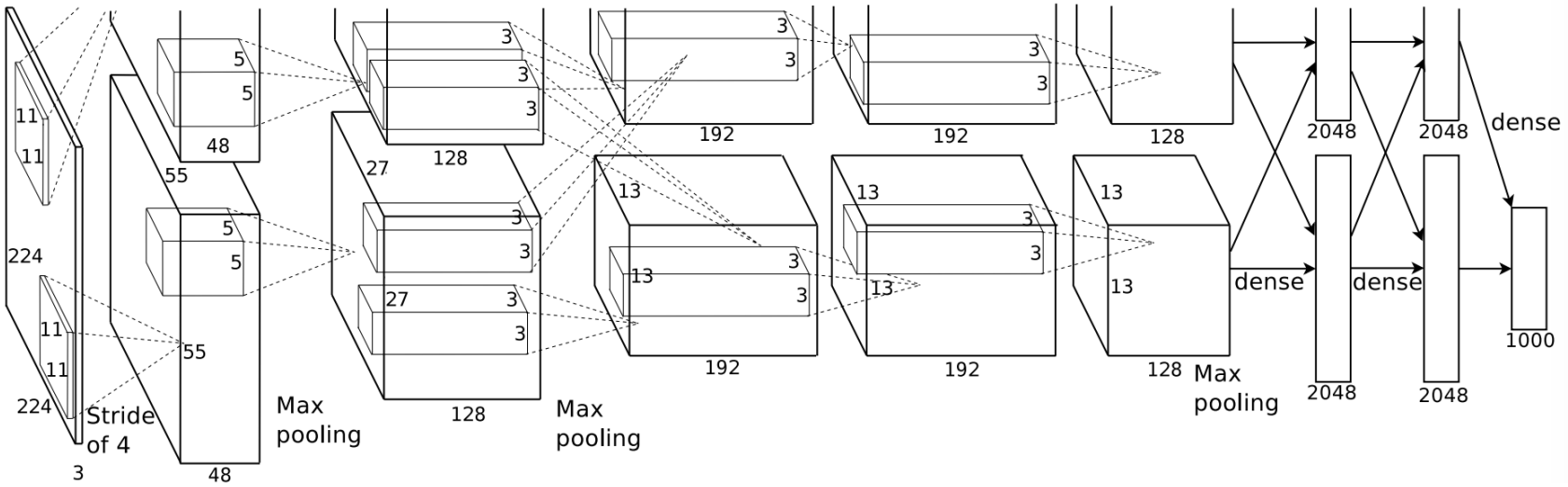

Krizhevsky, Alex, Ilya Sutskever, and Geoffrey E. Hinton. "Imagenet classification with deep convolutional neural networks." Advances in neural information processing systems. 2012.

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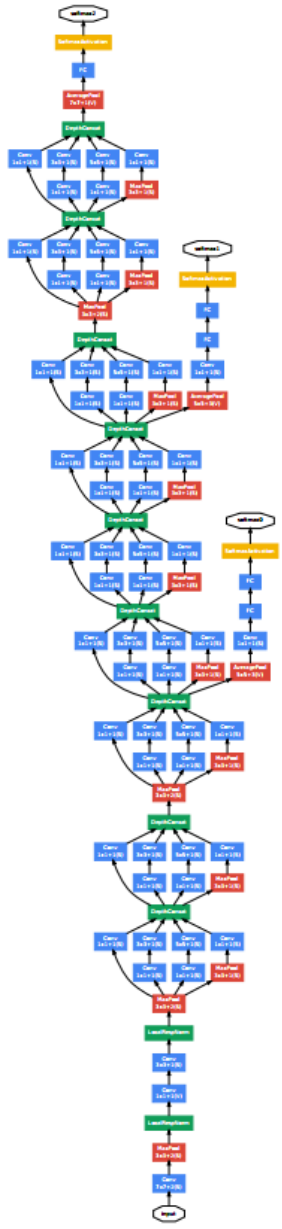

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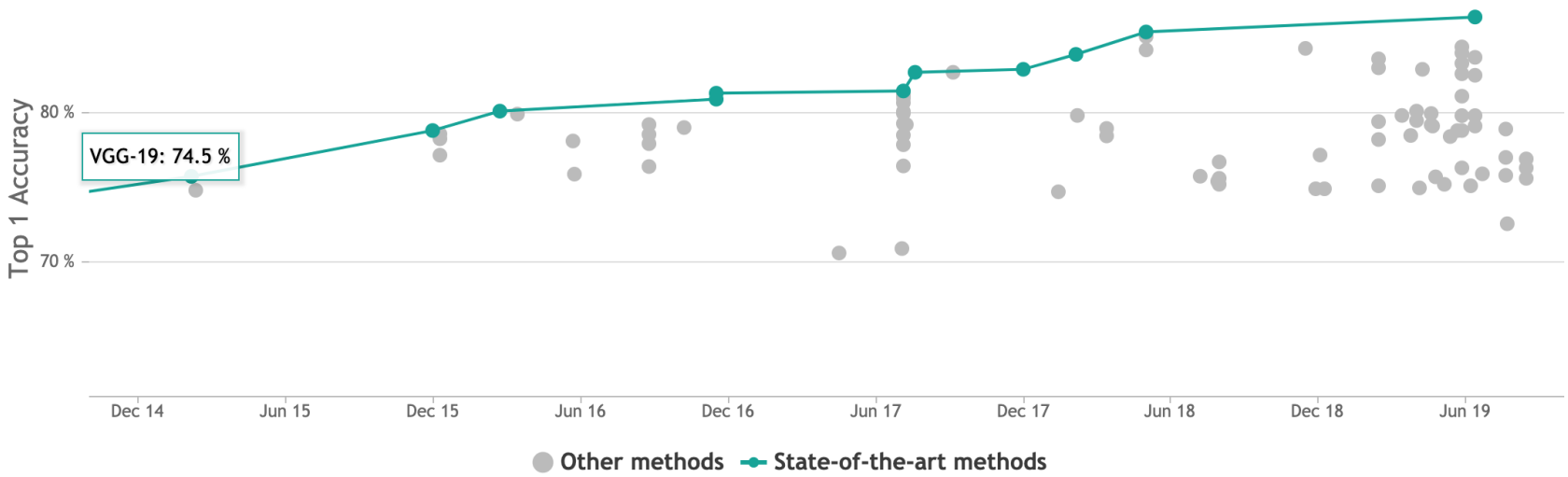

View: All methods

Edit

Rank	Method	Top 1 Accuracy	Top 5 Accuracy	Number of params	Extra Training Data	Paper Title	Year	Paper	Code
1	**FixResNeXt-101 32x48d**	86.4%	98.0%	829M	✓	Fixing the train-test resolution discrepancy	2019		
2	**ResNeXt-101 32x48d**	85.4%	97.6%	829M	✓	Exploring the Limits of Weakly Supervised Pretraining	2018		

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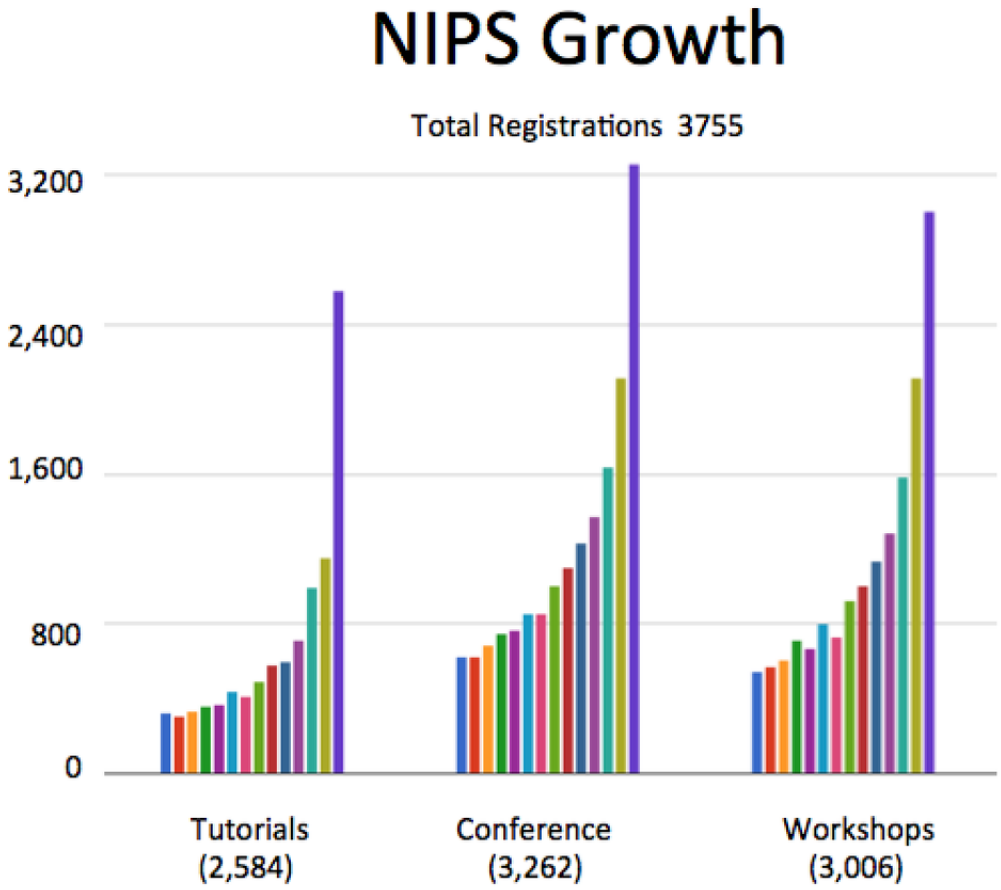

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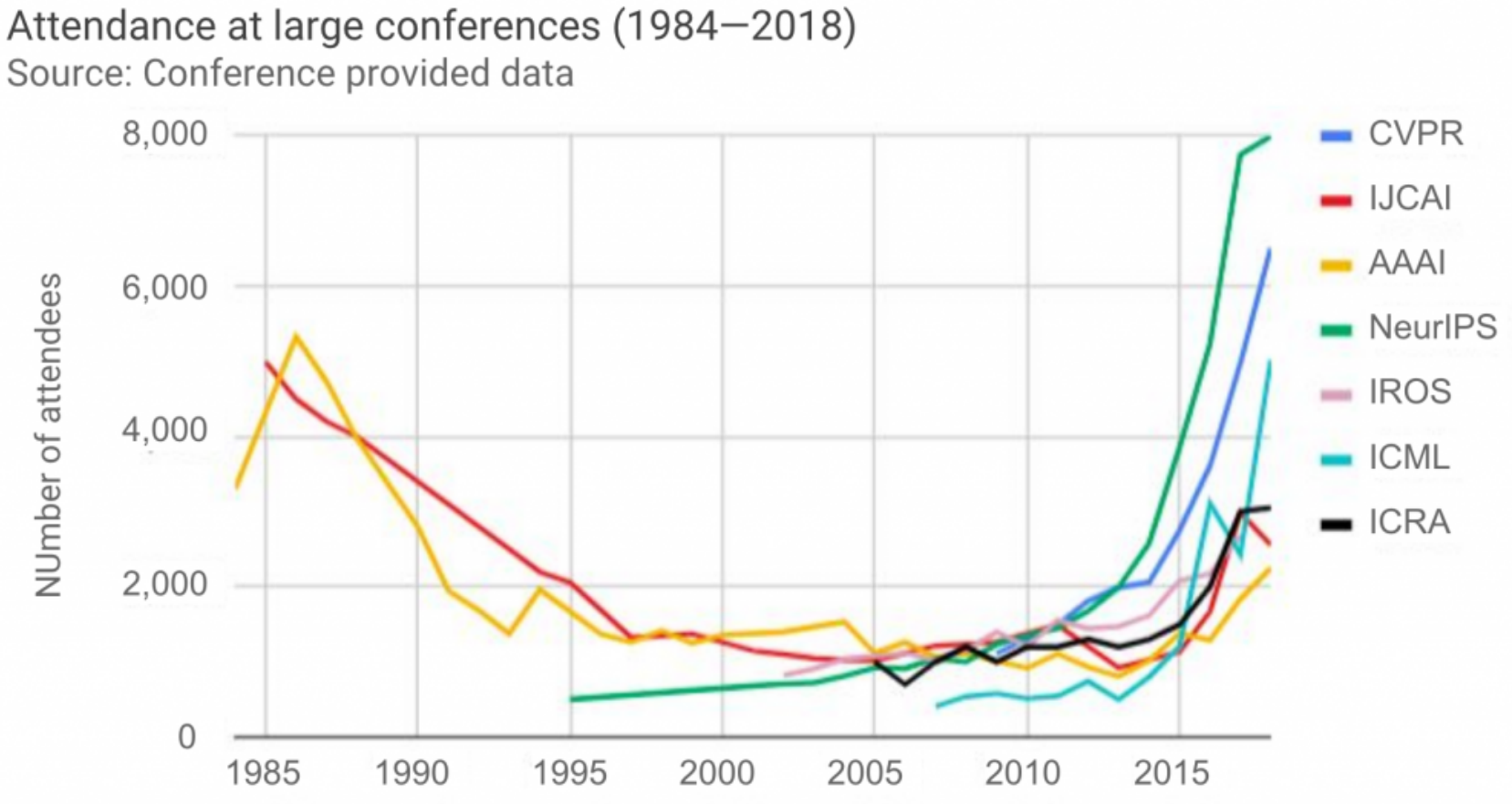

