Machine Learning

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https://github.com/safayani/machine_learning_course

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Machine Learning

- Grew out of work in AI
- New capability for computers
- Learn from Data

What is Machine Learning?

- It is very hard to write programs that solve problems like recognizing a three-dimensional object from a novel viewpoint in new lighting conditions in a cluttered scene.
  - We don't know what program to write because we don't know how its done in our brain.
  - Even if we had a good idea about how to do it, the program might be horrendously complicated.

- It is hard to write a program to compute the probability that a credit card transaction is fraudulent.
  - There may not be any rules that are both simple and reliable. We need to combine a very large number of weak rules.
  - Fraud is a moving target. The program needs to keep changing.

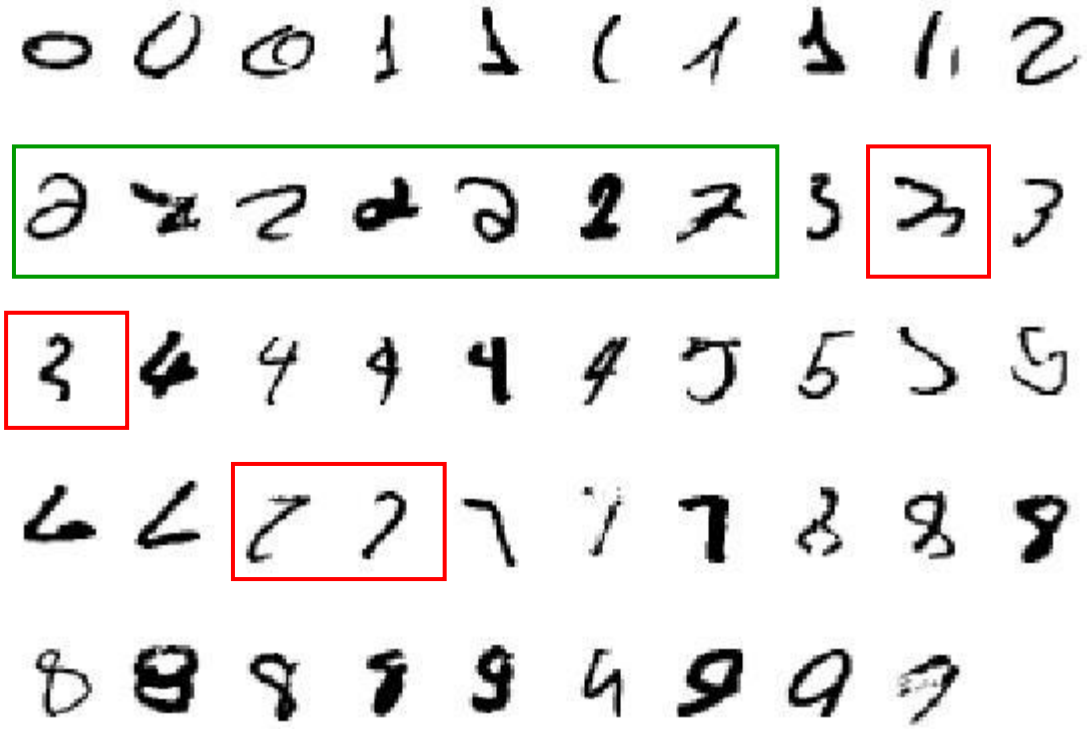
The Machine Learning Approach

- Instead of writing a program by hand for each specific task, we collect lots of examples that specify the correct output for a given input.
- A machine learning algorithm then takes these examples and produces a program that does the job.
  - The program produced by the learning algorithm may look very different from a typical hand-written program. It may contain millions of numbers.
  - If we do it right, the program works for new cases as well as the ones we trained it on.
  - If the data changes the program can change too by training on the new data.
- Massive amounts of computation are now cheaper than paying someone to write a task-specific program.

