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

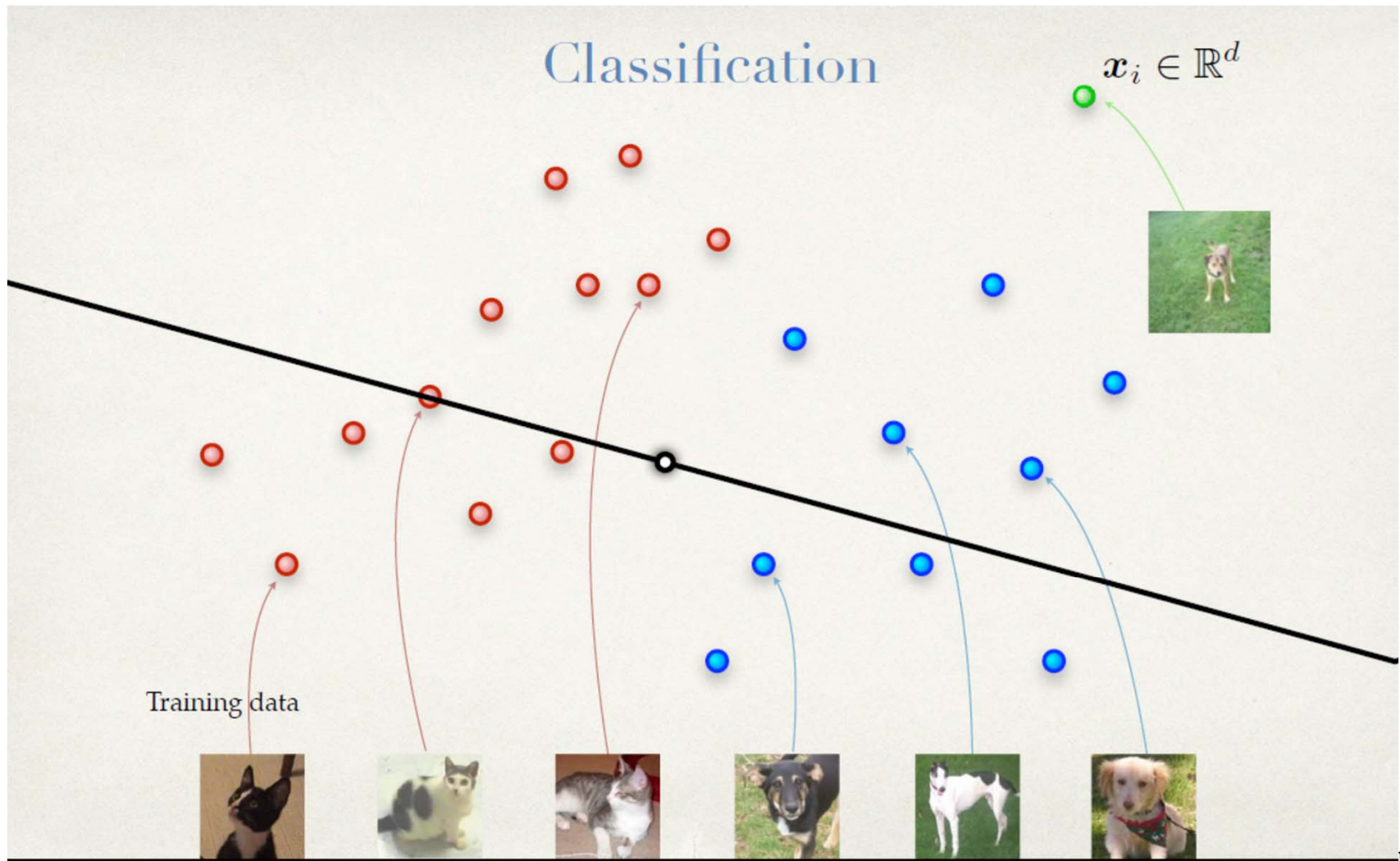- Learn from Data

Examples

CATs vs DOGs

if-then-else

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intelligence

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Classification