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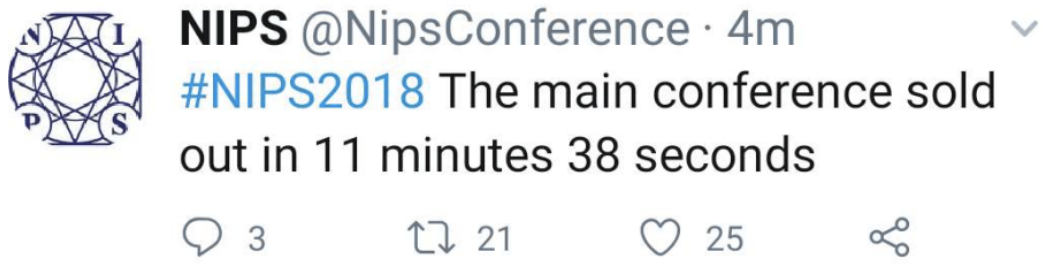

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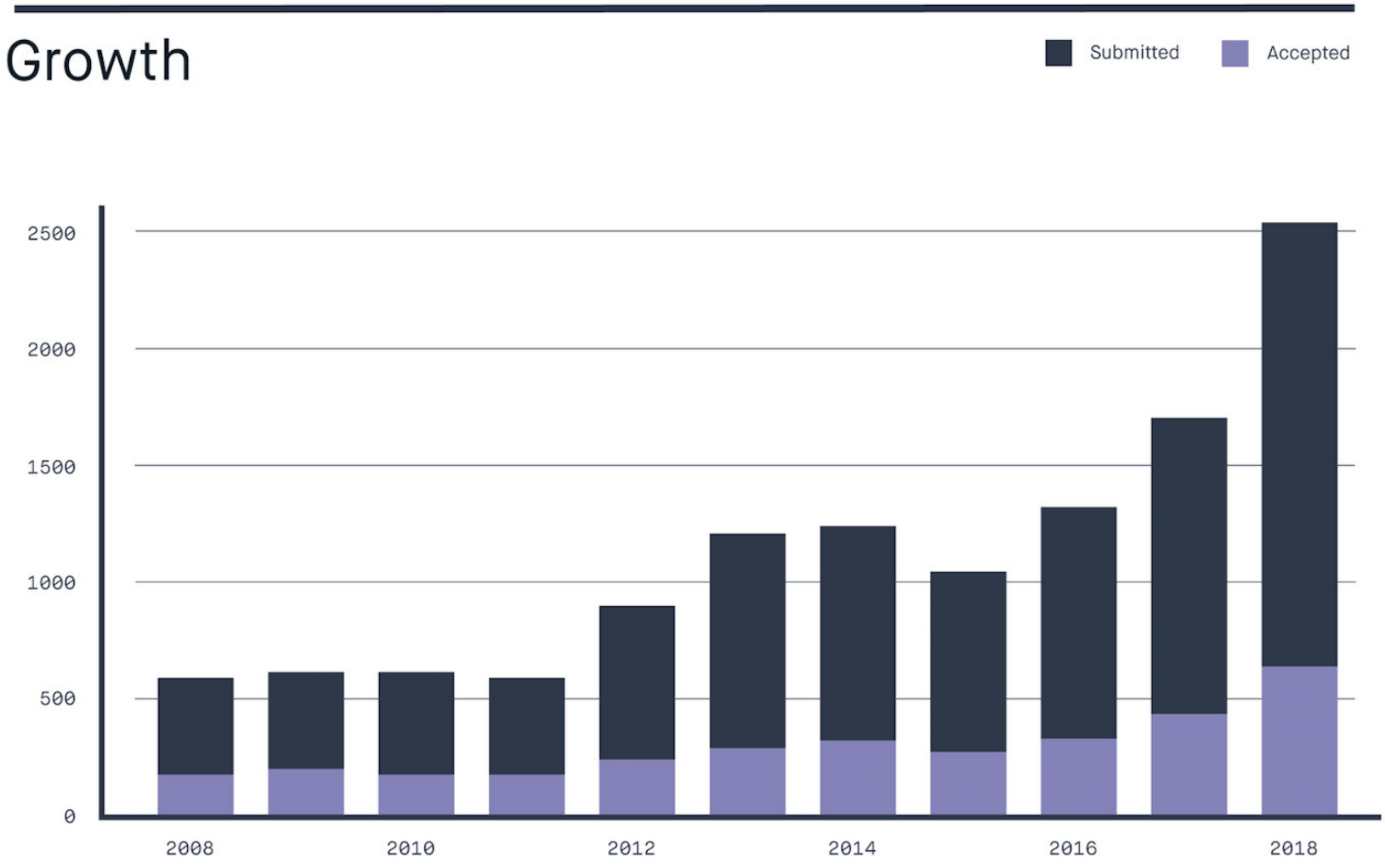

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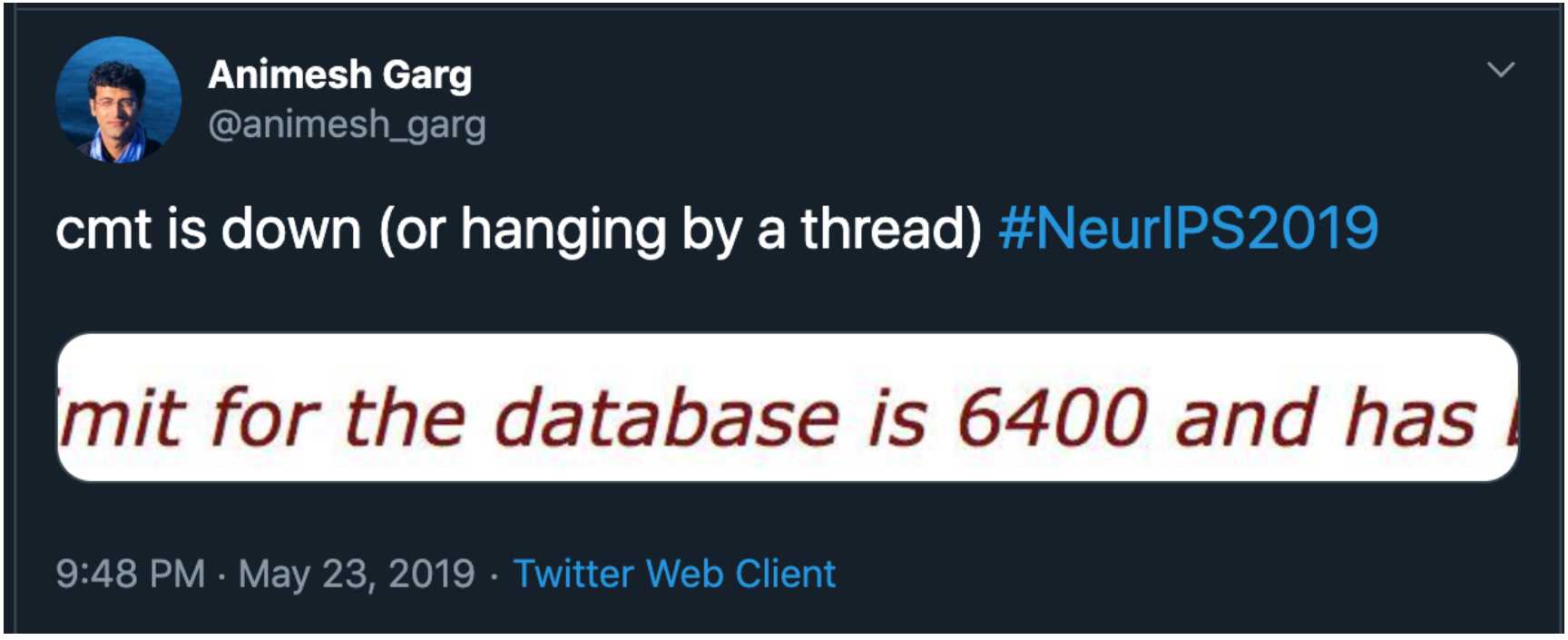

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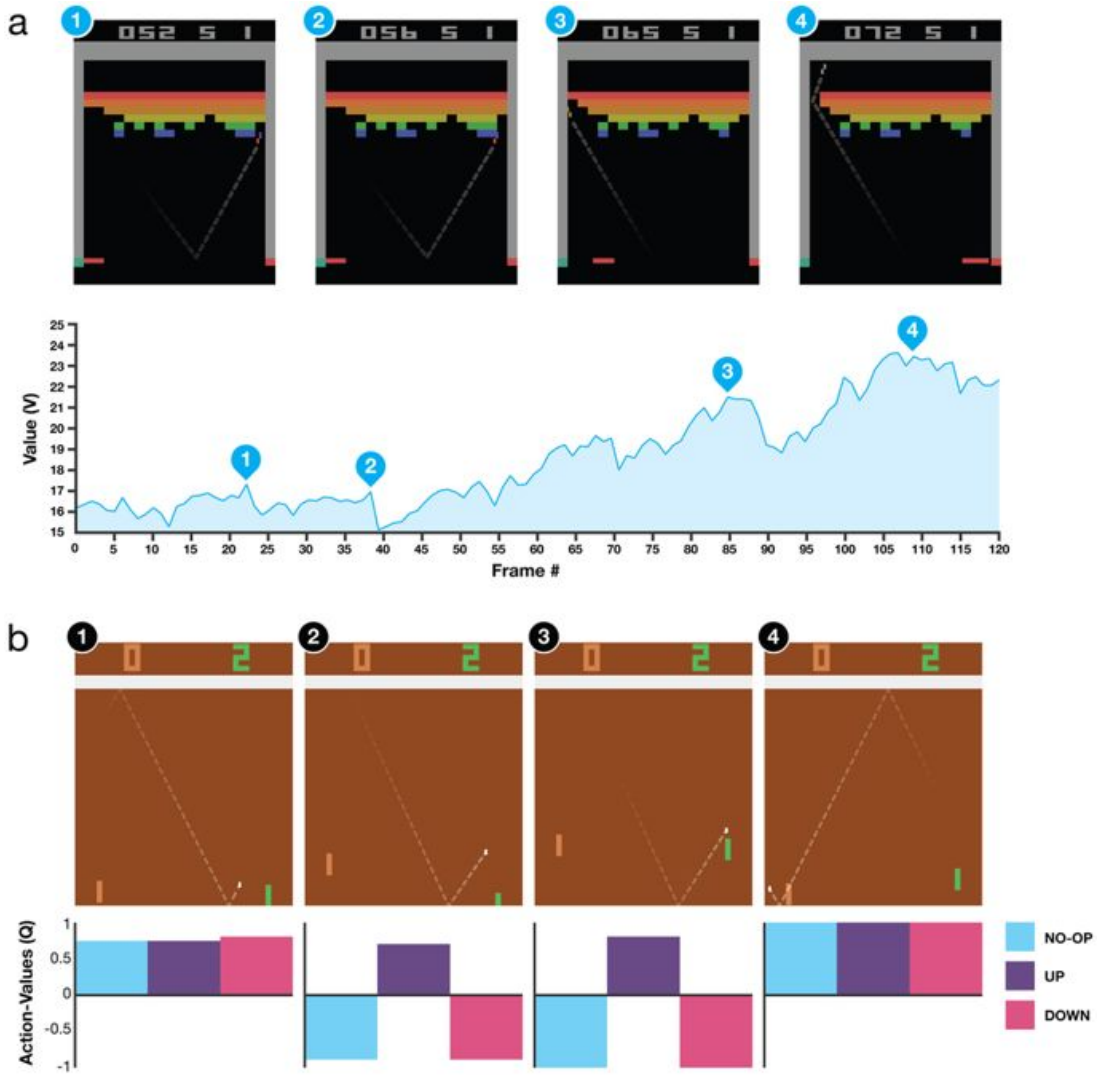