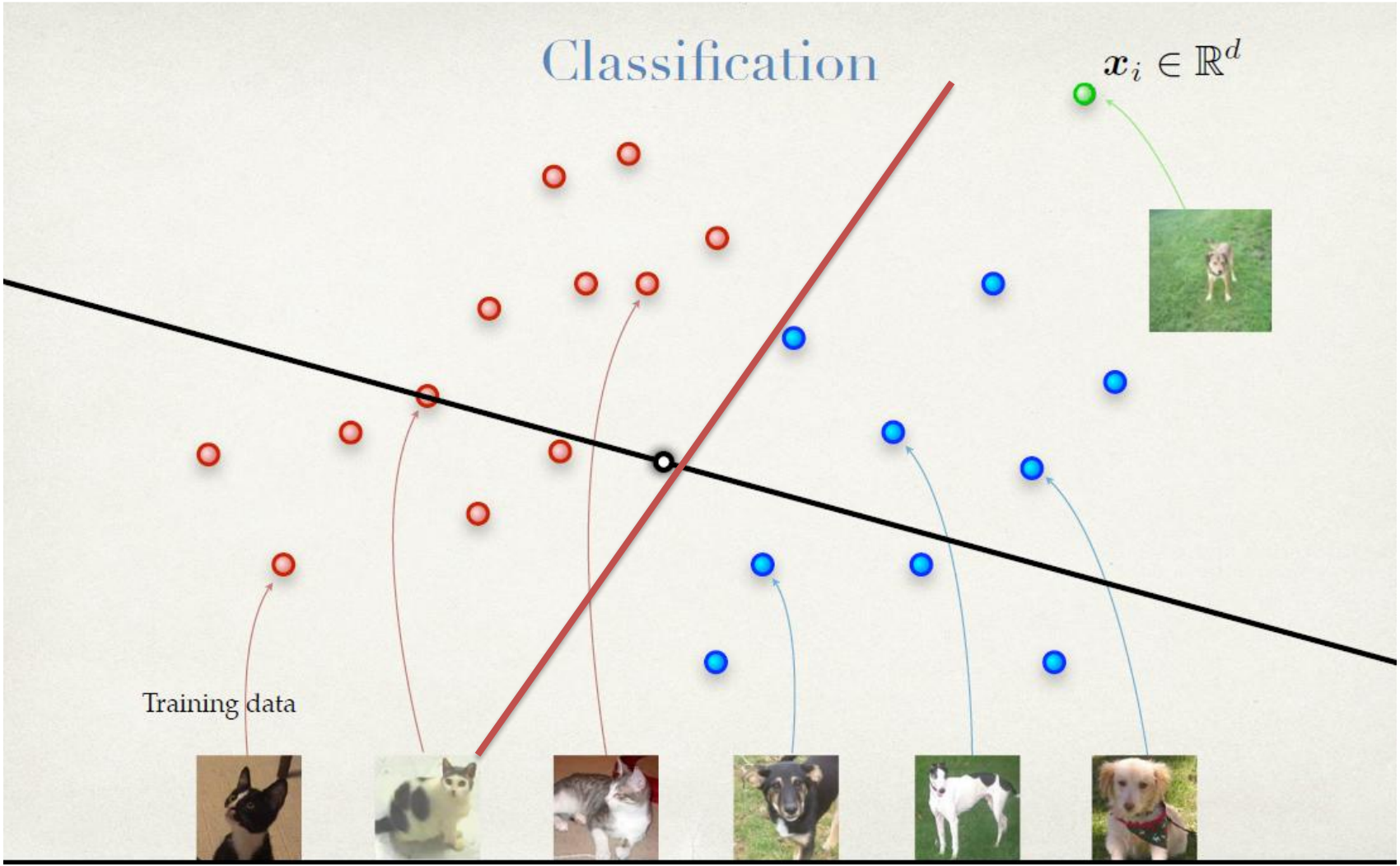
A standard example of machine learning

- The MNIST database of hand-written digits is the the machine learning equivalent of fruit flies.
  - They are publicly available and we can learn them quite fast in a moderate-sized neural net.
  - We know a huge amount about how well various machine learning methods do on MNIST.
- We will use MNIST as our standard task.

