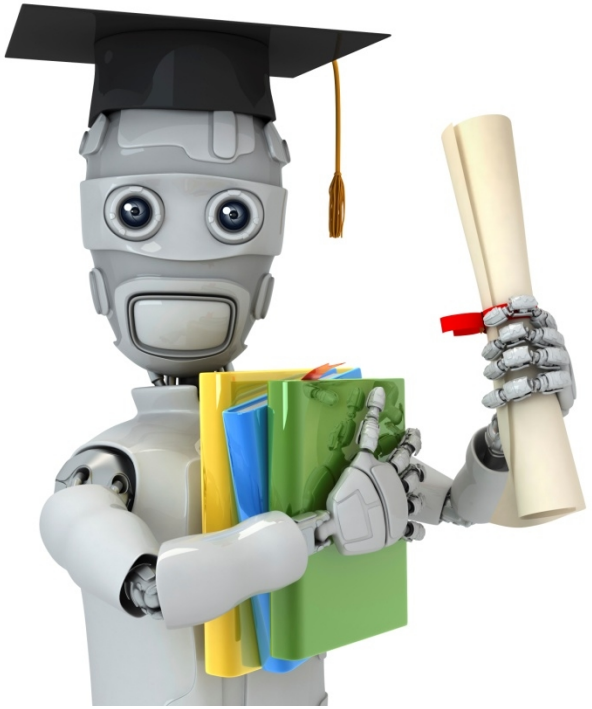
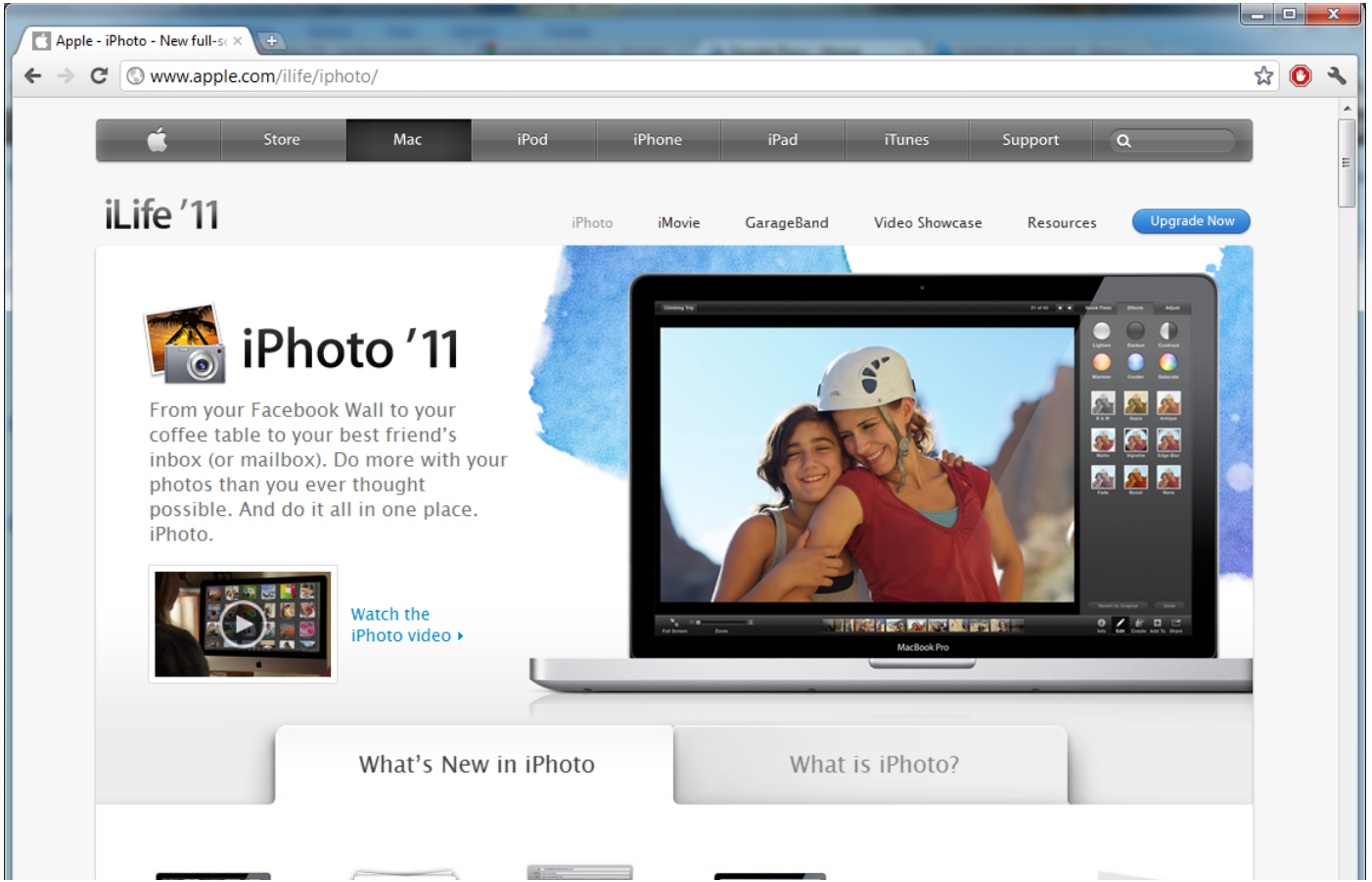


