



Machine Learning

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https://github.com/safayani/machine_learning_course



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

0 0 0 1 1 1 1 1 1 2

2 2 2 2 2 2 2 3 2 3

3 4 4 4 4 4 5 5 5 5

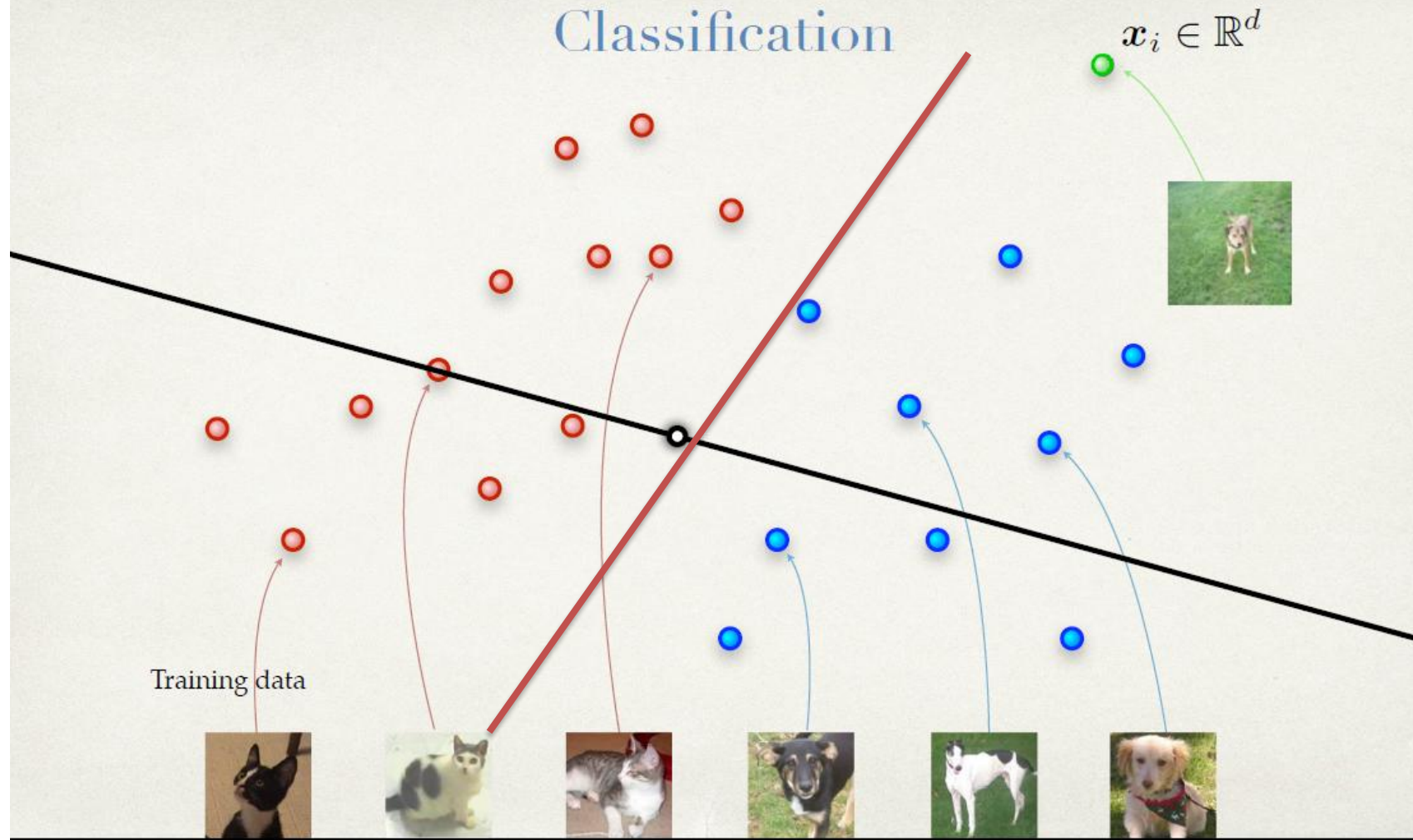
6 6 7 7 7 7 8 8 8