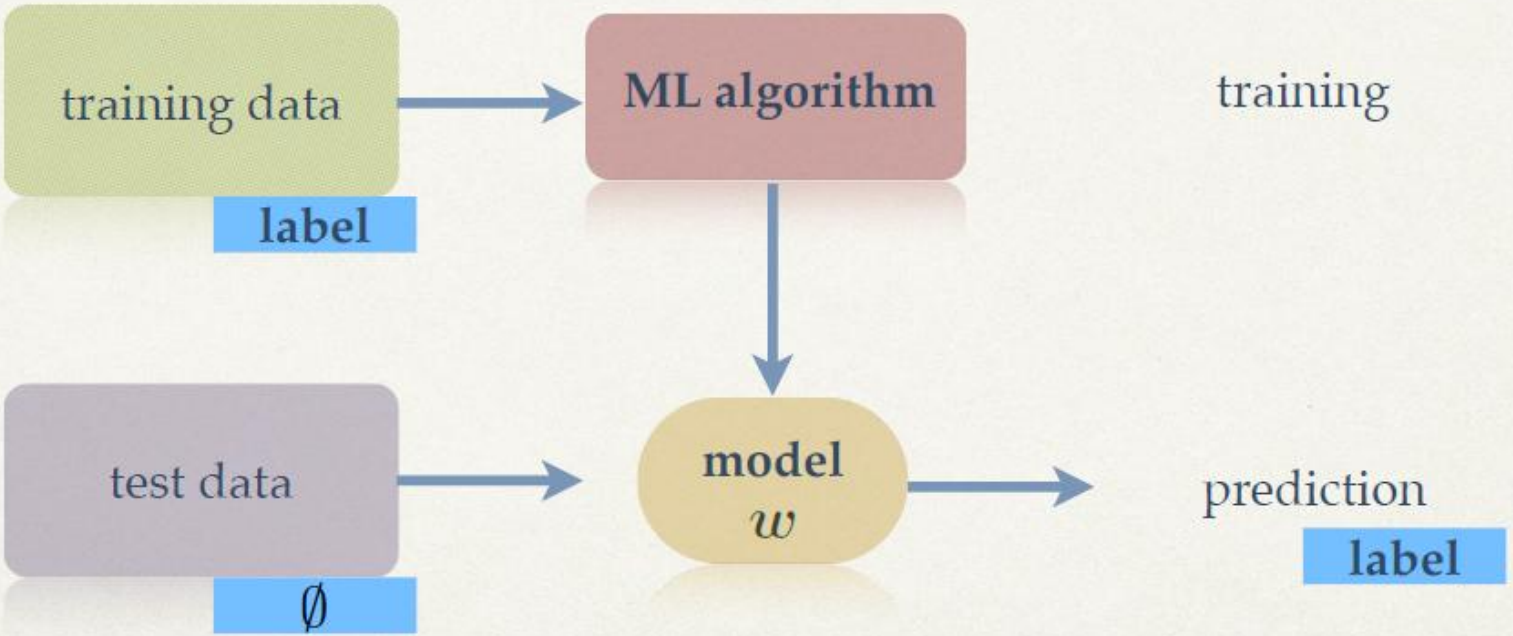
It is very hard to say what makes a 2



CATs vs DOGs


Classification
$x_i \in \mathbb{R}^d$
Training data

Machine Learning Fundamentals

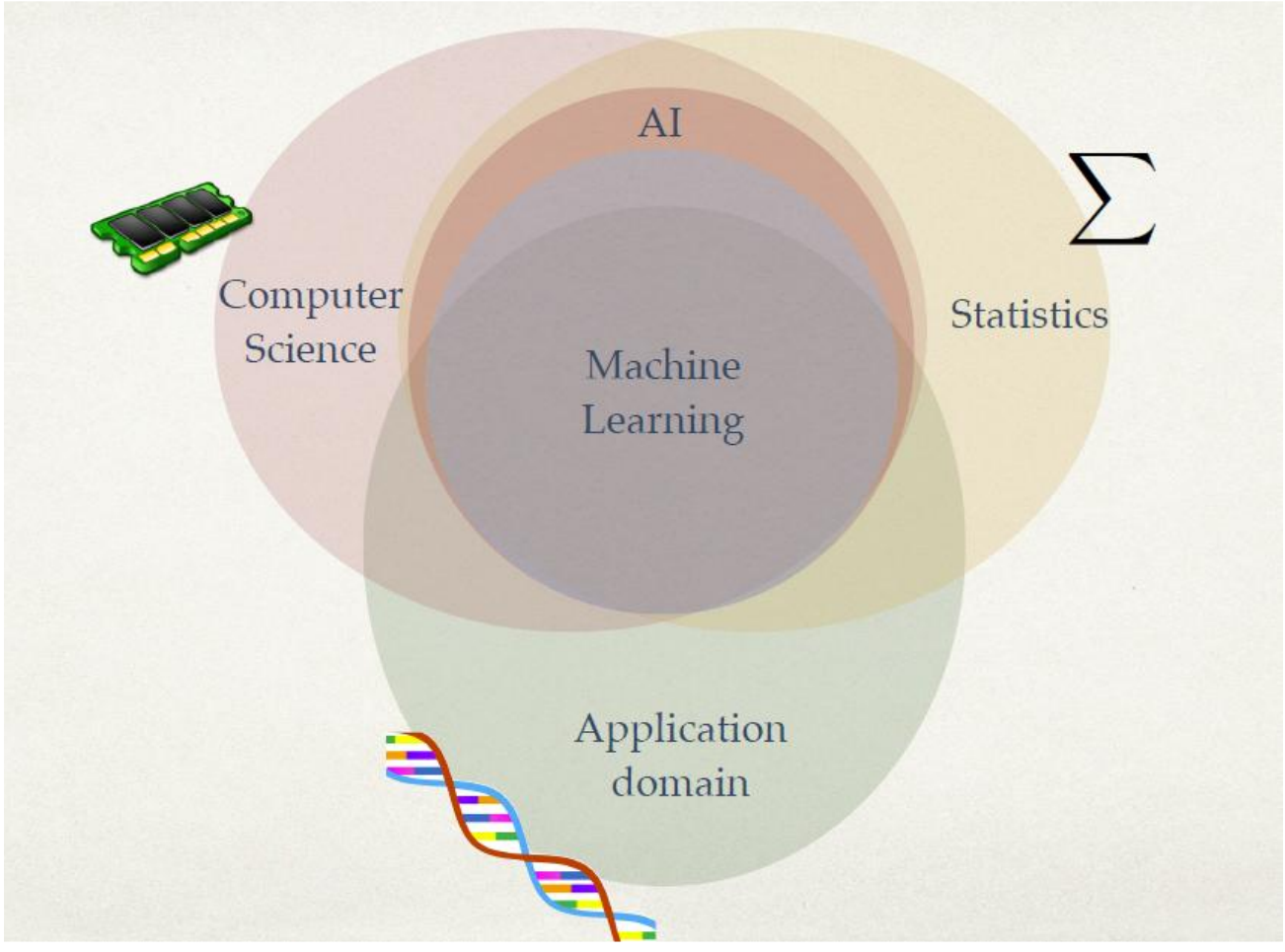


Machine Learning definition

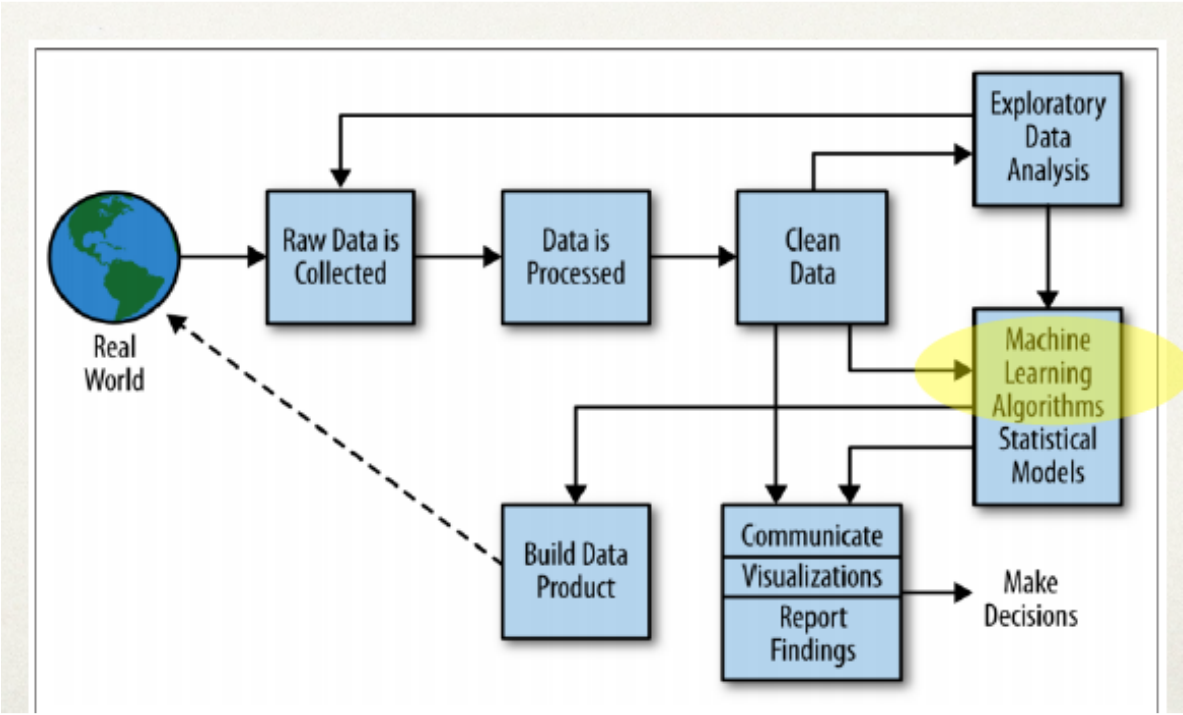
- Arthur Samuel (1959). Machine Learning: Field of study that gives computers the ability to learn without being explicitly programmed.
- Tom Mitchell (1998) Well-posed Learning Problem: A computer program is said to *learn* from experience E with respect to some task T and some performance measure P, if its performance on T, as measured by P, improves with experience E.