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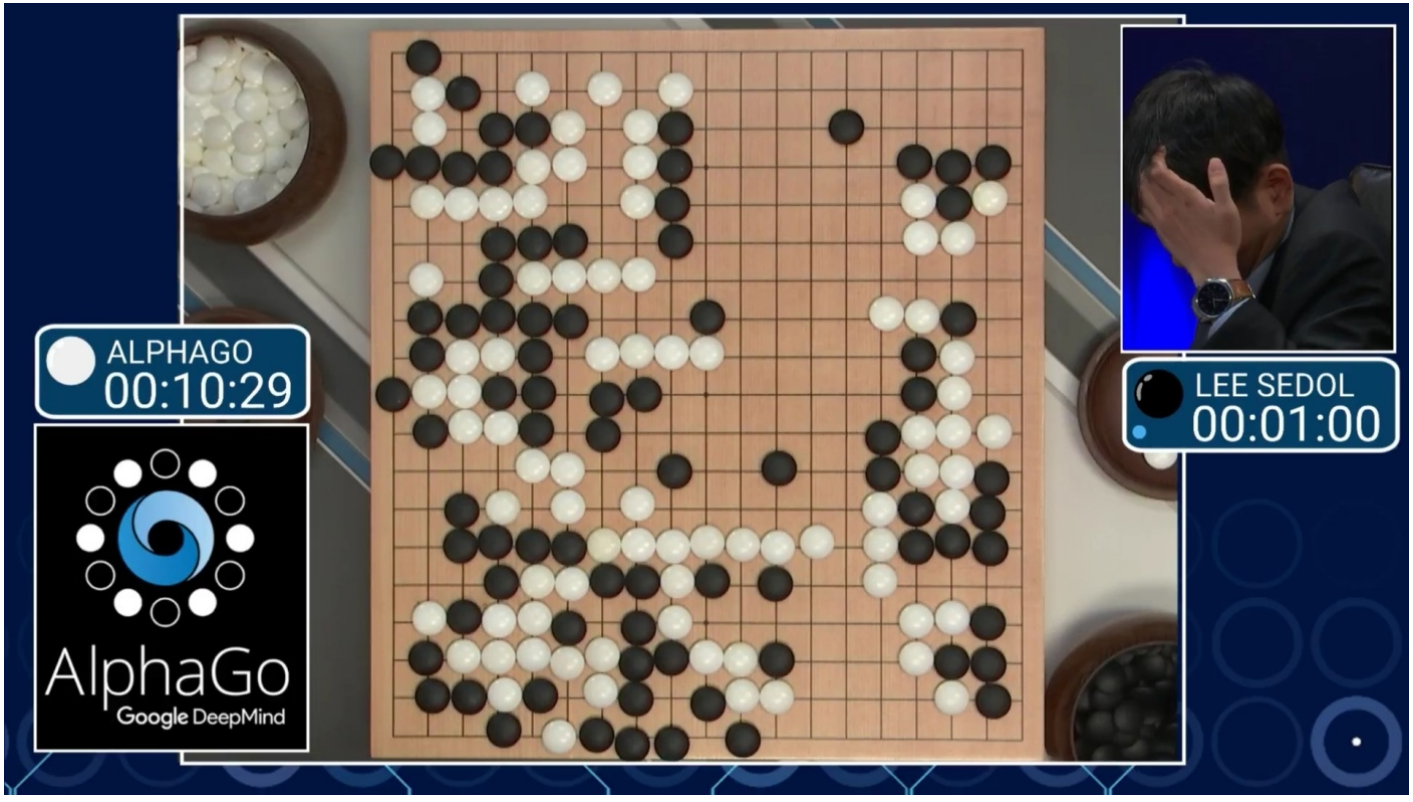

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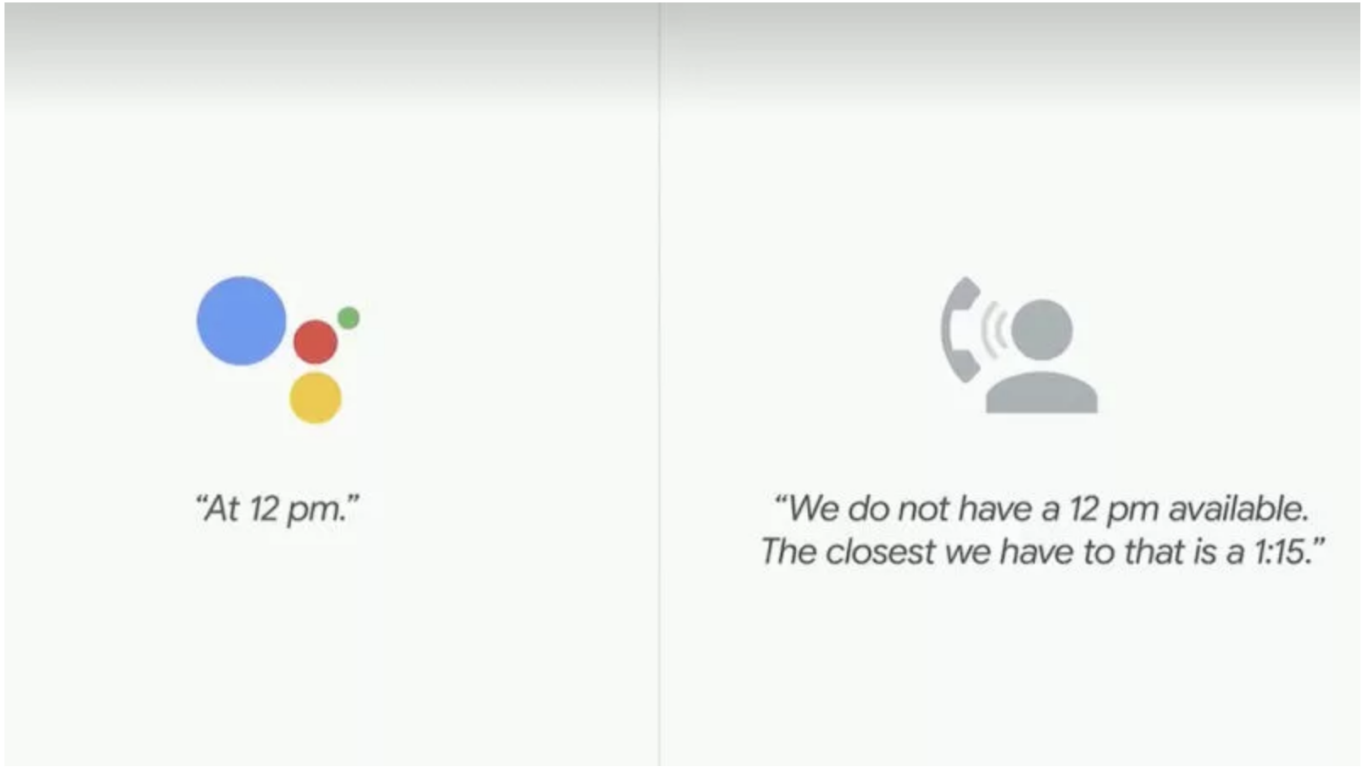


Screenshot: Andrew Liszewski (Gizmodo)

Introduction

Introduction

Context (human-written): In a shocking finding, scientist discovered a herd of unicorns living in a remote, previously unexplored valley, in the Andes Mountains. Even more surprising to the researchers was the fact that the unicorns spoke perfect English.

GPT-2: The scientist named the population, after their distinctive horn, Ovid's Unicorn. These four-horned, silver-white unicorns were previously unknown to science.

Now, after almost two centuries, the mystery of what sparked this odd phenomenon is finally solved.

Dr. Jorge Pérez, an evolutionary biologist from the University of La Paz, and several companions, were exploring the Andes Mountains when they found a small valley, with no other animals or humans. Pérez noticed that the valley had what appeared to be a natural fountain, surrounded by two peaks of rock and silver snow.

Pérez and the others then ventured further into the valley. "By the time we reached the top of one peak, the water looked blue, with some crystals on top," said Pérez.

Pérez and his friends were astonished to see the unicorn herd. These creatures could be seen from the air without having to move too much to see them – they were so close they could touch their horns.

While examining these bizarre creatures the scientists discovered that the creatures also spoke some fairly regular English. Pérez stated, "We can see, for example, that they have a common 'language,' something like a dialect or dialectic."

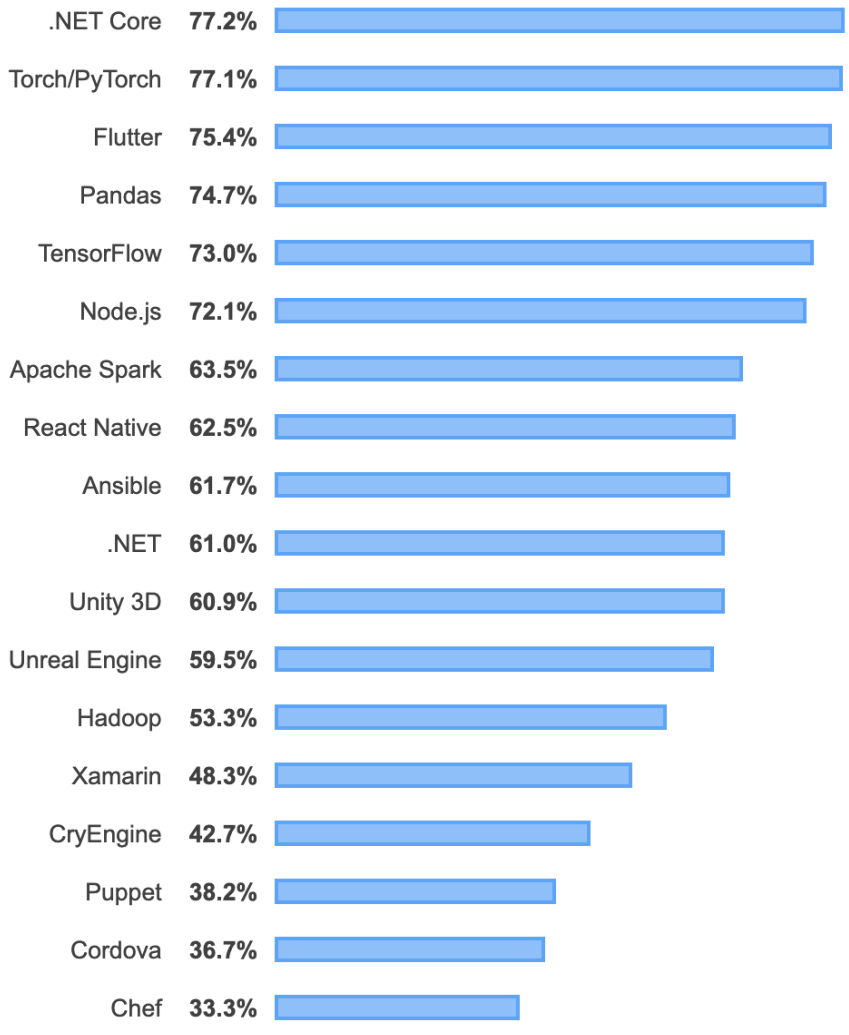
Dr. Pérez believes that the unicorns may have originated in Argentina, where the animals were believed to be descendants of a lost race of people who lived there before the arrival of humans in those parts of South America.

While their origins are still unclear, some believe that perhaps the creatures were created when a human and a unicorn met each other in a time before human civilization. According to Pérez, "In South America, such incidents seem to be quite common."

However, Pérez also pointed out that it is likely that the only way of knowing for sure if unicorns are indeed the descendants of a lost alien race is through DNA. "But they seem to be able to communicate in English quite well, which I believe is a sign of evolution, or at least a change in social organization," said the scientist.