Machine Learning

Introduction

Welcome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SPAM

Machine Learning

- Grew out of work in AI
- New capability for computers

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.

Machine Learning

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  Large datasets from growth of automation/web.
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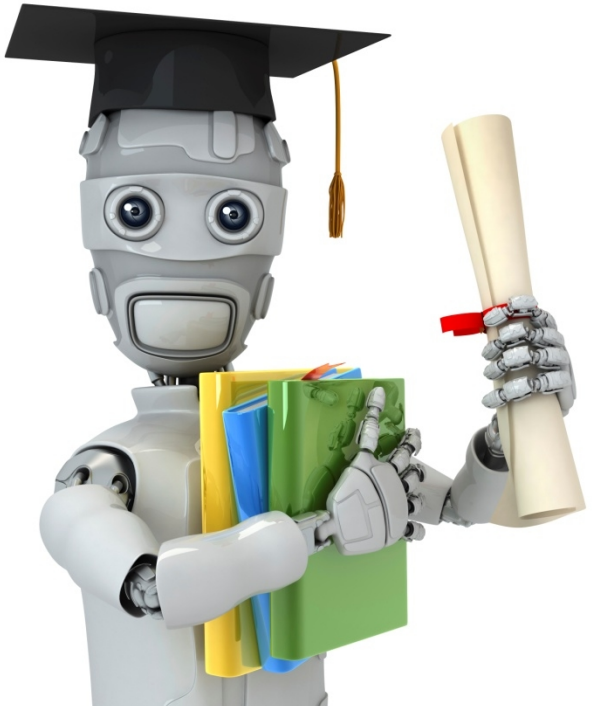
- Applications can’t program by hand.
  E.g., Autonomous helicopter, handwriting recognition, most of Natural Language Processing (NLP), Computer Vision.
- Self-customizing programs
  E.g., Amazon, Netflix product recommendations



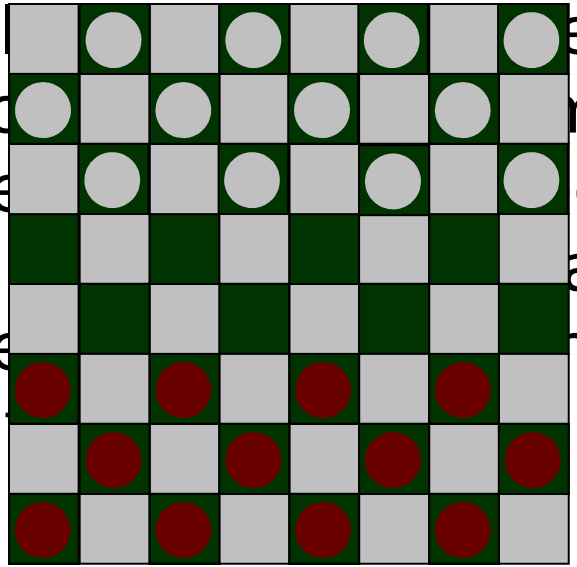
Machine Learning

Introduction

What is machine learning

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.