> "A computer program is said to *learn* from experience E with respect to some task T and some performance measure P, if its performance on T, as measured by P, improves with experience E."

Suppose your email program watches which emails you do or do not mark as spam, and based on that learns how to better filter spam. What is the task T in this setting?


AI
Computer Science
Statistics
Machine Learning
Application domain

ML is only a small part!



More Examples:

- Database mining

  Large datasets from growth of automation/web.

  E.g., Web click data, medical records, biology, engineering

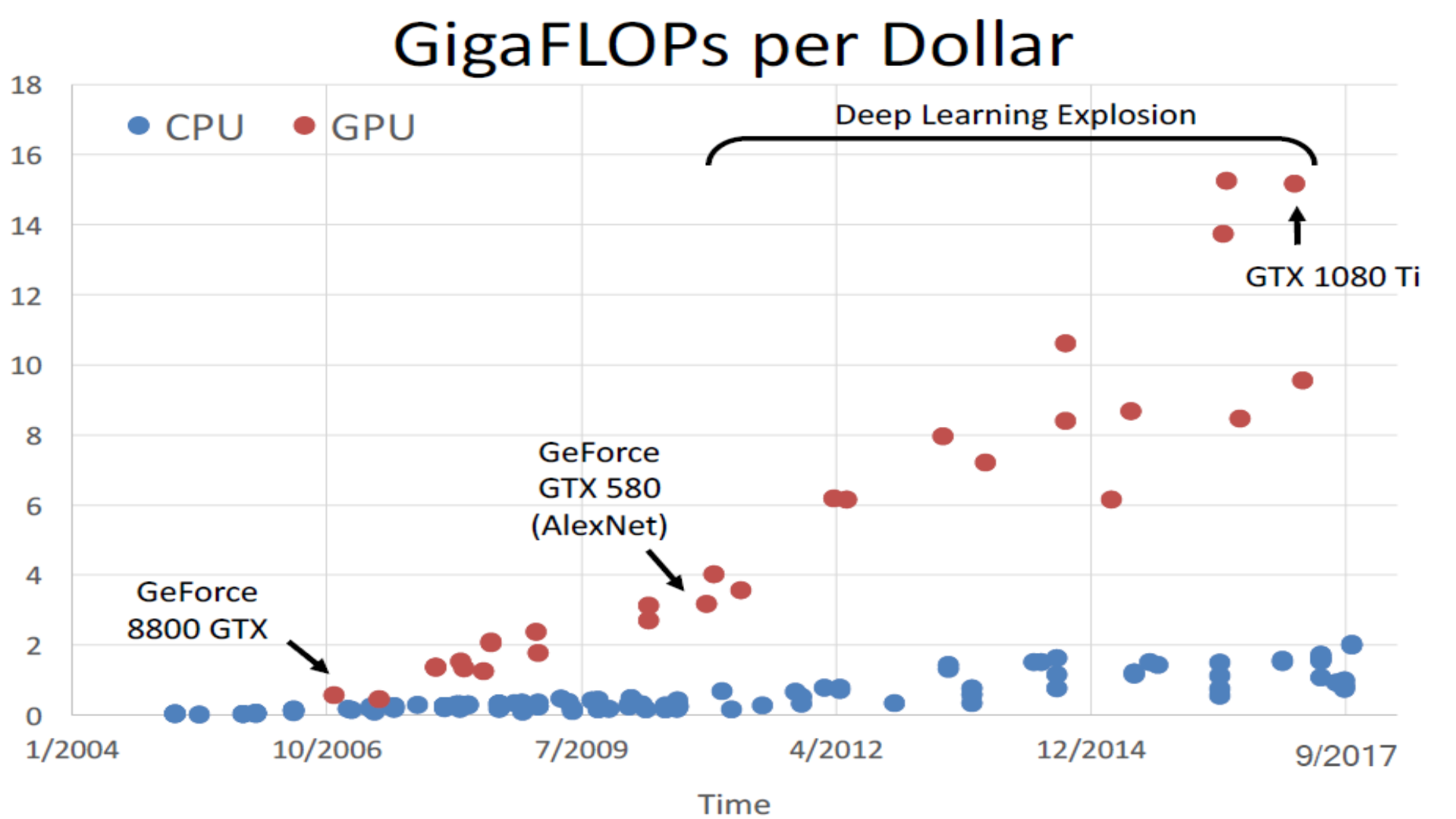
- Applications can’t program by hand.