Introduction

Loved | Dreaded | Wanted



% of developers who are developing with the language or technology and have expressed interest in continuing to develop

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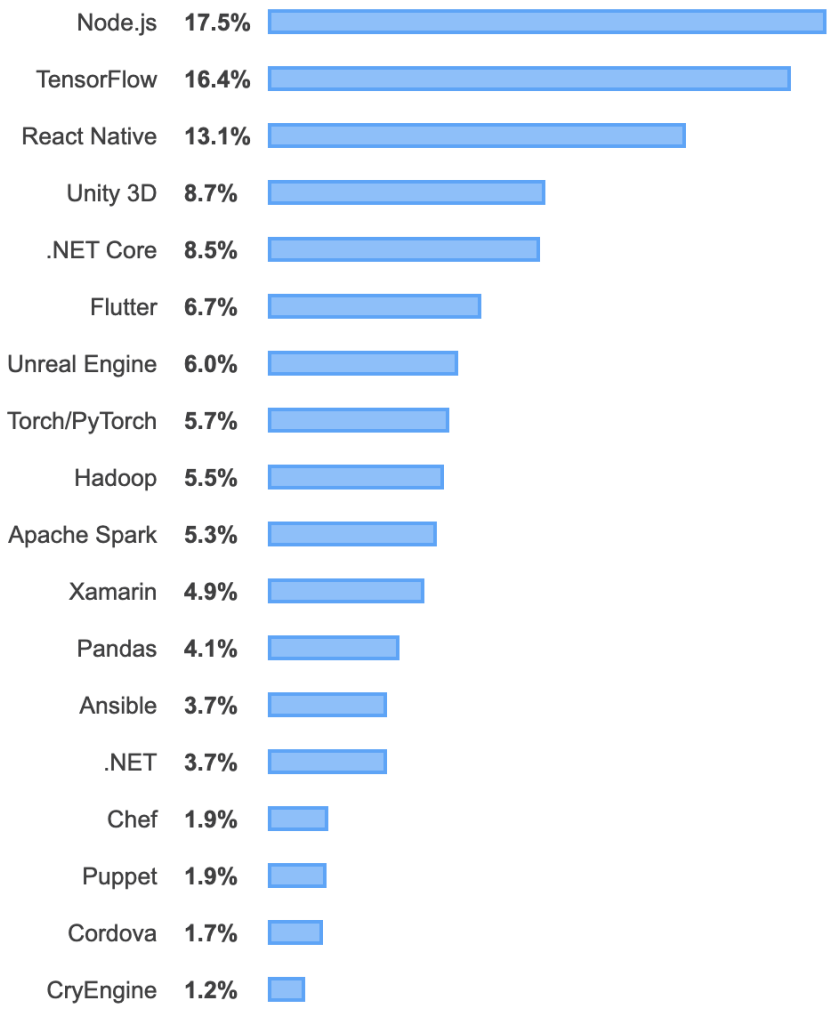
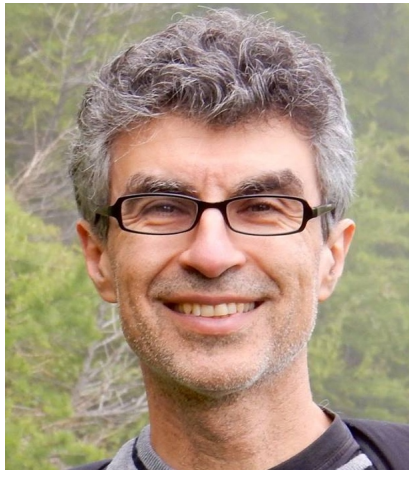


% of developers who are not developing with the language or technology but have expressed interest in developing with it

Introduction



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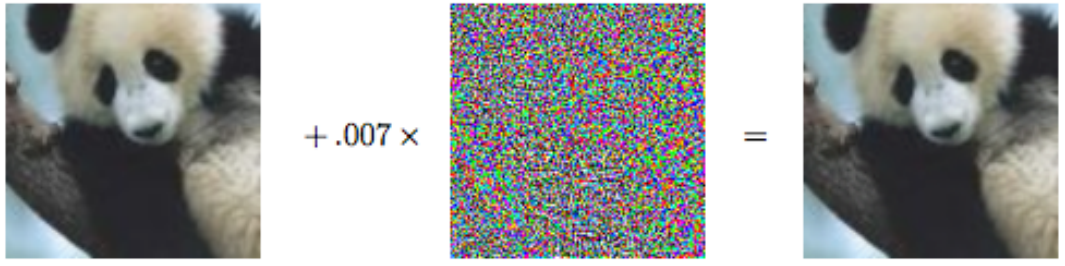


Introduction

future tense

When Is Technology Too Dangerous to Release to the Public?

A new text-generating algorithm has reignited a long-running debate.

By AARON MAK

FEB 22, 2019 • 5:56 PM

Introduction

Drones, facial recognition and a social credit system: 10 ways China watches its citizens

From tracking the activity of mobile app users to setting up a social credit scorecard, the world's most populated country is taking surveillance technology to new heights

Zhou Jiaquan

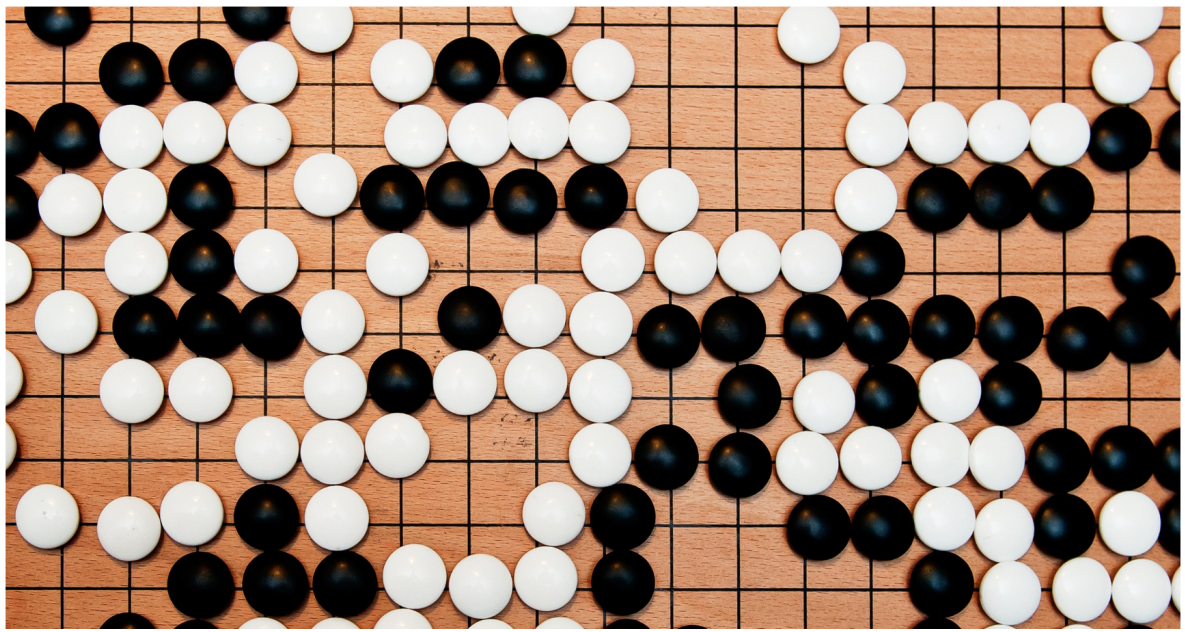
Published: 10:32pm, 4 Aug, 2018

Introduction

Introduction

Artificial Intelligence Confronts a 'Reproducibility' Crisis

Machine-learning systems are black boxes even to the researchers that build them. That makes it hard for others to assess the results.