$$\boldsymbol{x}_i \in \mathbb{R}^d$$

Training data

It is very hard to say what makes a 2

Machine Learning Fundamentals

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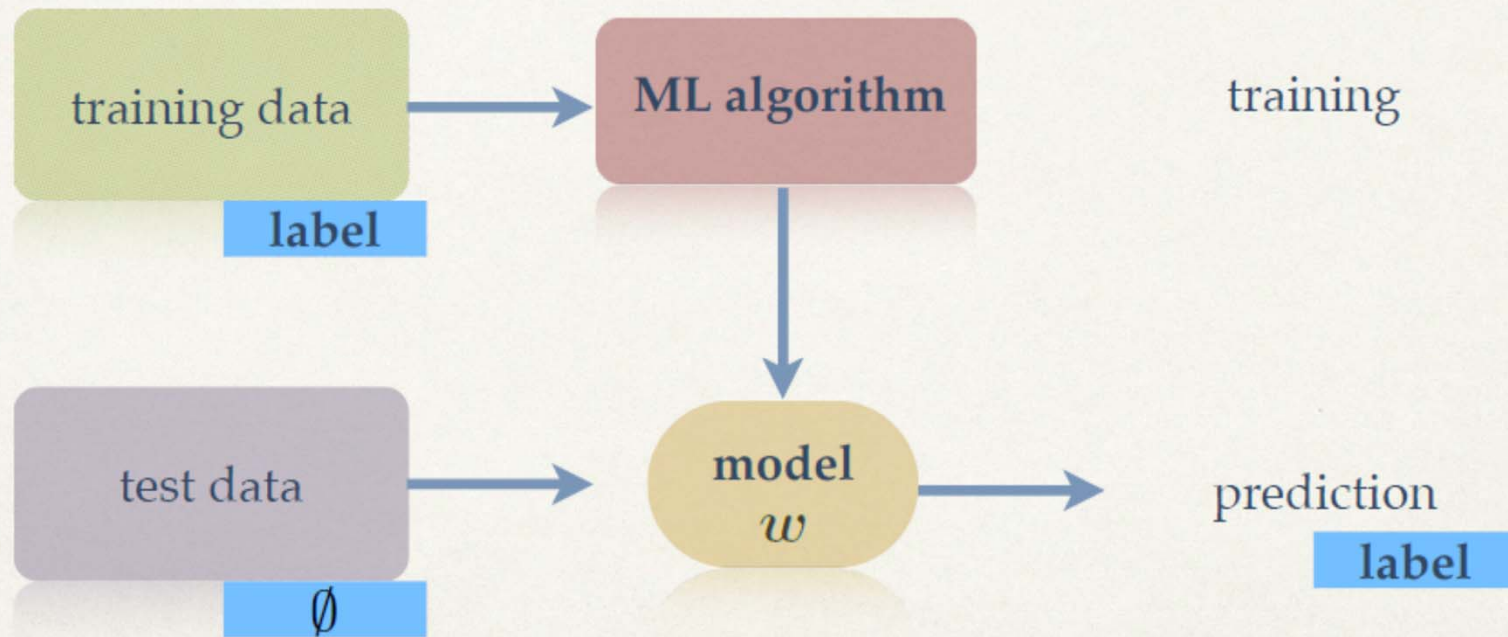
Machine Learning definition