  E.g., Autonomous helicopter, handwriting recognition, most of Natural Language Processing (NLP), Computer Vision.

- Self-customizing programs

  E.g., Amazon, Netflix product recommendations

- Understanding human learning (brain, real AI).


GigaFLOPs per Dollar
CPU
GPU
Deep Learning Explosion
GTX 1080 Ti
GeForce
GTX 580
(AlexNet)
GeForce
8800 GTX
18
16
14
12
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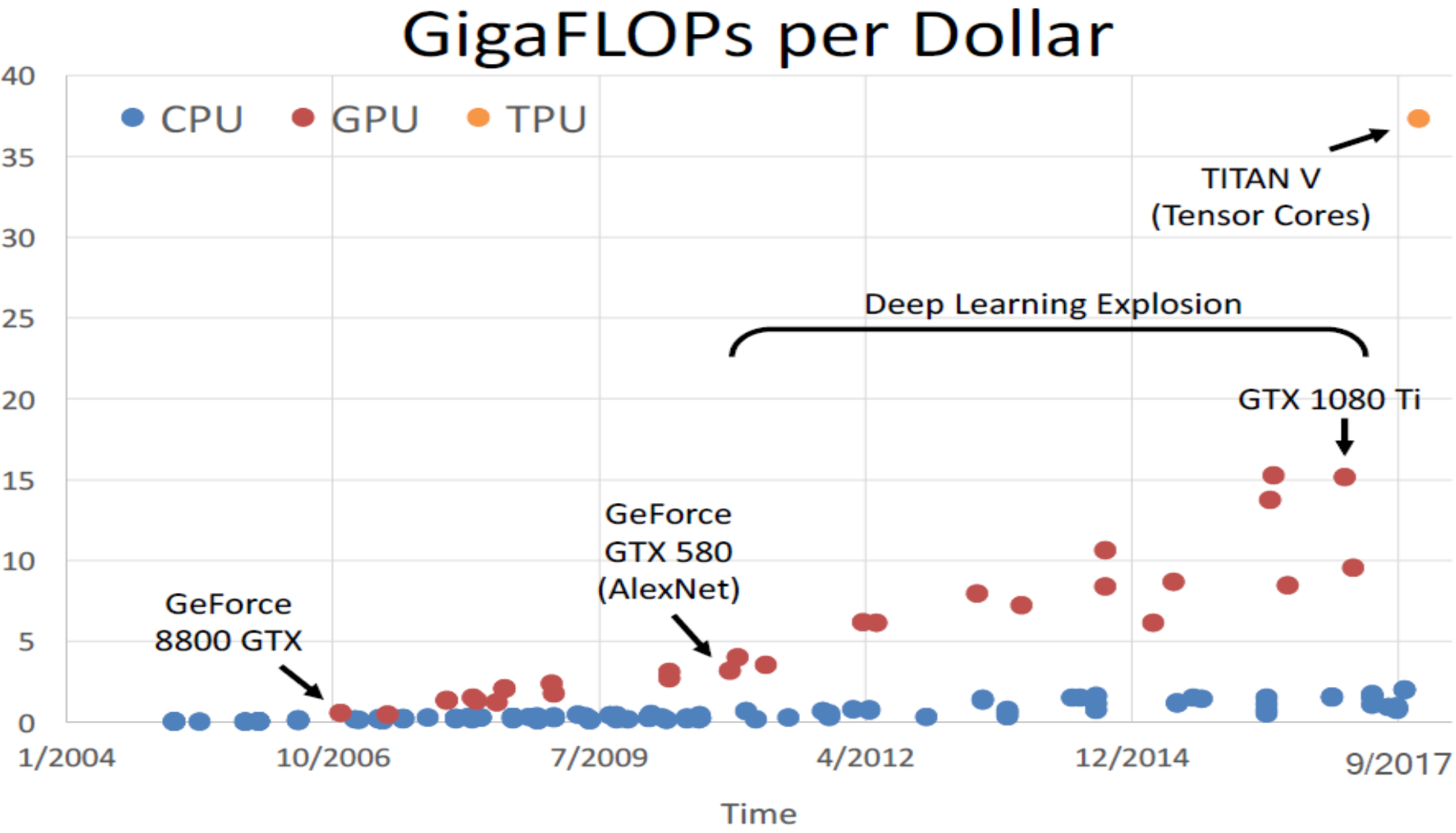
0
1/2004
10/2006
7/2009
4/2012
12/2014
9/2017
Time