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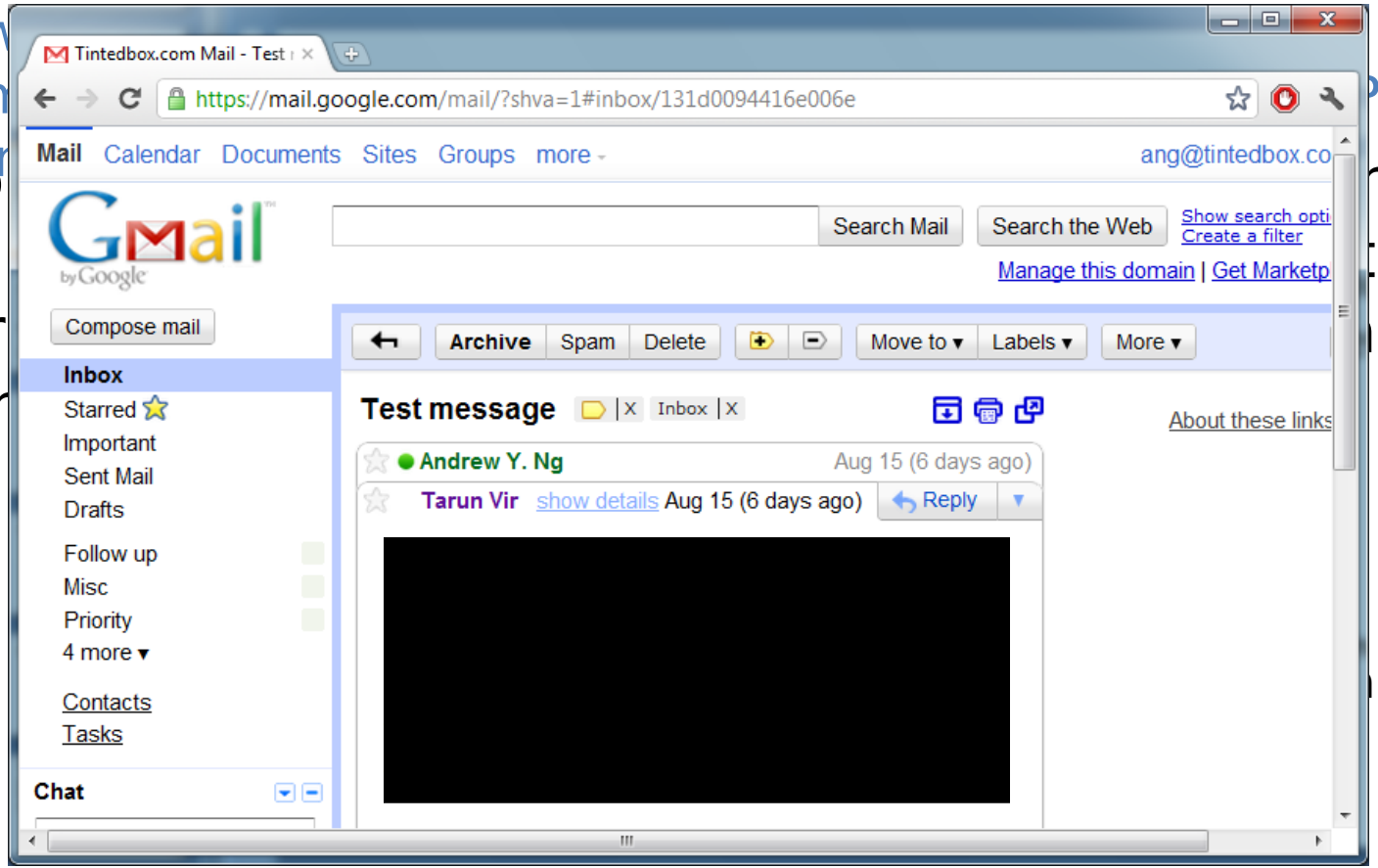
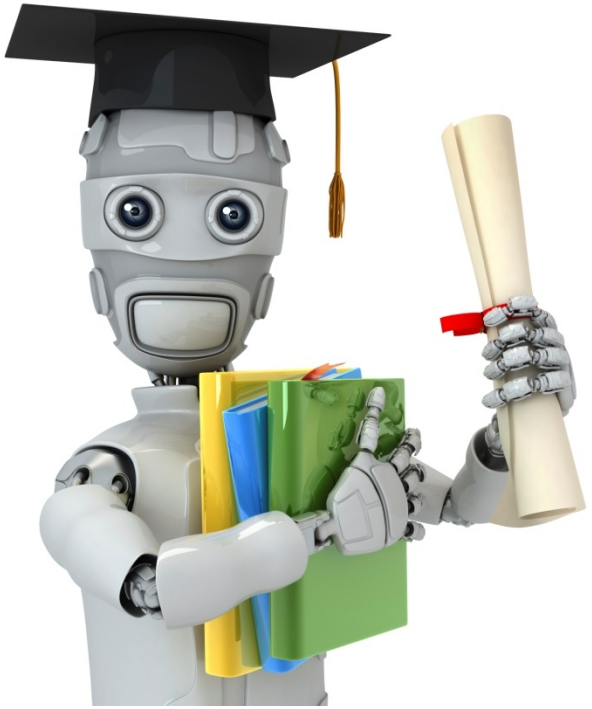


Machine learning algorithms:

- Supervised learning
- Unsupervised learning

Others: Reinforcement learning, recommender systems.