8 8 8 8 8 9 9 9 9

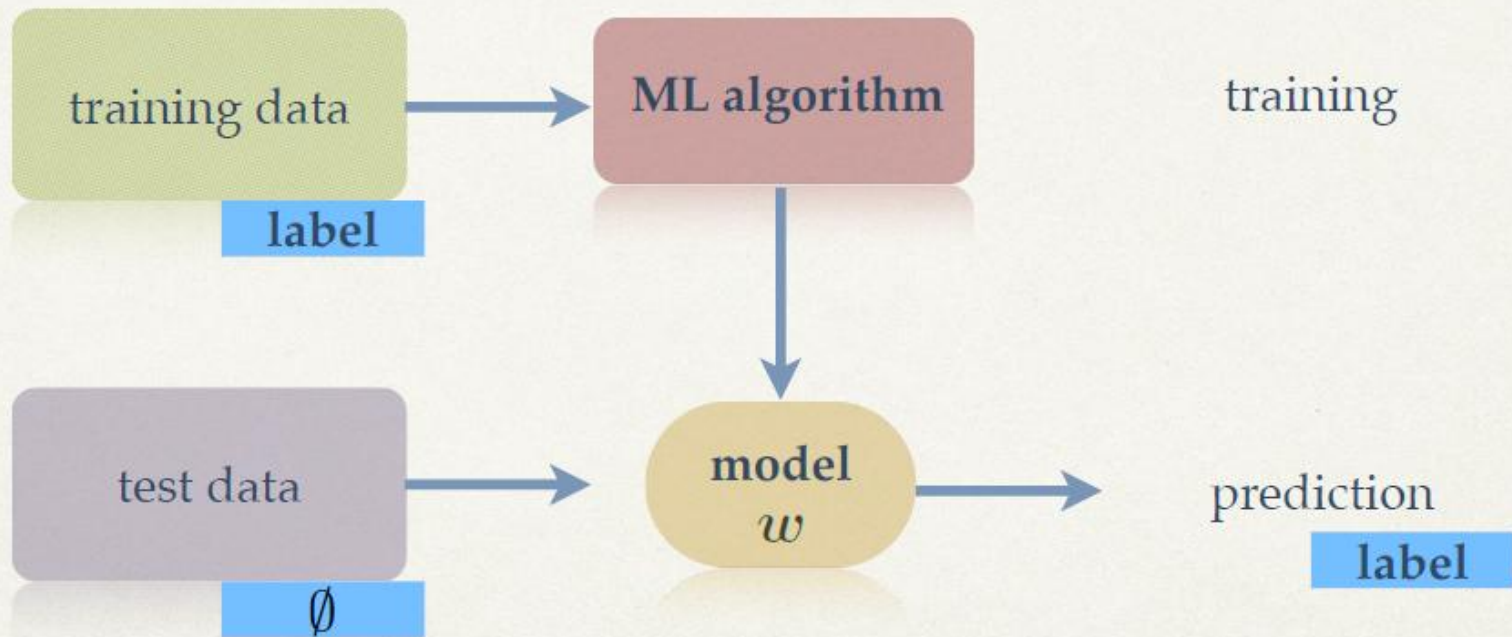
CATs vs DOGs



Classification



Machine Learning Fundamentals

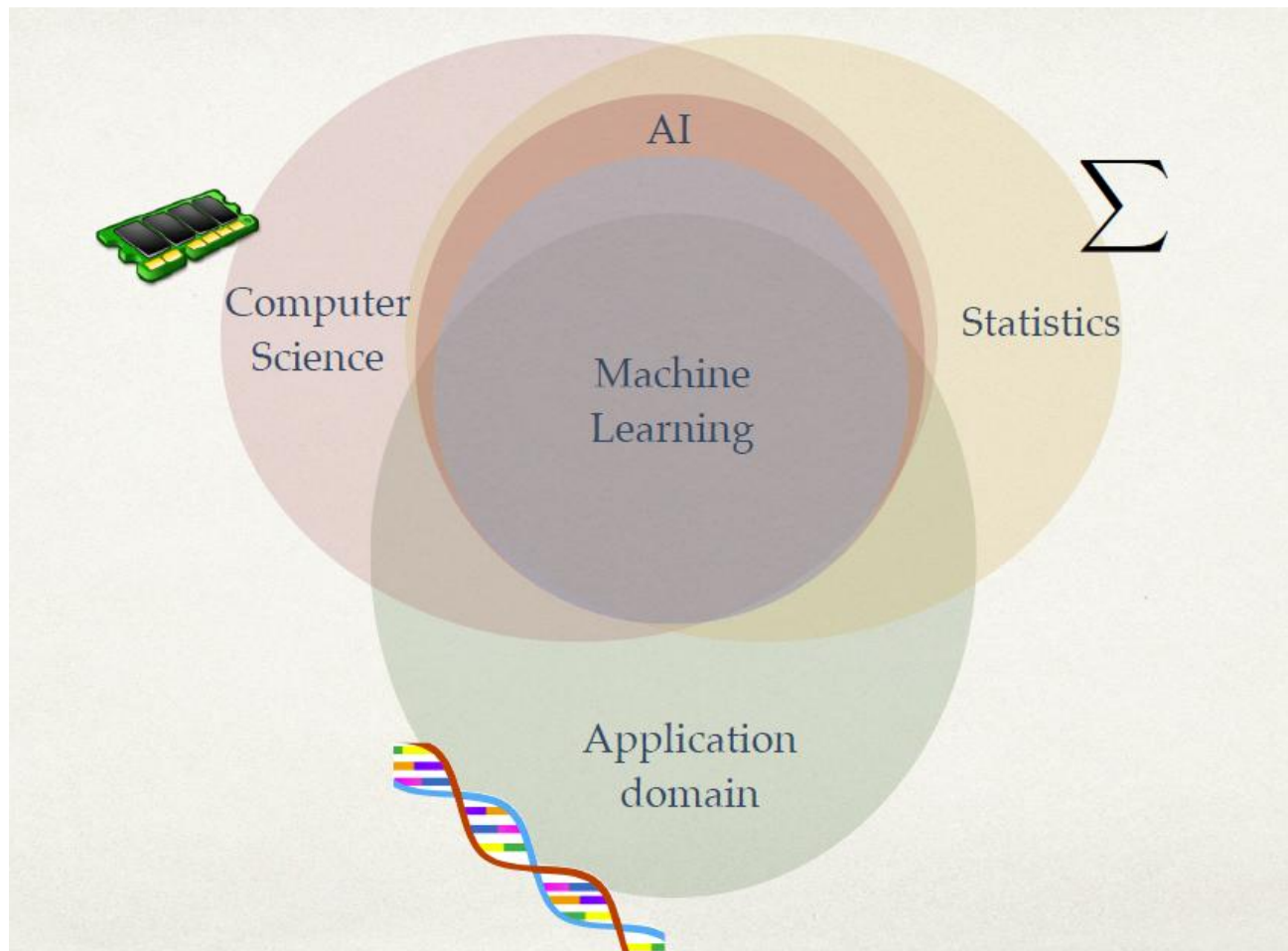


Machine Learning definition

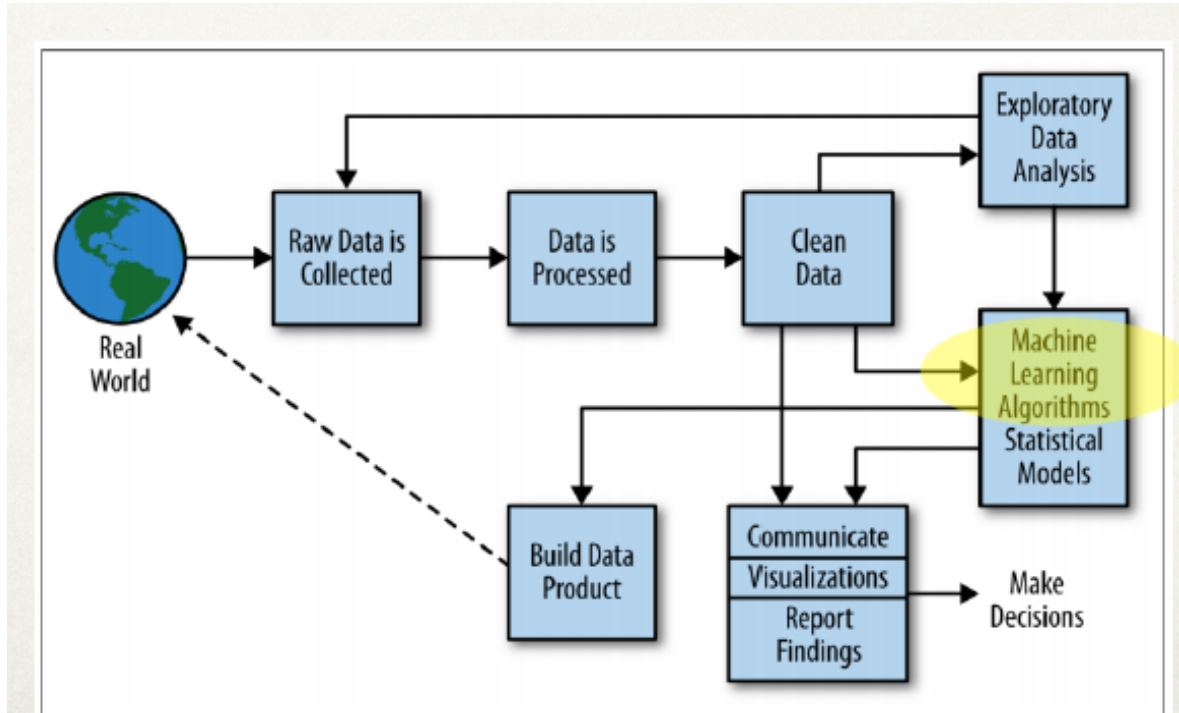
- Arthur Samuel (1959). Machine Learning: Field of study that gives computers the ability to learn without being explicitly programmed.
- Tom Mitchell (1998) Well-posed Learning Problem: A computer program is said to *learn* from experience E with respect to some task T and some performance measure P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