- 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

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Computer
Science

Statistics

Machine
Learning

Application
domain

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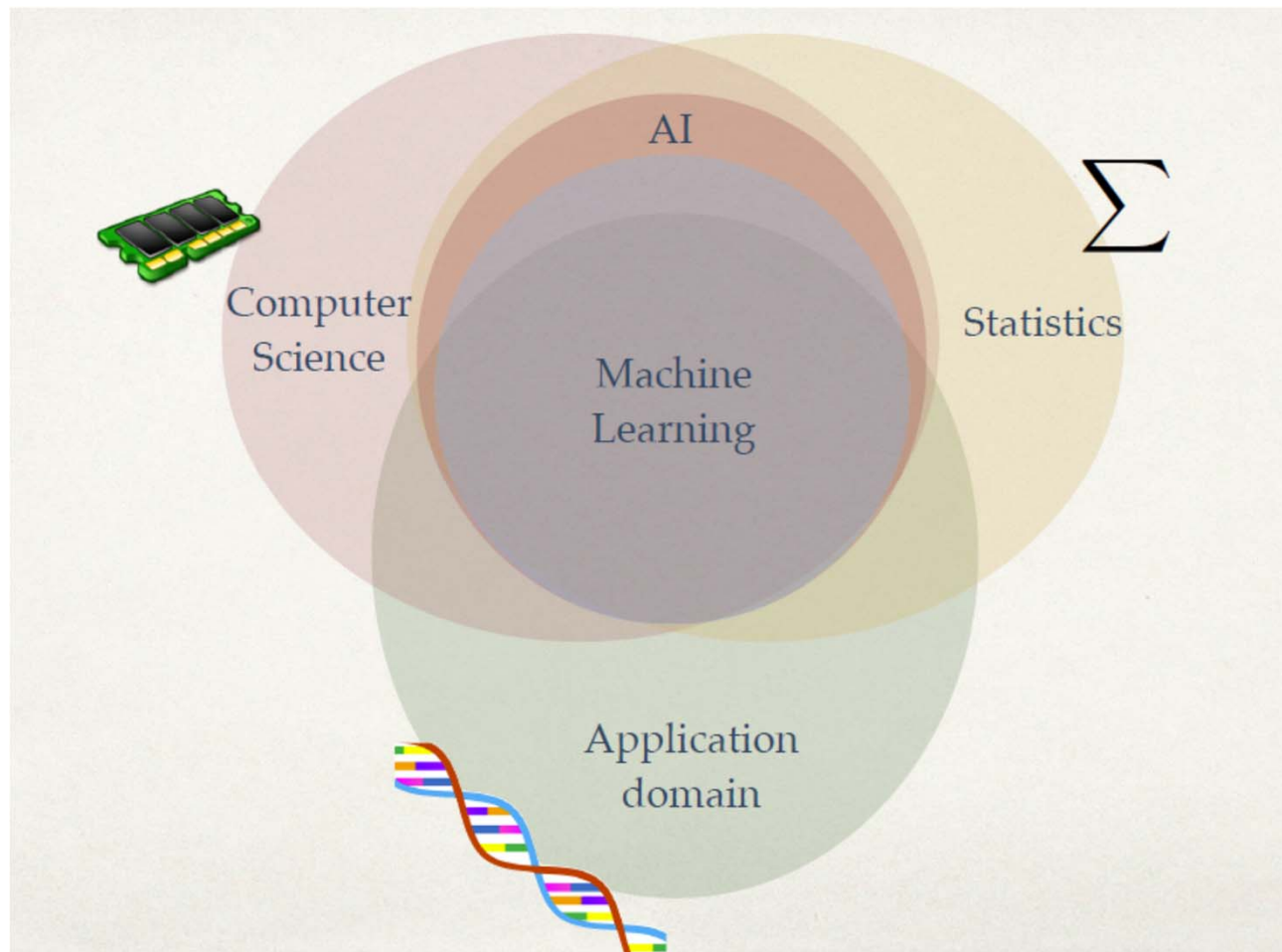
ML is only a small part!
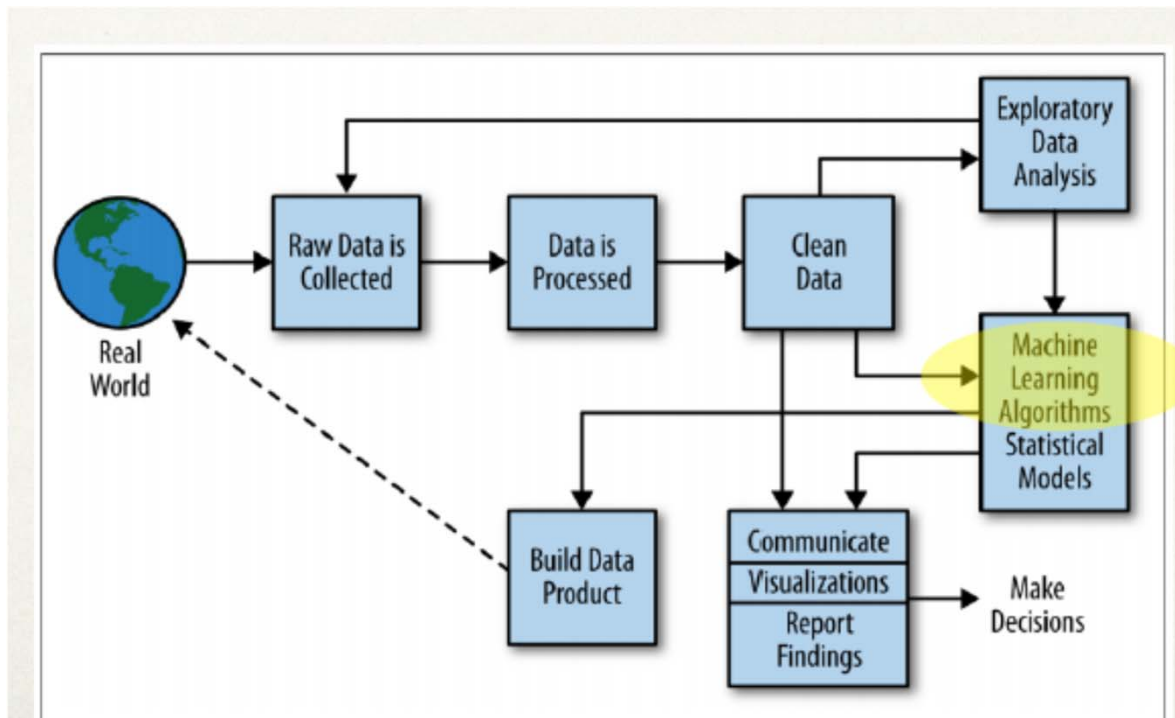
More Examples:
- Database mining
    Large datasets from growth of automation/web.
    E.g., Web click data, medical records, biology, engineering