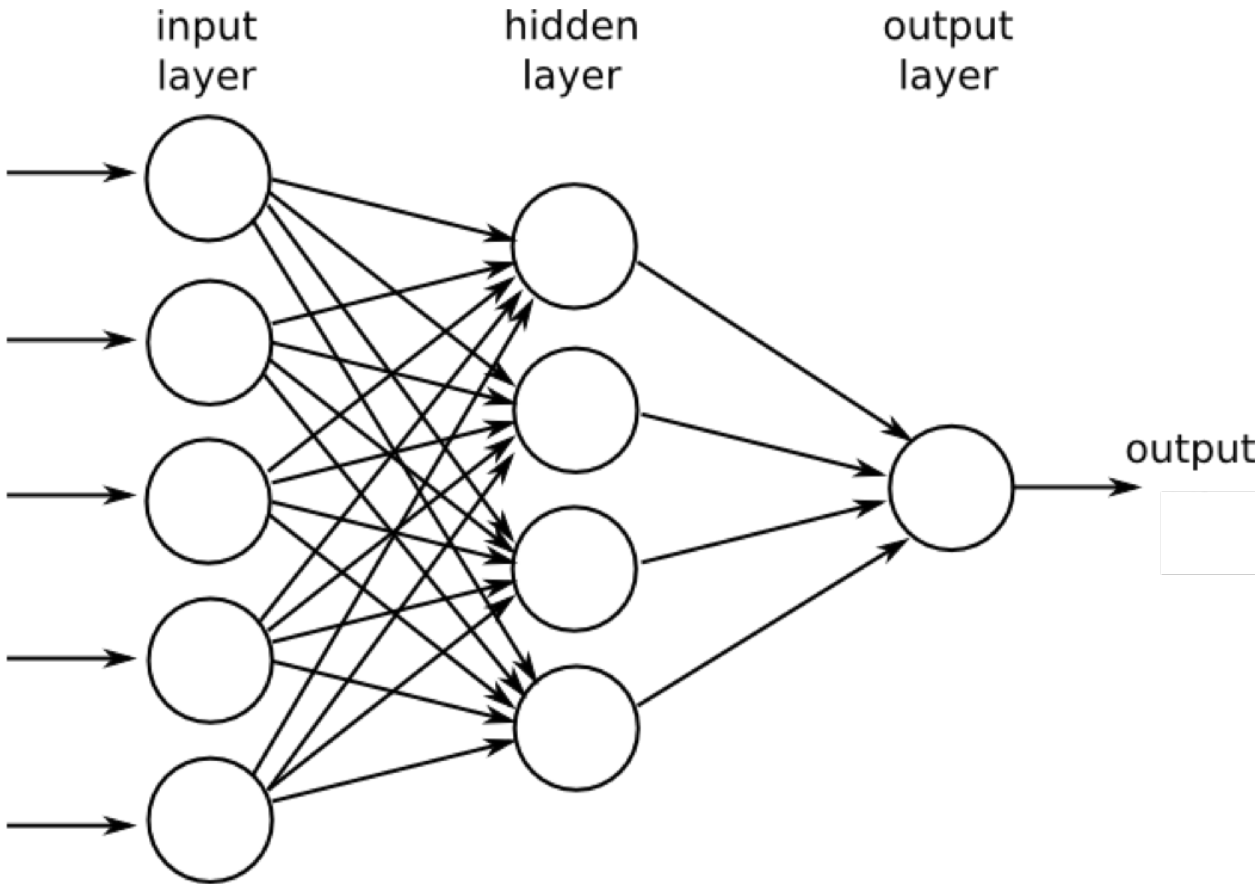


Introduction

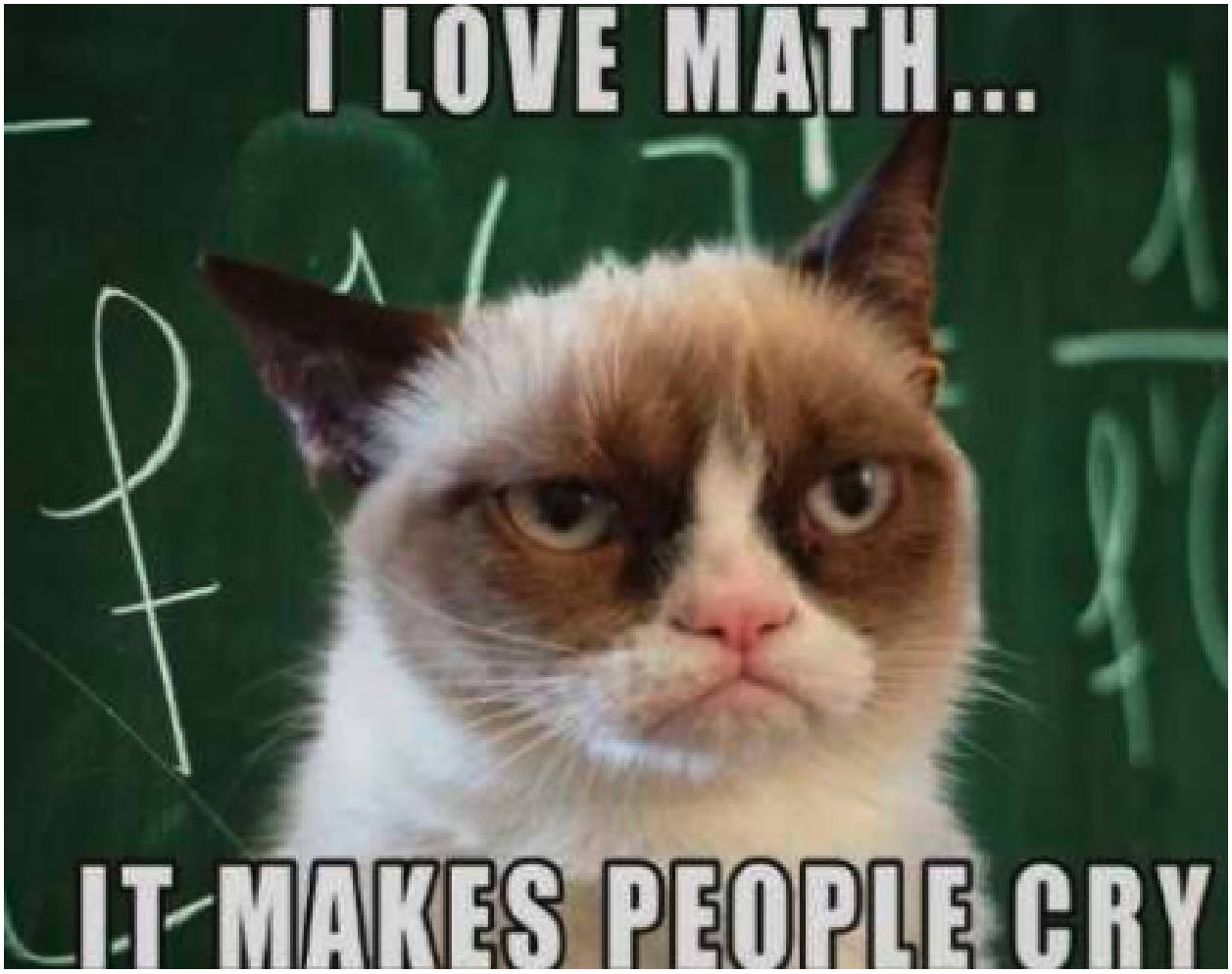
Section 2

Course Overview

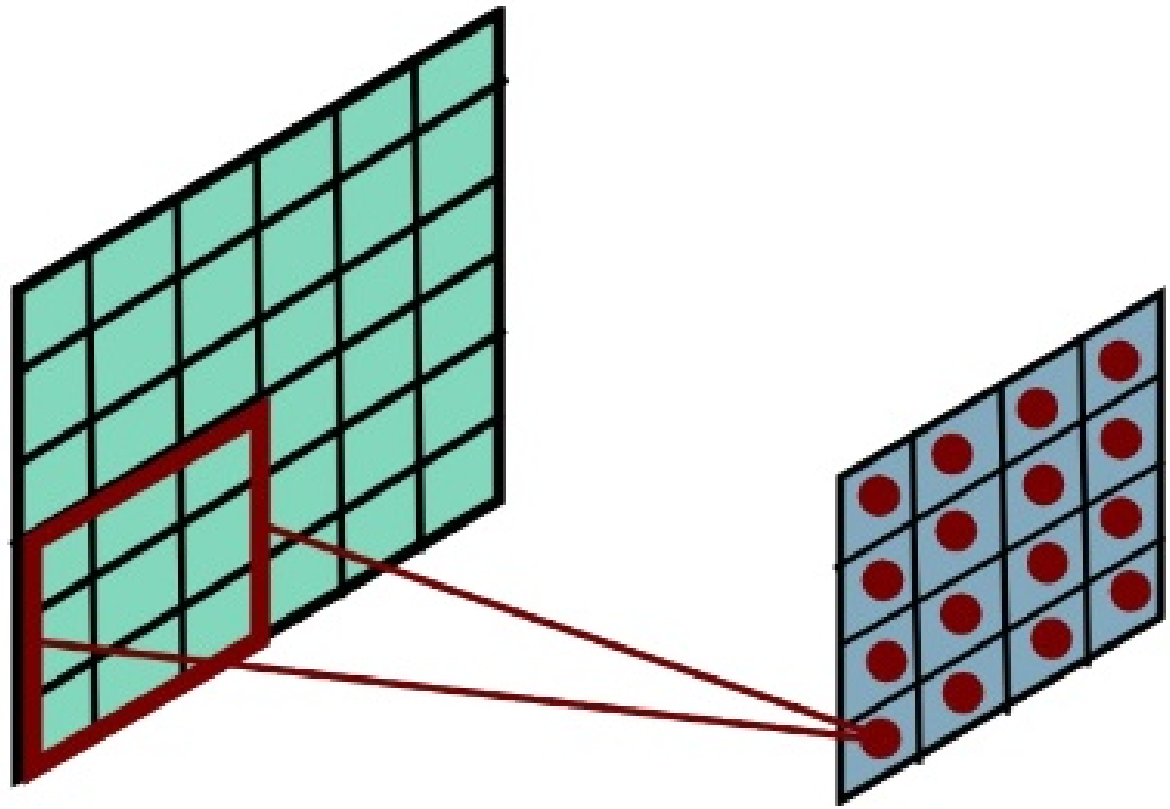
Lecture 1: MLPs



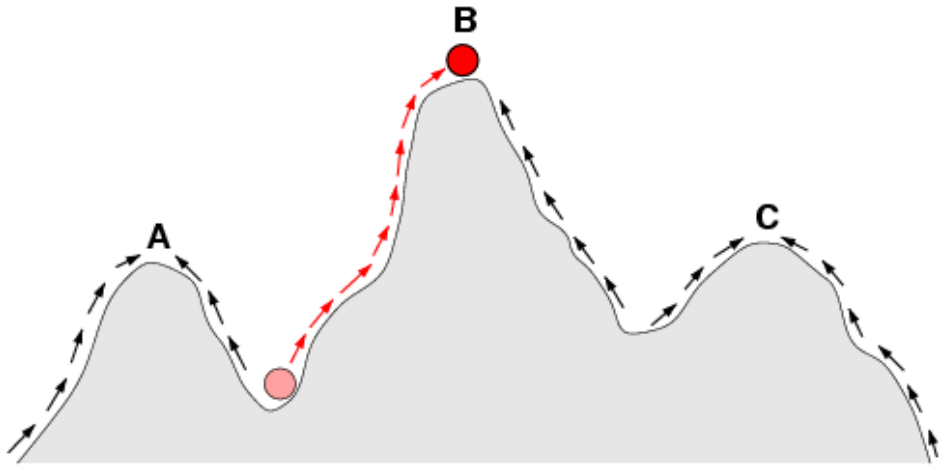
Lecture 2: Backpropagation



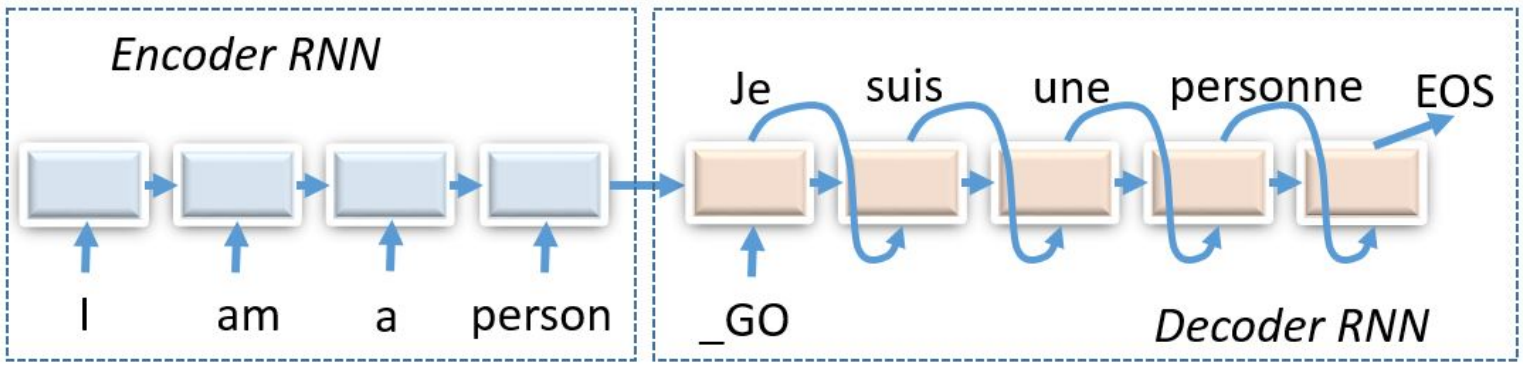
Lecture 3: Convolutional Neural Networks



Lecture 4: Optimization



Lectures 5, 6 & 7: Architectures & Algorithms



Lectures 5, 6 & 7: Architectures & Algorithms

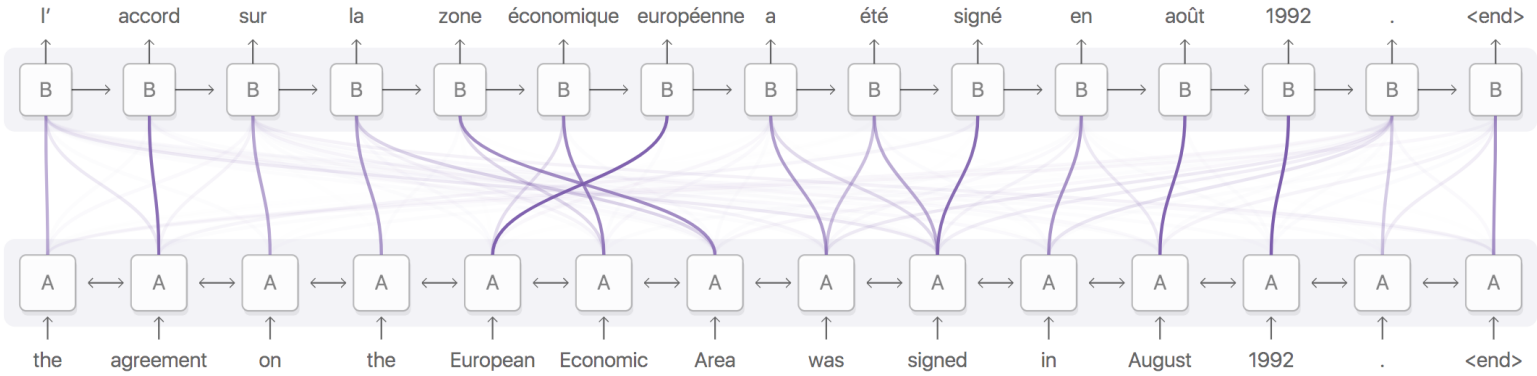
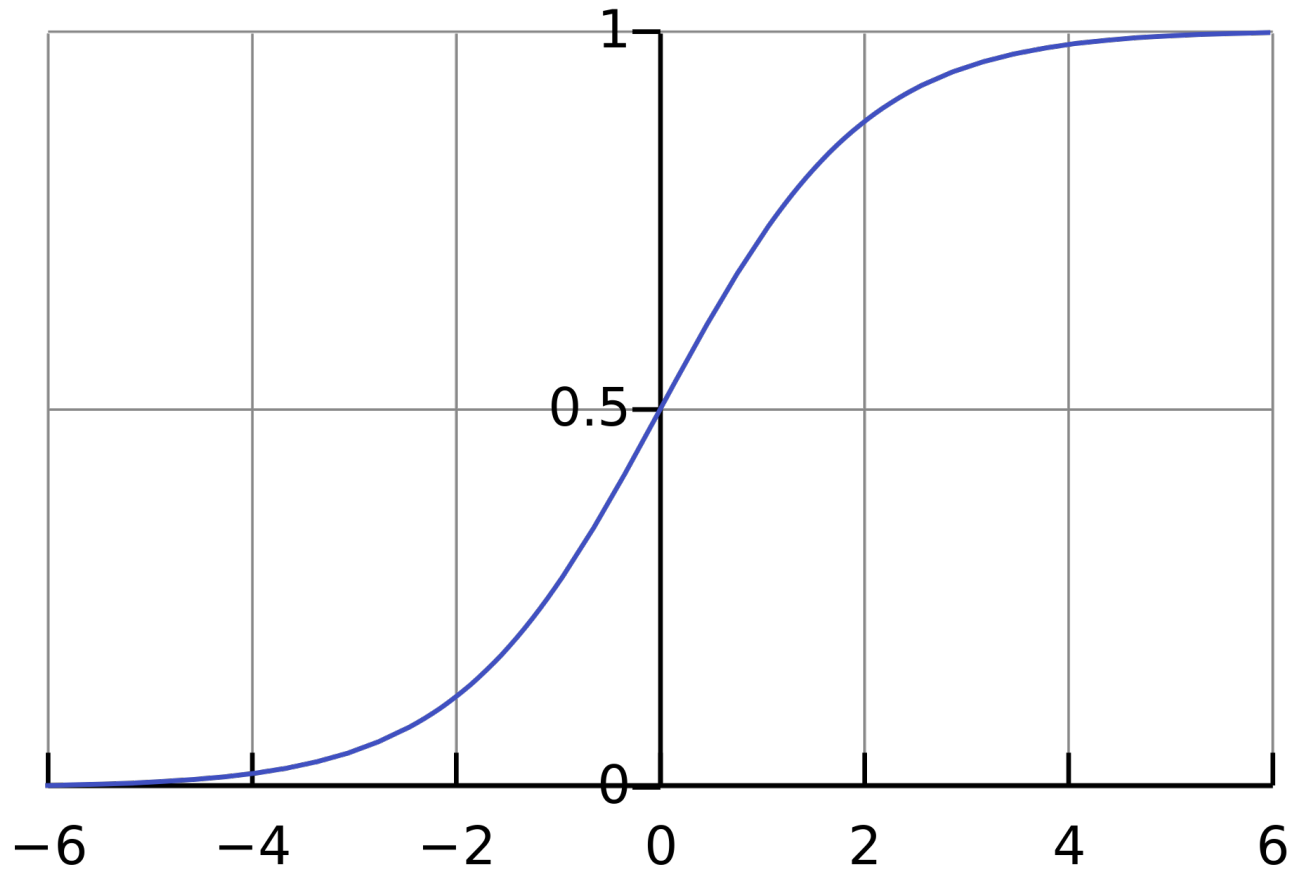
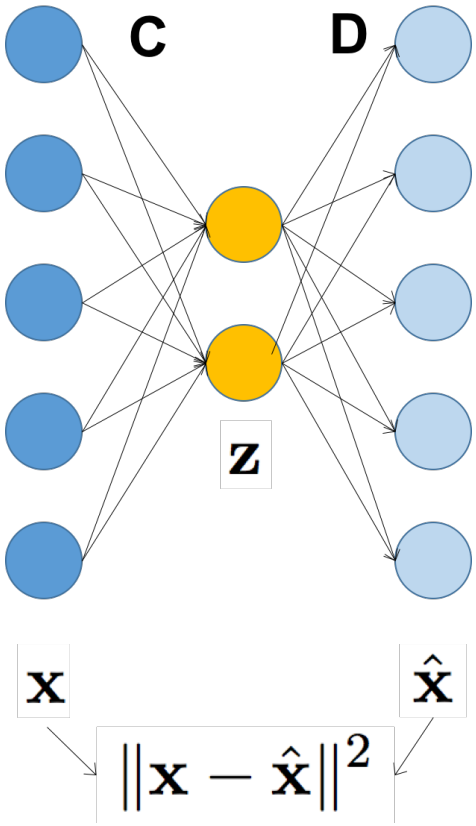