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.

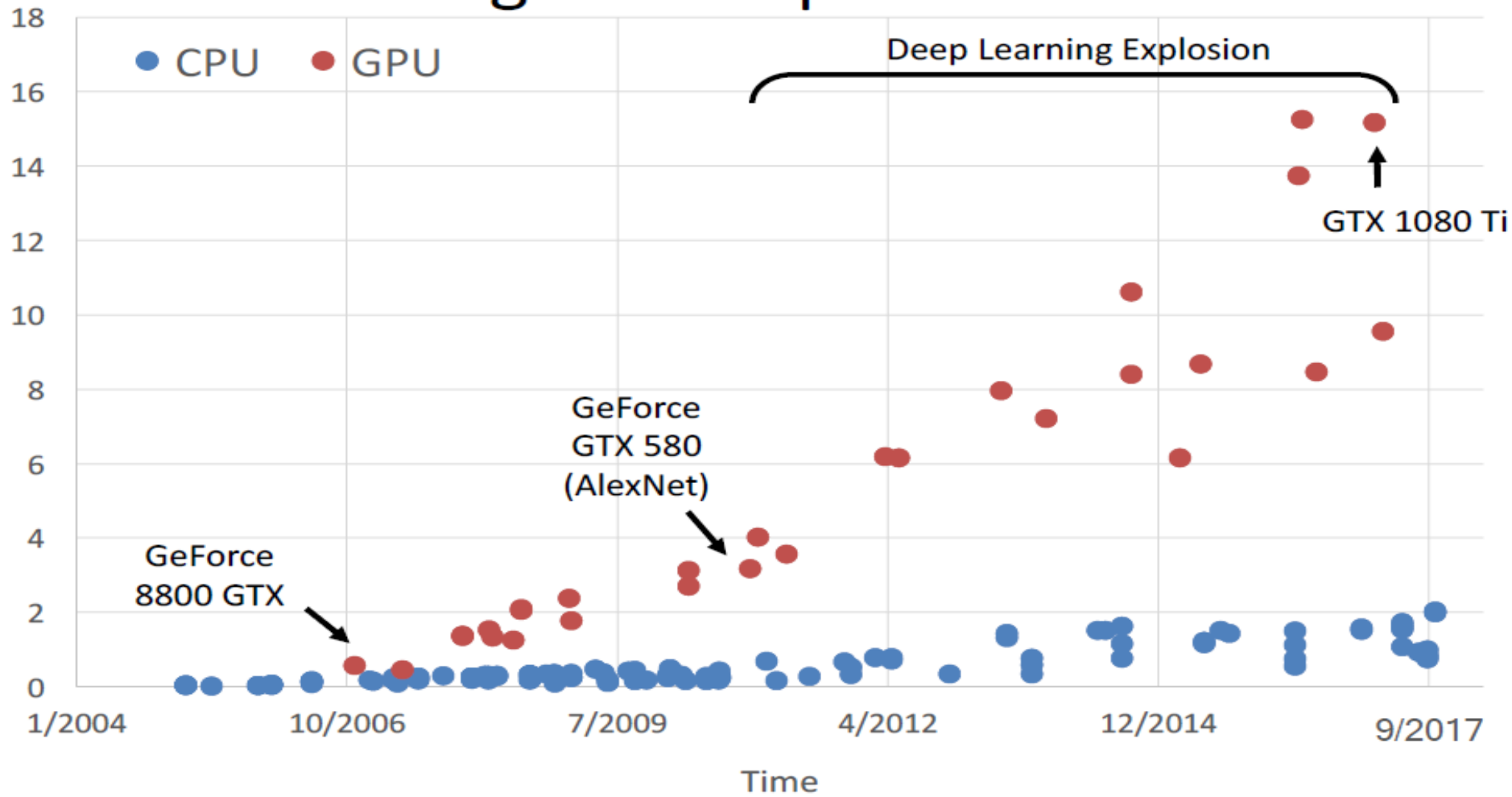
E.g., Autonomous helicopter, handwriting recognition, most of Natural Language Processing (NLP), Computer Vision.