Also talk about: Practical advice for applying learning algorithms.

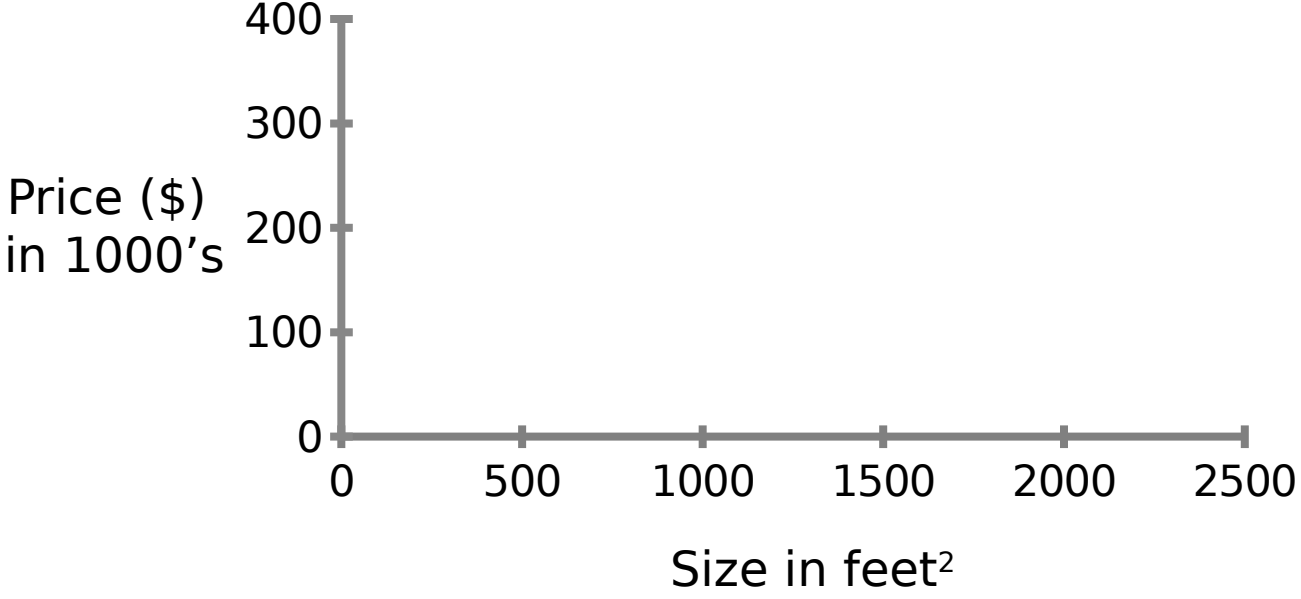


Machine Learning

Introduction

Supervised Learning

Housing price prediction.



Supervised Learning

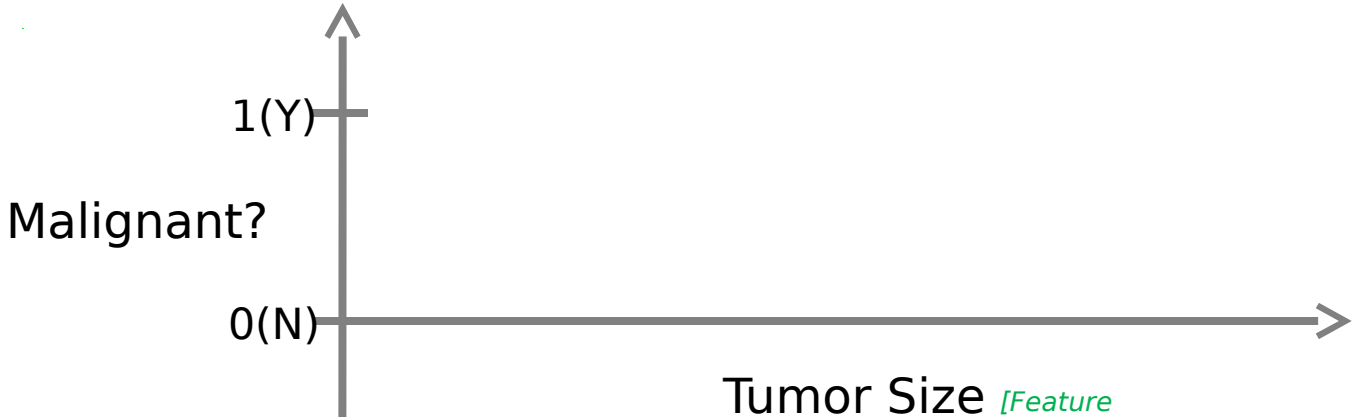
"right answers" given

Regression: Predict continuous valued output (price)