GigaFLOPs per Dollar
CPU
GPU
TPU
40
35
30
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TITAN V
(Tensor Cores)
Deep Learning Explosion
GTX 1080 Ti
GeForce
GTX 580
(AlexNet)
GeForce
8800 GTX
1/2004
10/2006
7/2009
4/2012
12/2014
9/2017
Time

What to expect?

- overview over ML
- basic understanding of most important ML methods and fundamental concepts
- experience how ML is done on a practical problem

What not to expect?

- instantly becoming an **expert** data scientist / ML researcher / statistician / large-scale ML specialist / ML software expert / domain expert
- You will not learn ALL advanced methods.
- This course is not specially about big data or large-scale methods.

Syllabus

- Introduction
- Supervised Learning
  - Regression
    - Least Square
    - Maximum Likelihood
    - Overfitting
    - Regularization
    - Ridge and Lasso Regression
    - Model Selection
    - Bias and variance

Syllabus

- Classification
  - Logistic Regression
  - softmax regression
  - Bayes classifier
    - Naive Bayes
  - K-nearest Neighbors (KNN)
  - Support vector machine (SVM)
  - Decision tree
  - Random forest
  - Error metrics for unbalance data

Syllabus

- Unsupervised Learning
  - k-means clustering (K-means)
  - Gaussian mixture models (GMM)
  - Expectation maximization algorithm (EM)
  - Dimension Reduction
    - Singular value decomposition
    - Principal Component Analysis

Prerequisites

- Statistics and probability
- Linear Algebra
- Programming

Recommended Textbooks

- G. James, D. Witten, T. Hastie and R. Tibshirani: An introduction to statistical learning
- C. Bishop: Pattern Recognition and Machine Learning
- K. Murphy: Machine Learning: A Probabilistic Perspective

Related Courses

- Machine Learning, EPFL, https://www.epfl.ch/labs/mlo/machine-learning-cs-433/

- Machine Learning, Standford university, Coursera https://www.coursera.org/learn/machine-learning

Course Strategy

- Assignments and projects 20% to 30%
- Midterm and quizzes 30% to 40%
- Final and quizzes 30% to 40%

برای دریافت آموزش های بیشتر در حوزه یادگیری عمیق و یادگیری ماشین کانال زیر را دنبال کنید:

هوش مصنوعی برای همه

تنظیمات

۶۳۳ دنبال‌کننده

۶۷.۵ هزار بازدید کل

خانه | ویدیوها | ویدیوهای کوتاه | لیست‌های پخش | درباره کانال

پیش بینی در بازار ارز دیجیتال با بهره گیری از مدل های زبانی بزرگ

جلسه دفاع از پایان نامه کارشناسی ارشد دانشجو: مریم فخاری استاد راهنما: دکتر مهران صفایانی مهرماه ۱۴۰۴ دانشکده مهندسی برق و کامپیوتر دانشگاه صنعتی اصفهان

۱۰۹ بازدید ۲ ماه پیش

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