- Self-customizing programs

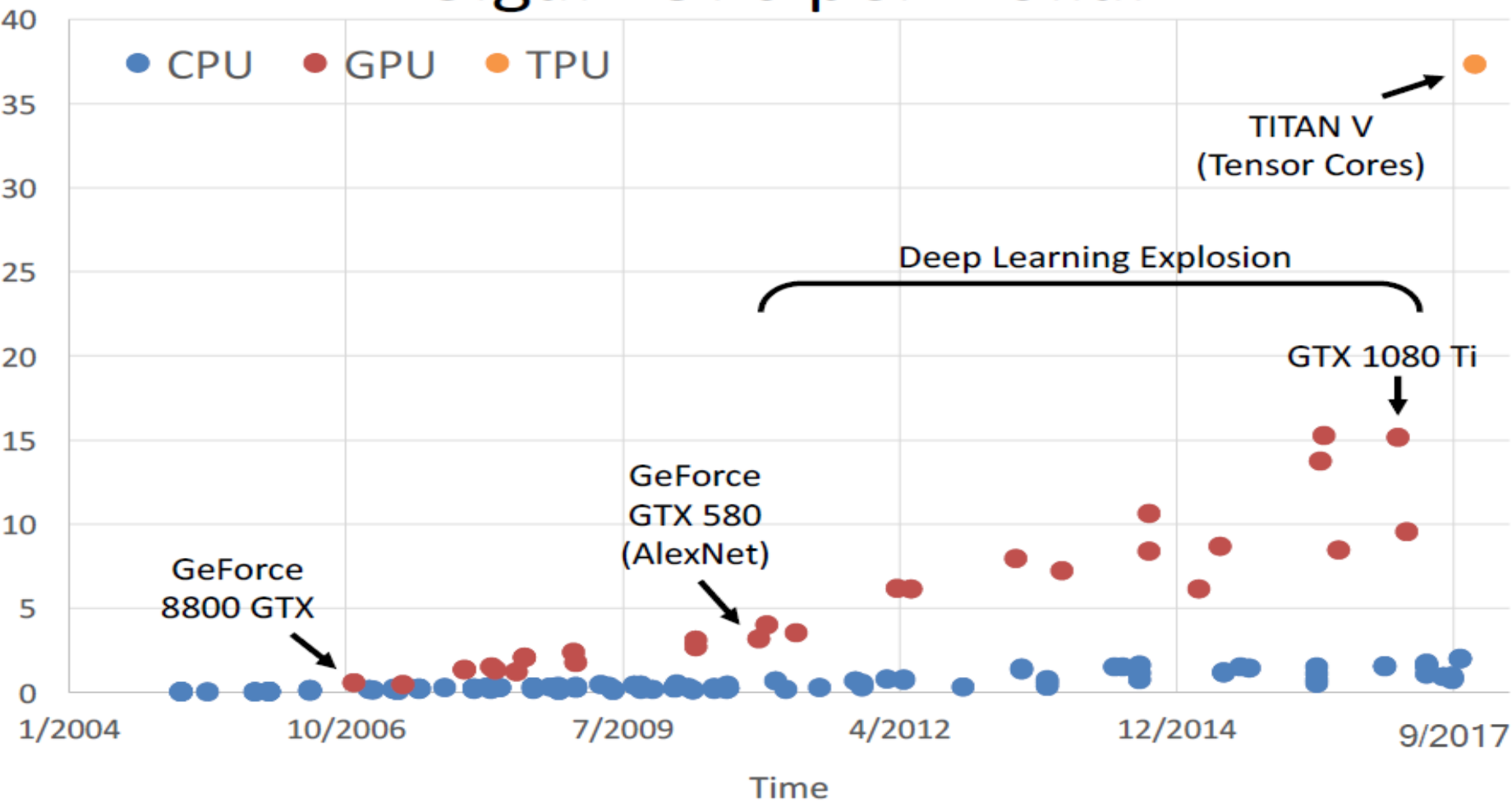
E.g., Amazon, Netflix product recommendations