Harmful

Not Harmful

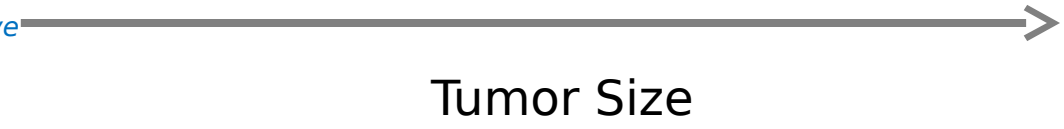
Breast cancer (malignant, benign)



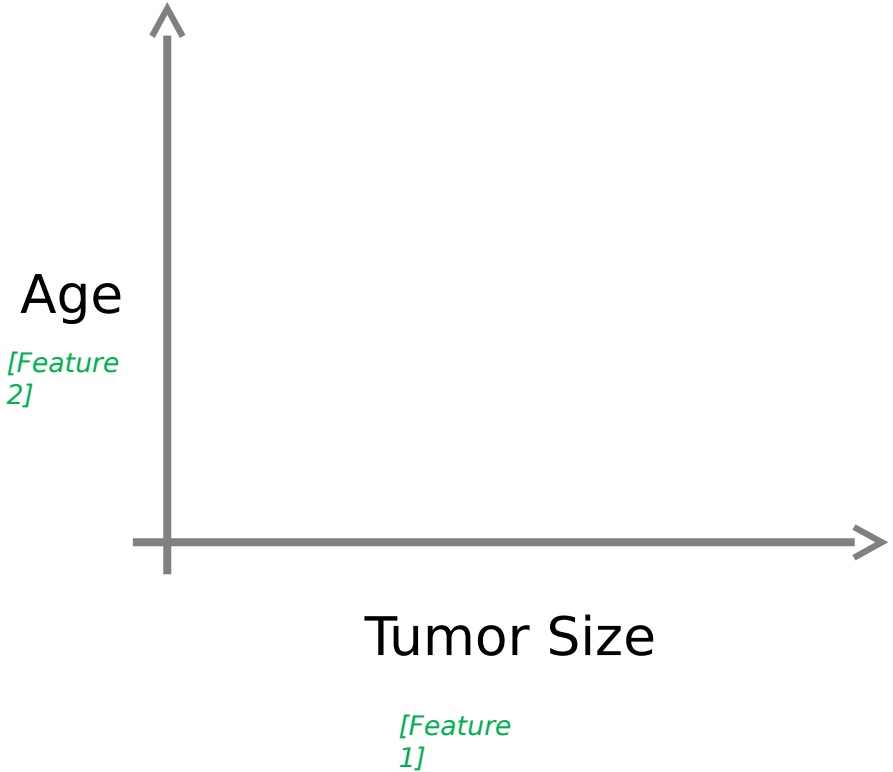
Classification

Discrete valued output (0 or 1)

Another way of representing above graph



We have given training data set (past medical records) which tells whether a particular tumor size lead to a breast cancer or not. We want to know , the given tumor size falls in which category



- Clump Thickness
- Uniformity of Cell Size
- Uniformity of Cell Shape

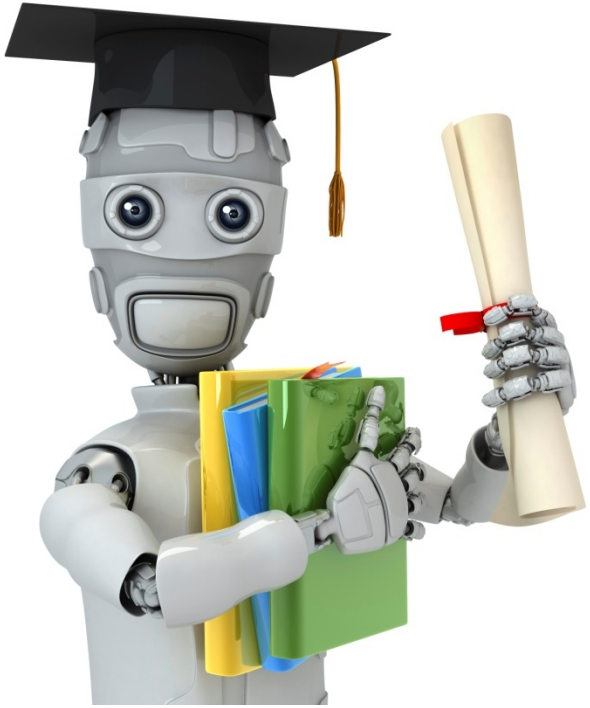
...