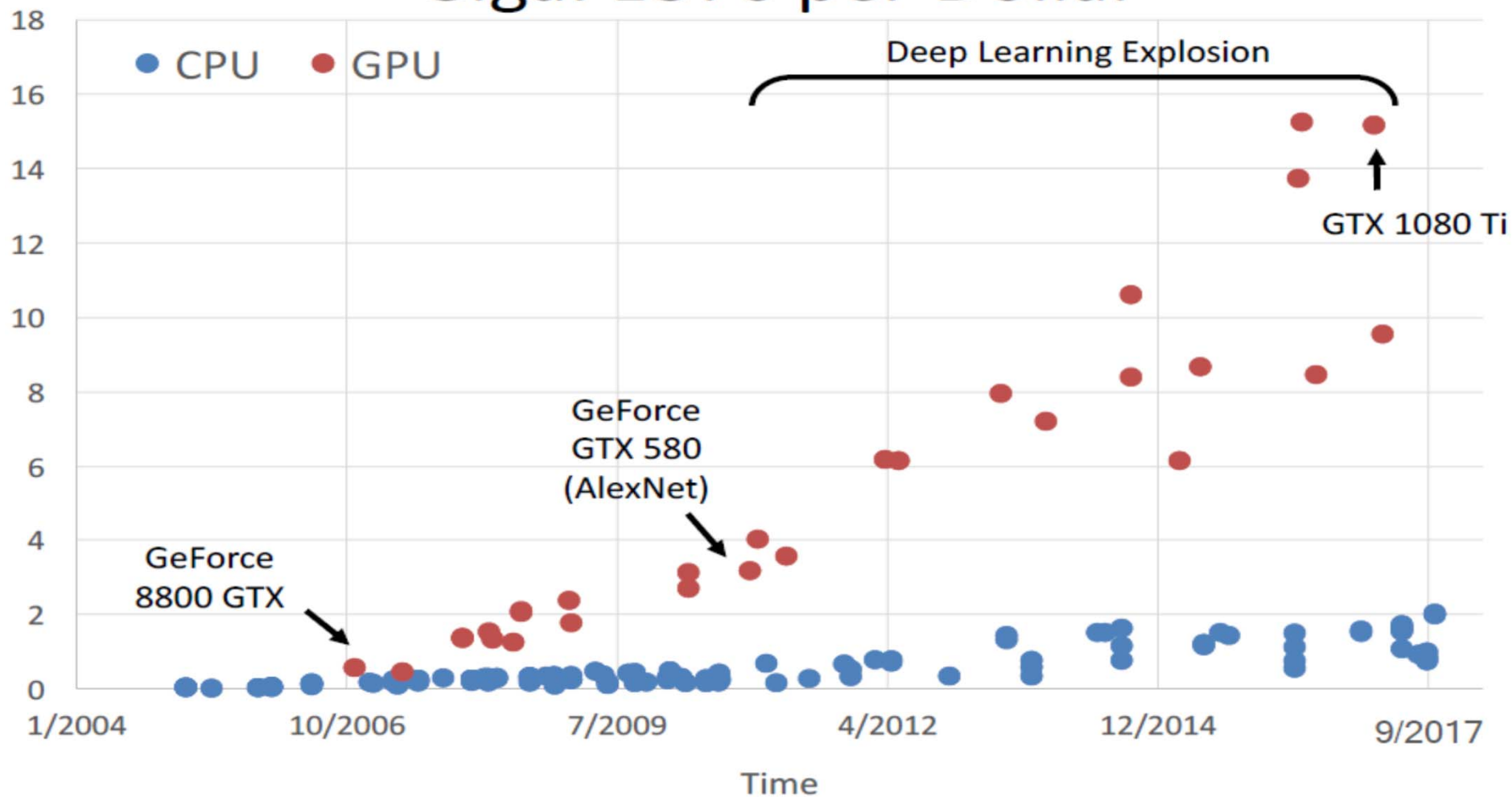- Applications can't program by hand.
    E.g., Autonomous helicopter, handwriting recognition, most of
    Natural Language Processing (NLP), Computer Vision.
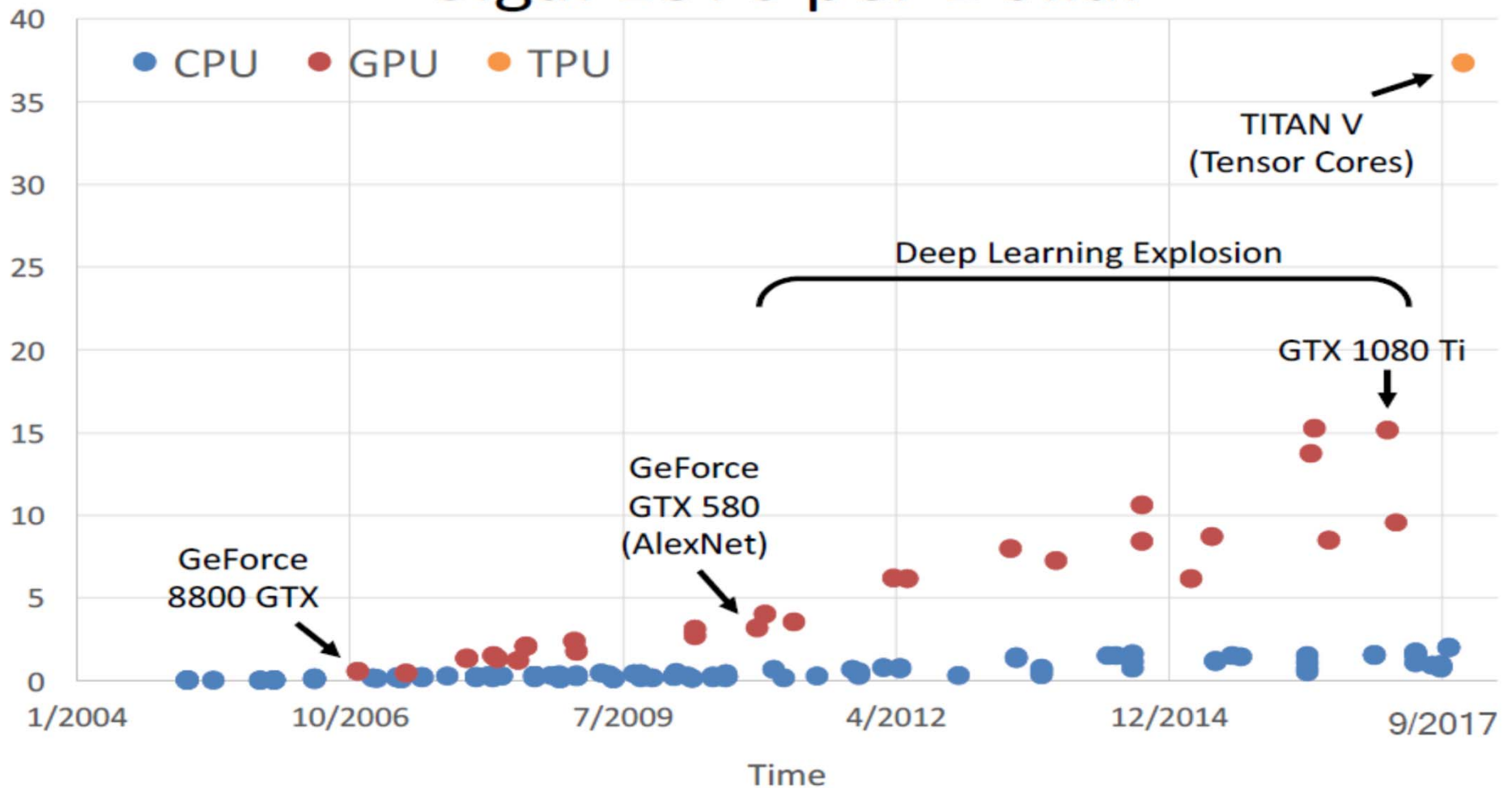- Self-customizing programs
    E.g., Amazon, Netflix product recommendations
- Understanding human learning (brain, real AI).

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.

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Syllabus

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

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Syllabus

- Classification
  - Logistic Regression
  - softmax regression
  - Bayes classifier
  - Naive Bayes
  - K-nearest Neighbors
  - support vector machine
  - Decision tree
  - Error metrics for unbalance data
- Unsupervised Learning
  - k-means clustering
  - Gaussian mixture models
  - Expectation maximization
  - 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

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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

Teacher Assistants

- Fatemeh Piri

- Ali Tamizifar

- Arsham haghighat

- Amir Arbab

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Course Strategy

- Assignments and projects 20% to 30%

- Midterm and quizzes 30% to 40%

- Final 30% to 40%

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براى دريافت آموزش هاى بيشتر در حوزه يادگيرى عميق و يادگيرى ماشين كانال زير را دنبال كنيد:

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