- Understanding human learning (brain, real AI).

GigaFLOPs per Dollar



GigaFLOPs per Dollar



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, Stanford university, Coursera
<https://www.coursera.org/learn/machine-learning>

Course Strategy

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



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



Mehran Safayani
هوش مصنوعی برای همه
Machine Learning • Deep Learning • Soft Computing



هوش مصنوعی
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۷۲ دنبال کننده ۶.۷ هزار بازدید ویدیو

هوش مصنوعی برای همه تنظیمات

[خانه](#)[لیست پخش](#)[همه ویدیوها](#)[درباره کانال](#)

 <p>پایاس و واریانس ج ۱۰ Machine Learning ۱:۱۱:۳۴</p> <p>یادگیری ماشین جلسه دهم: پایاس و واریانس (Machine Learning) ۳۵ بازدید - ۲۰ ماه پیش</p>	 <p>اعتبارسنجی متقابل ج ۱۱ Machine Learning ۱:۰۶:۴۶</p> <p>یادگیری ماشین جلسه یازدهم: اعتبارسنجی متقابل (Machine Learning) ۳۹ بازدید - ۲۰ ماه پیش</p>	 <p>تخمین MAP ج ۱۲ Machine Learning ۵:۴۰:۵۰</p> <p>یادگیری ماشین جلسه دوازدهم: MAP estimation ۷۵ بازدید - ۲۰ ماه پیش</p>	 <p>Naive Bayes ج ۱۳ Machine Learning ۱:۰۶:۳۱</p> <p>یادگیری ماشین جلسه سیزدهم: Naive Bayes ۸۶ بازدید - ۲۰ ماه پیش</p>	 <p>Logistic Regression ج ۱۴ Machine Learning ۱:۰۴:۵۸</p> <p>یادگیری ماشین جلسه چهاردهم: Logistic Regression ۸۶ بازدید - ۲۰ ماه پیش</p>	 <p>روش نیوتن ج ۱۵ Machine Learning ۱:۰۷:۰۸</p> <p>یادگیری ماشین جلسه پانزدهم: Newton method ۸۰ بازدید - ۲۰ ماه پیش</p>
 <p>نزول گرادیان ج ۴ Machine Learning ۱:۰۶:۱۲</p> <p>یادگیری ماشین جلسه چهارم: نزول گرادیان (Machine Learning) ۵۸ بازدید - ۲۰ ماه پیش</p>	 <p>نزول گرادیان ج ۵ Machine Learning ۱:۰۸:۰۷</p> <p>یادگیری ماشین جلسه پنجم: نزول گرادیان (Machine Learning) ۵۷ بازدید - ۲۰ ماه پیش</p>	 <p>Least Square ج ۶ Machine Learning ۱:۰۳:۰۱</p> <p>یادگیری ماشین جلسه ششم: کمترین مربع - Least Square ۴۴ بازدید - ۲۰ ماه پیش</p>	 <p>mini-batch gradient descent ج ۷ Machine Learning ۱:۱۴:۵۲</p> <p>یادگیری ماشین جلسه هفتم: mini-batch gradient descent ۳۹ بازدید - ۲۰ ماه پیش</p>	 <p>Maximum Likelihood ج ۸ Machine Learning ۱:۱۸:۳۳</p> <p>یادگیری ماشین جلسه هشتم: Maximum Likelihood ۵۰ بازدید - ۲۰ ماه پیش</p>	 <p>بیش برازش ج ۹ Machine Learning ۵:۸:۱۳</p> <p>یادگیری ماشین جلسه نهم: Overfitting ۳۷ بازدید - ۲۰ ماه پیش</p>



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