Diagram derived from Fig. 3 of Bahdanau, *et al.* 2014

Lectures 8, 9 & 10: Theory



Lecture 11: Autoencoders



Lecture 12: Generative Adversarial Models

Section 2

Course Overview

What you can expect

- Introduction to neural networks and deep learning
- Foundations and principles (mathematics!)
- Major model architectures and learning algorithms
- Exemplary use cases, getting intuitions
- Machine learning for machine intelligence
- Hands-on experience (exercise sessions / projects)
- Getting addicted to deep learning :)

What you should not expect

- Learning magic tricks
- Learning machine learning basics (pre-requisite)
- Avoiding mathematics "gets you through"
- Becoming an expert "framework" user (not prevented)
- Solving strong AI in 2020
- Immediate wealth :)

Course Information

- Lecture
  - Thursdays, 15-17
  - HG F7 (+ HG F5)
- Exercises
  - Mondays, 15-16, CAB G 11
  - Thursdays, 17-18, CAB G 11
  - **NO CLASS** means also no exercises that week
  - Identical sessions
  - Discussion of the exercise sheets
  - No hand-in of homework

Course Information

- Enrollment limit: None (first time)
  - size of largest lecture halls available
  - limited TA resources
  - requirements: see course catalogue
- Lectures & material
  - course homepage:
    `www.da.inf.ethz.ch/teaching/2019/DeepLearning`
  - handouts: linked on course homepage
  - communication via piazza
  - textbook: Goodfellow, Bengio, Courville: Deep Learning, 2016

Grading

- Mixed grading scheme
  - 70% Exam
  - 30% Group project

Exam

- During exam session
- Written
- Closed-book
- Scope
  - All lecture content (written & oral)
  - All exercise content (written & oral)
  - Textbook
  - Referenced papers
  - Wikipedia
  - Everything else

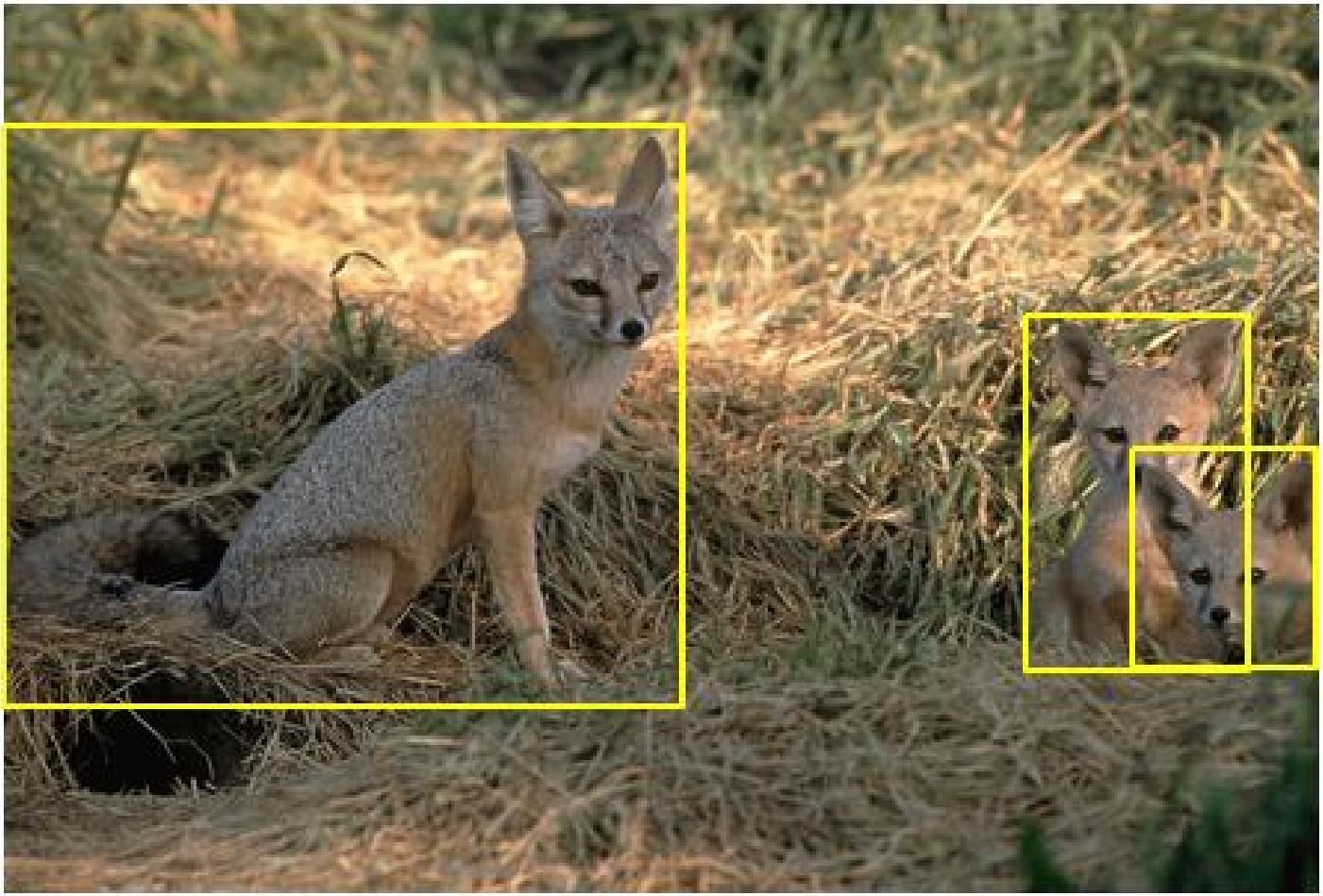
Project

- Hands-on, 40 hours
- Groups of 3-4 people
- You choose your topic
- 1-page proposal due before Christmas
- Report & code due January 18th
- Early Submission Bonus!
- Frameworks: Tensorflow, Pytorch, Keras

Project Grading

- Quality of report
- Cleanliness of execution
- Soundness of evaluation (comparison to baselines, etc.)
- Presentation and interpretation of results
- Creativity

Project Suggestions



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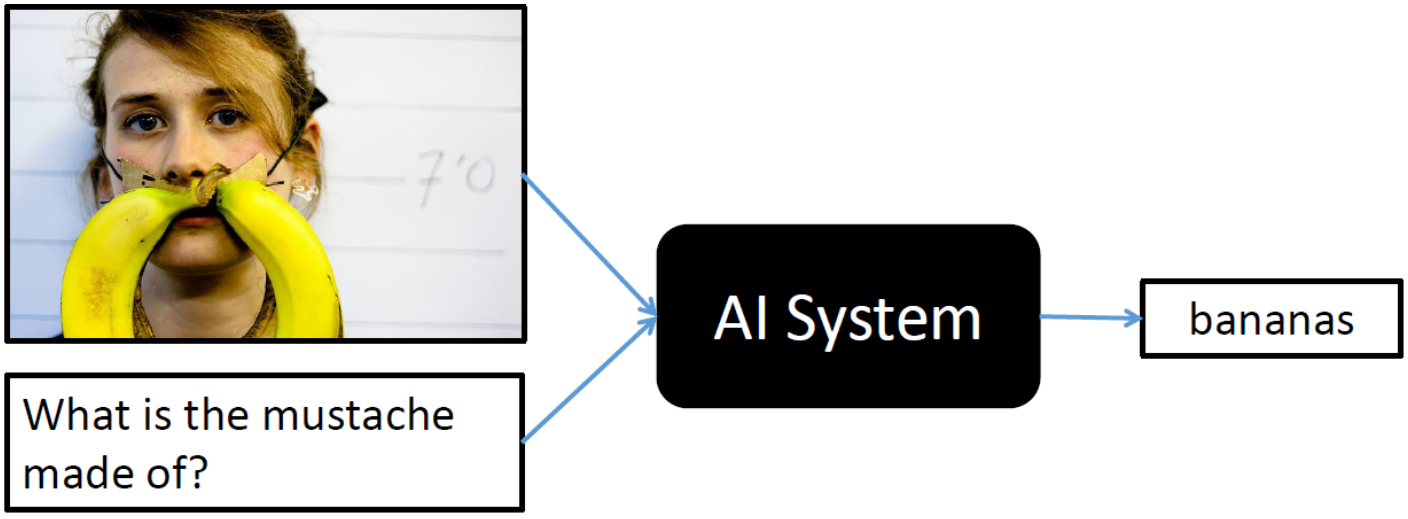