You’re running a company, and you want to develop learning algorithms to address each of two problems.

Problem 1: You have a large inventory of identical items. You want to predict how many of these items will sell over the next 3 months.
Problem 2: You’d like software to examine individual customer accounts, and for each account decide if it has been hacked/compromised.

Should you treat these as classification or as regression problems?

- Treat both as classification problems.
- Treat problem 1 as a classification problem, problem 2 as a regression problem.
- Treat problem 1 as a regression problem, problem 2 as a classification problem.
- Treat both as regression problems.

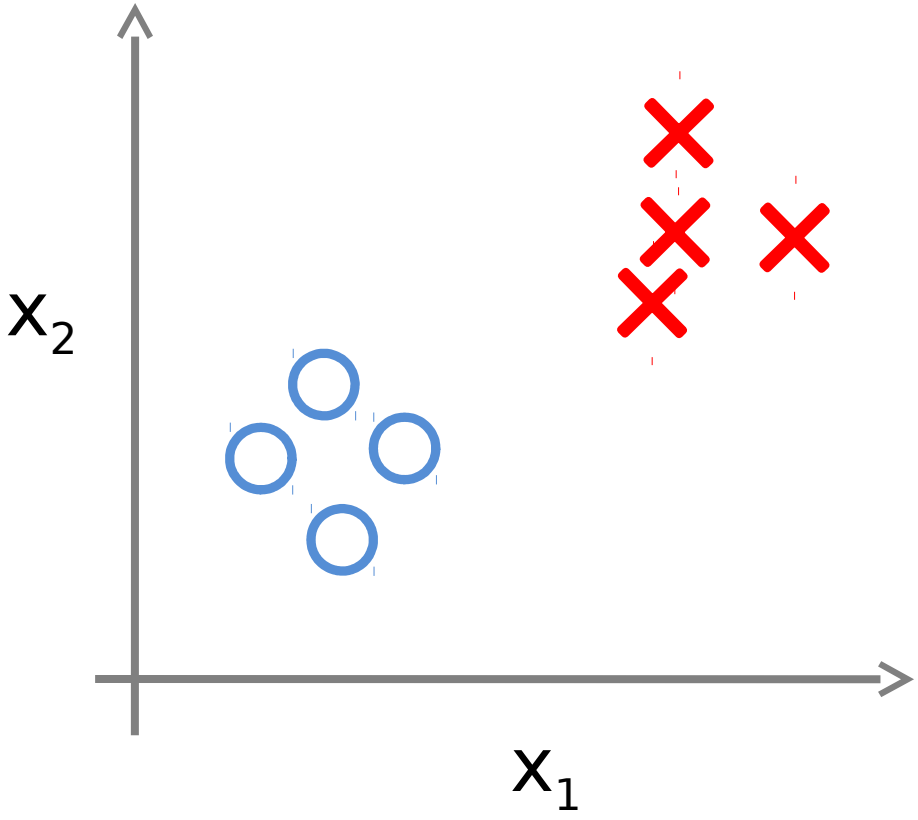


Machine Learning

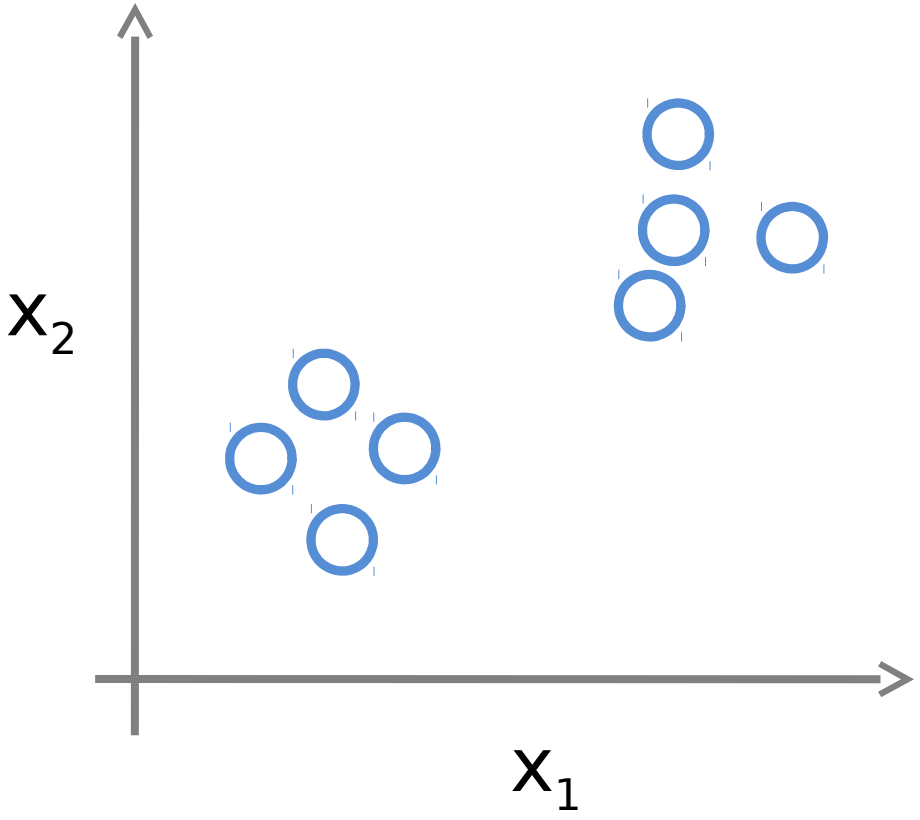
Introduction

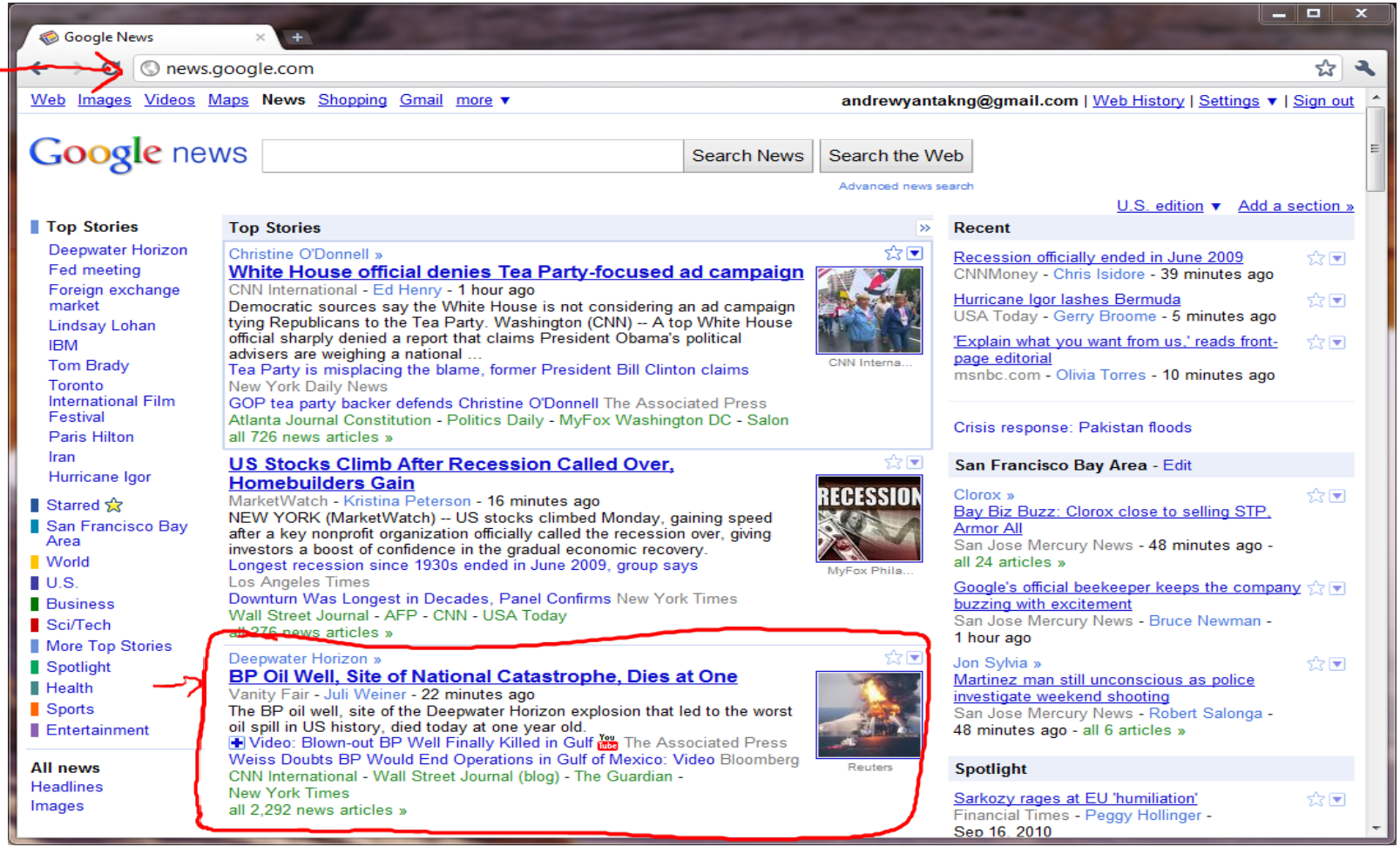