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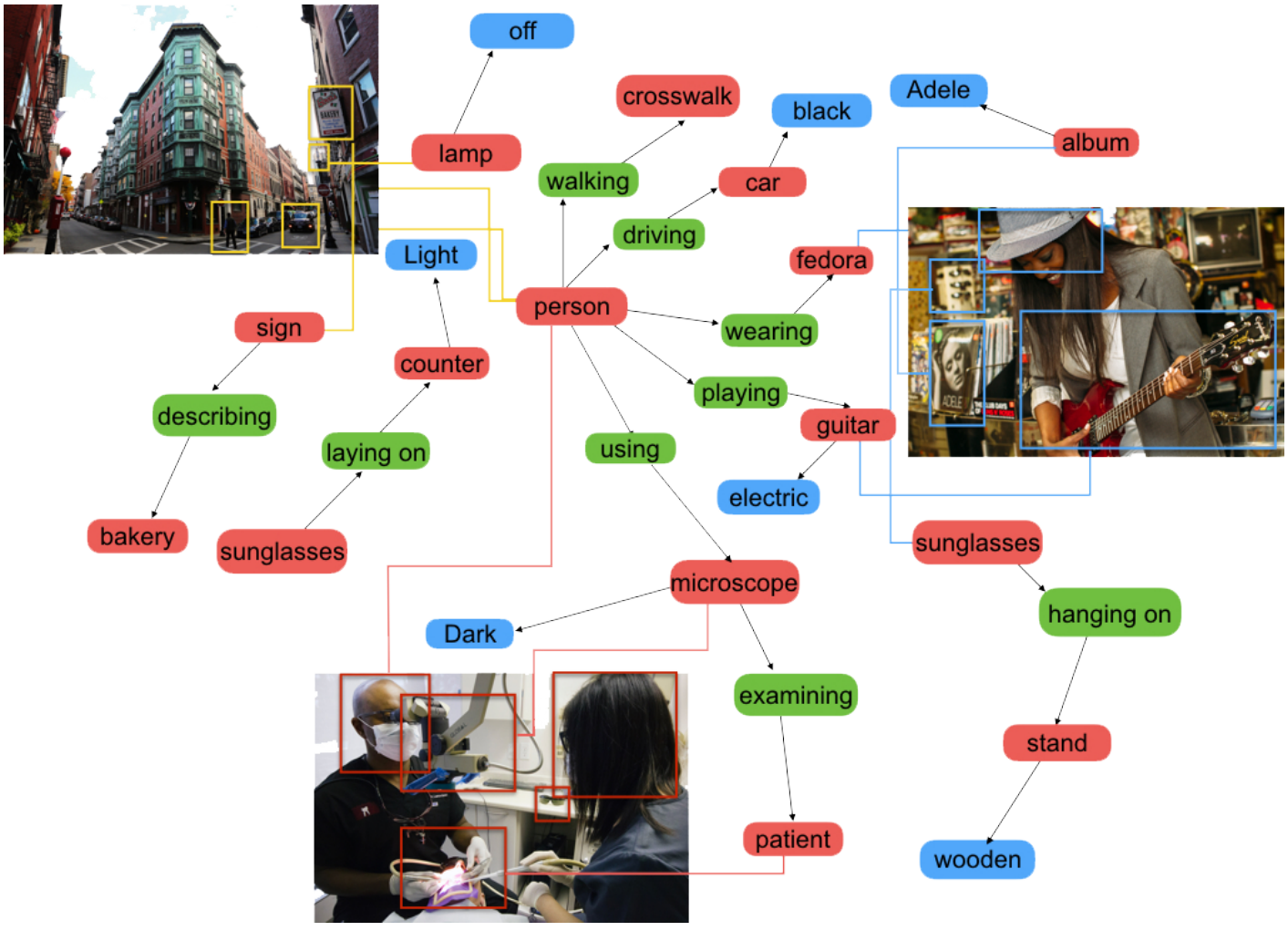

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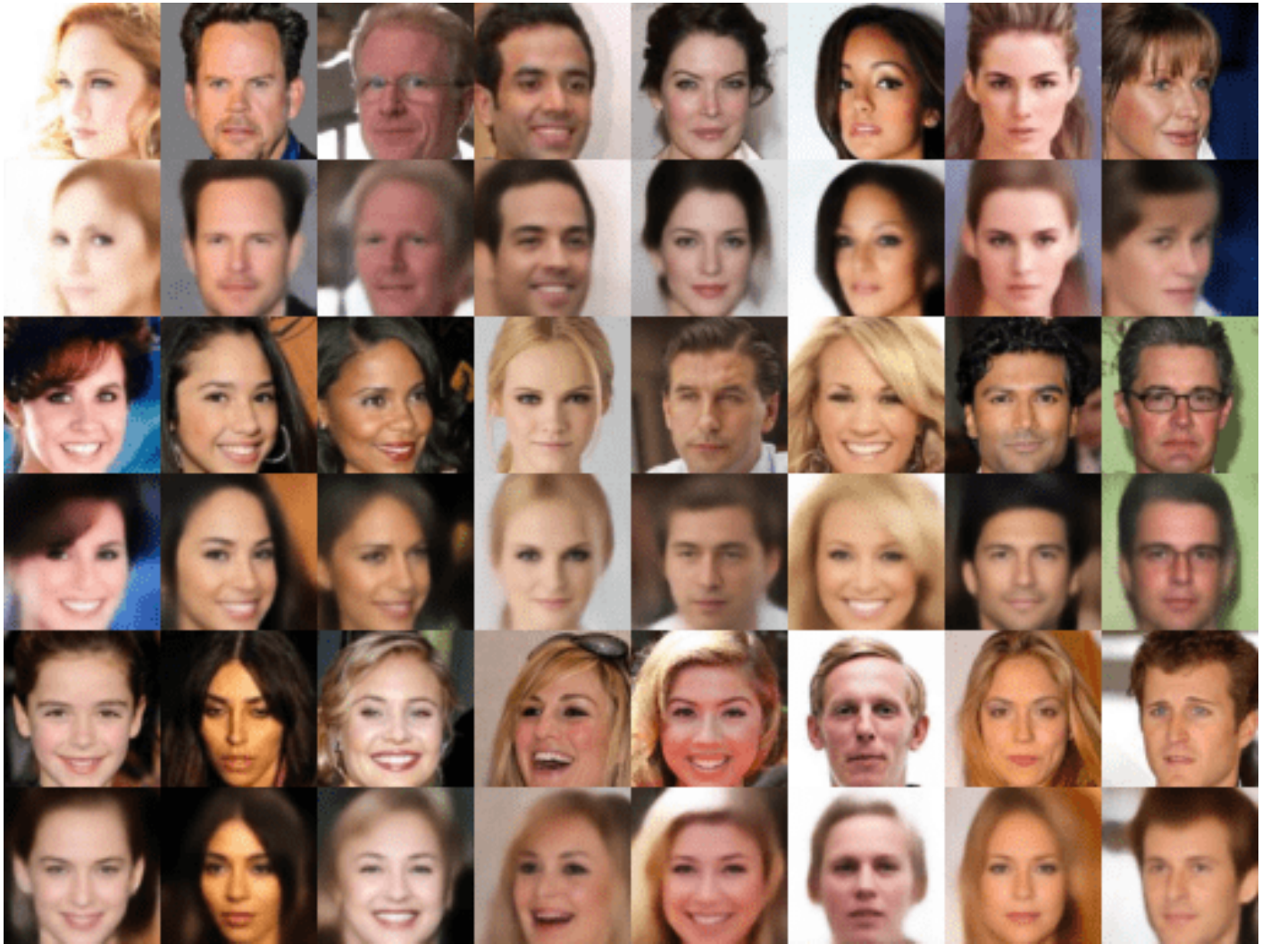

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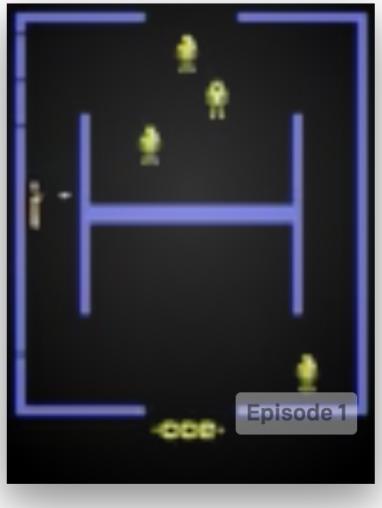
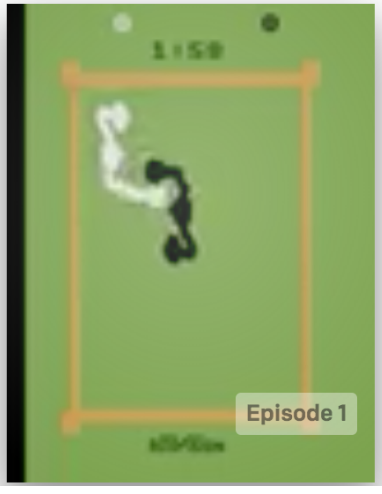
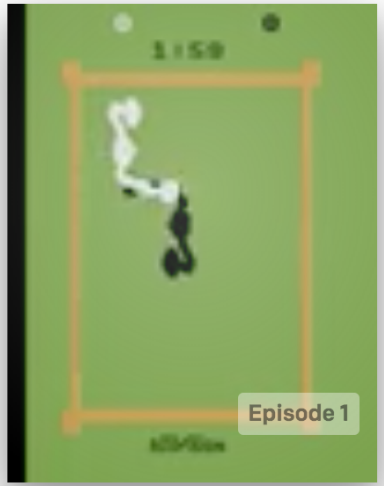


Berzerk-v0
Maximize score in the game Berzerk, with screen images as input

Bowling-ram-v0
Maximize score in the game Bowling, with RAM as input

Bowling-v0
Maximize score in the game Bowling, with screen images as input





Project Suggestions

DeepMind Lab

DeepMind Lab is a 3D learning environment based on id Software's Quake III Arena via ioquake3 and other open source software.

Project Suggestions

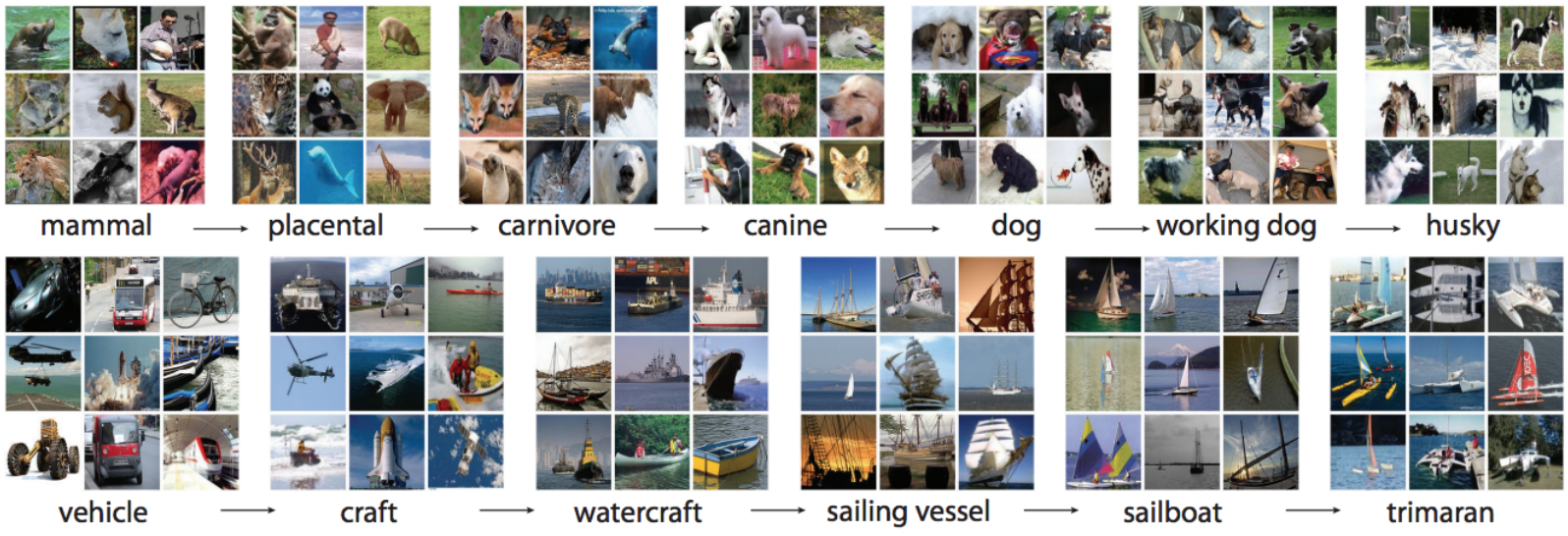


Figure 1: A snapshot of two root-to-leaf branches of ImageNet: the **top** row is from the mammal subtree; the **bottom** row is from the vehicle subtree. For each synset, 9 randomly sampled images are presented.

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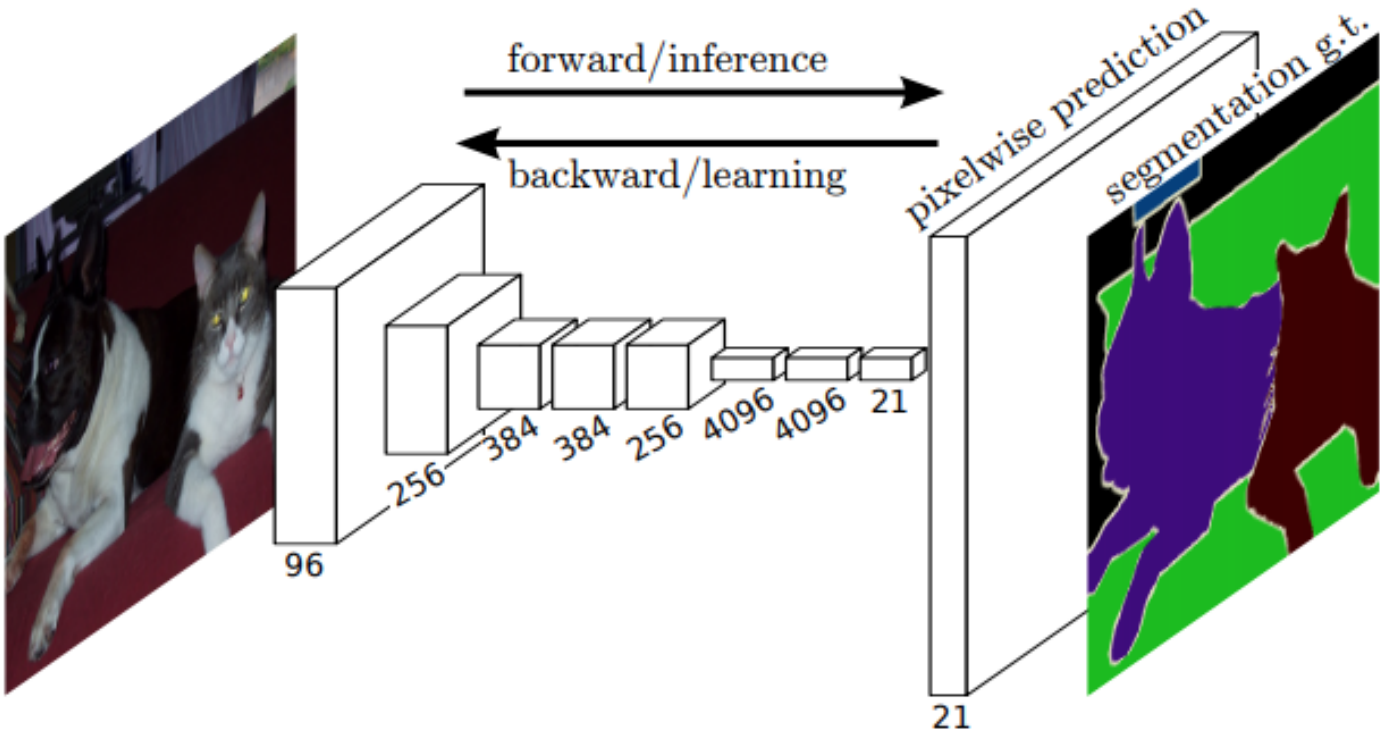
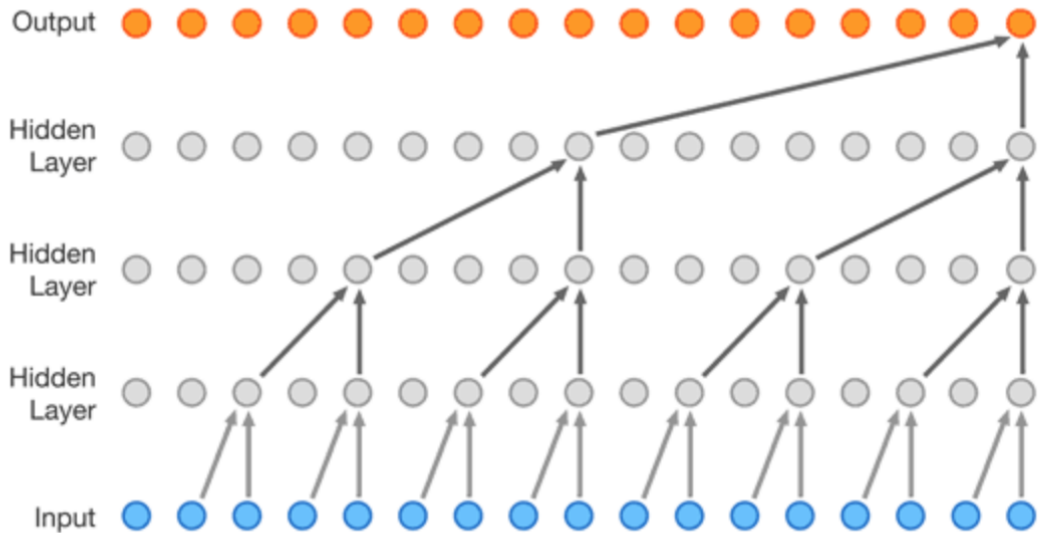


Fig. 1. Fully convolutional networks can efficiently learn to make dense predictions for per-pixel tasks like semantic segmentation.

Project Suggestions



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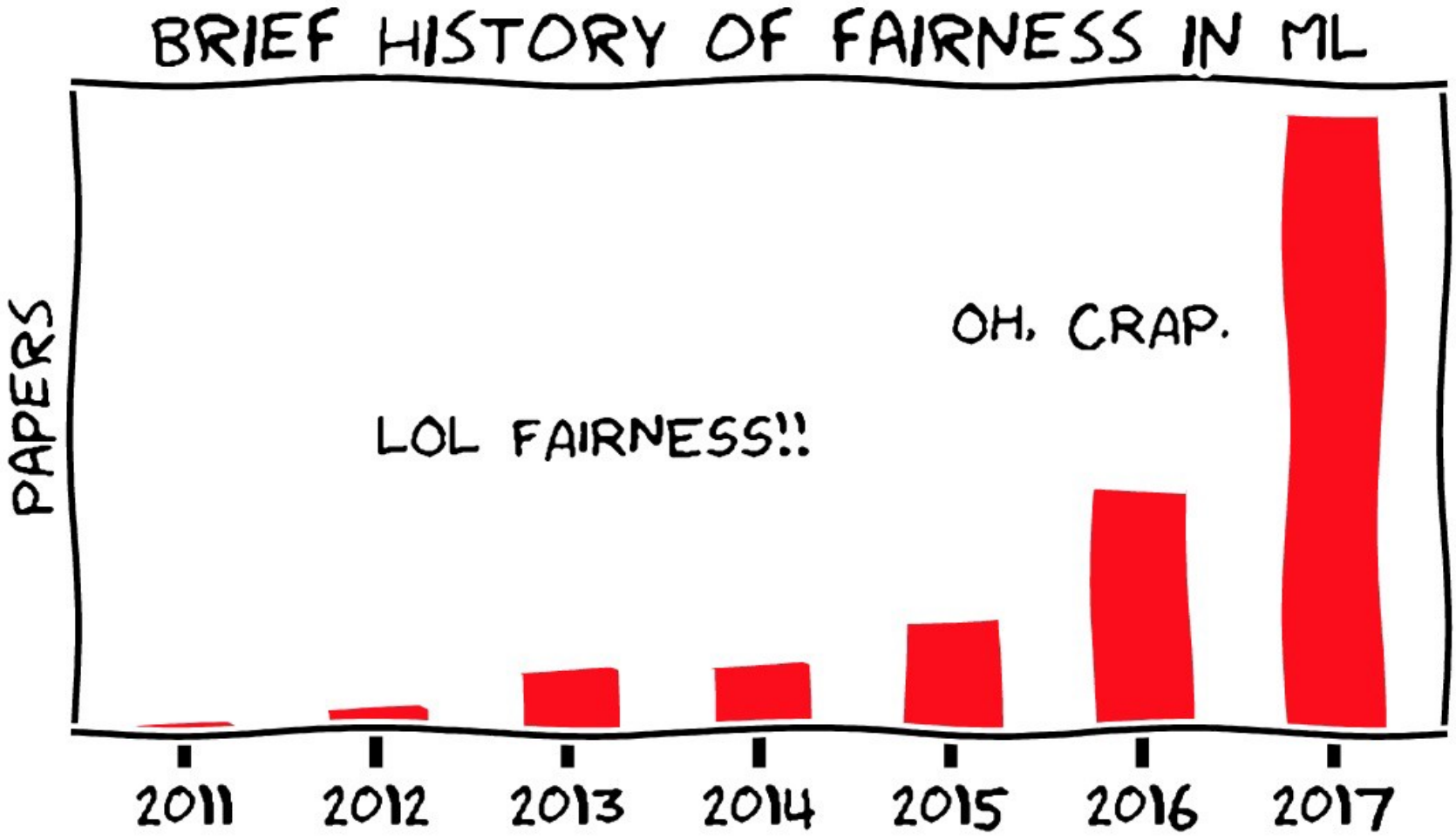

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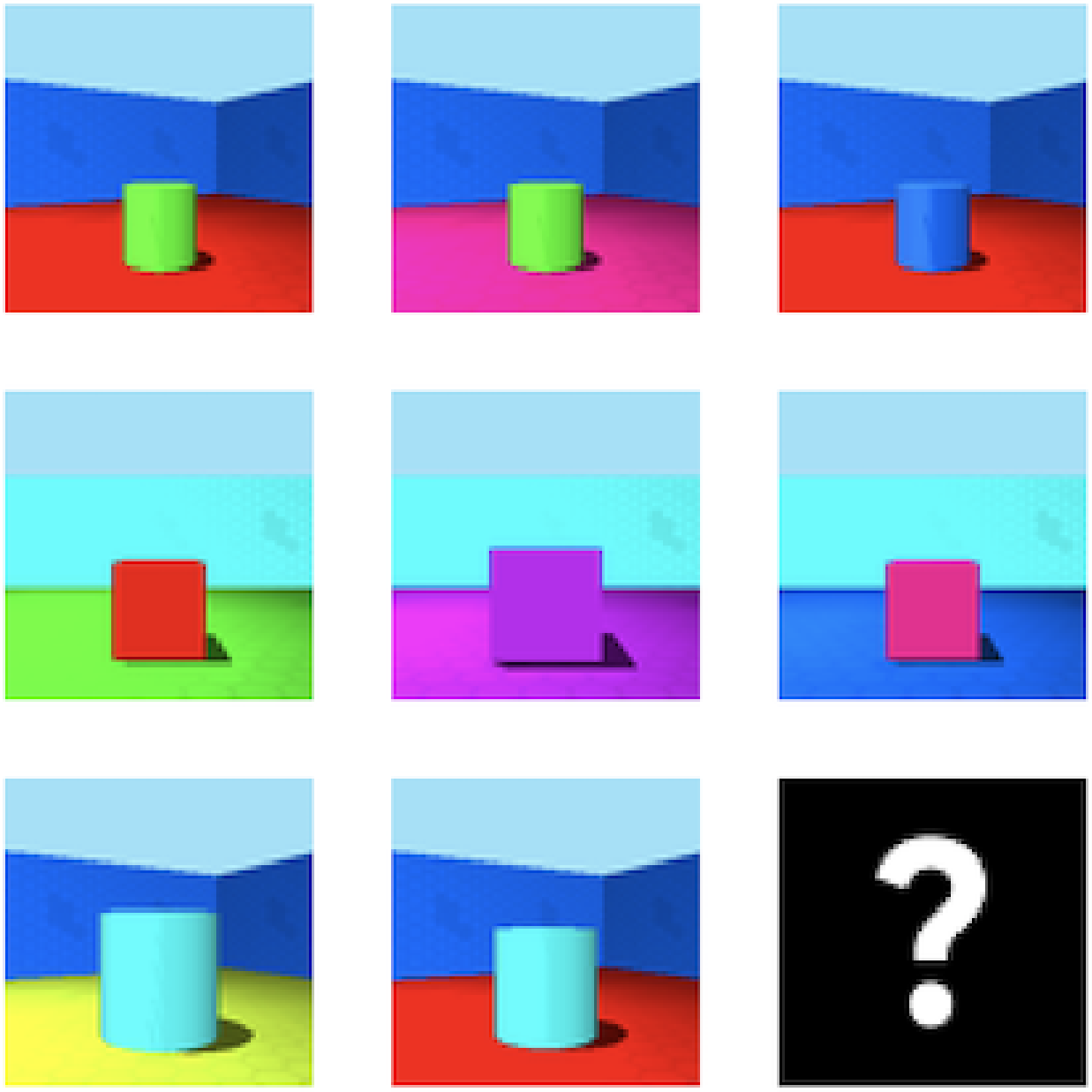

Questions