Unsupervised Learning

Supervised Learning



Unsupervised Learning

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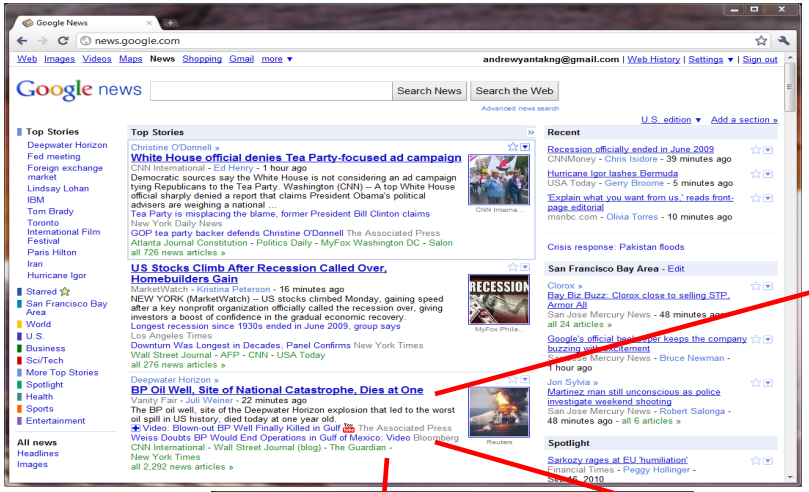
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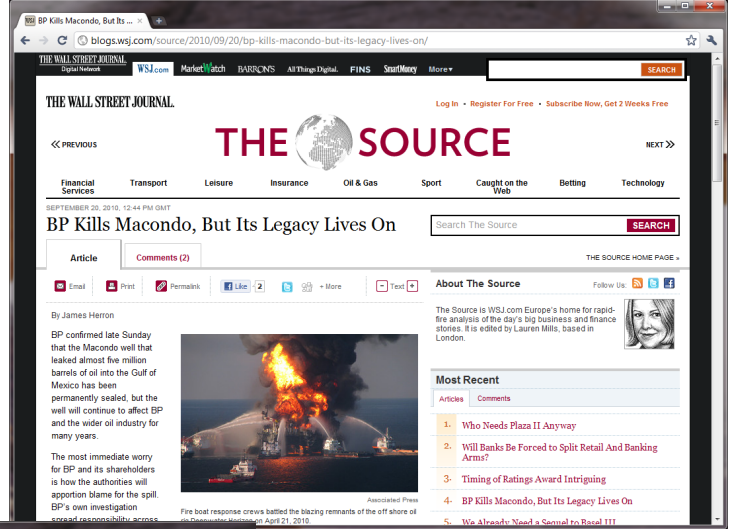
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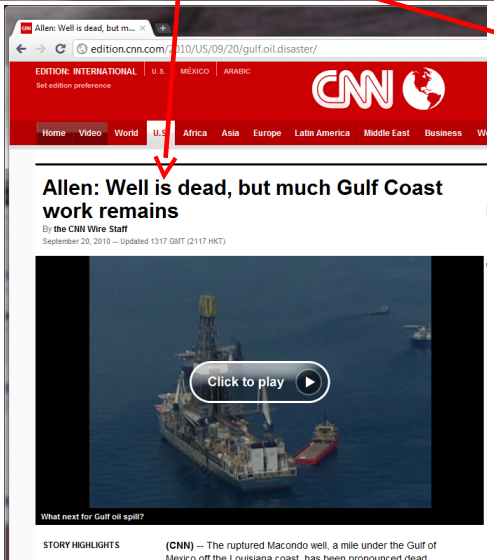
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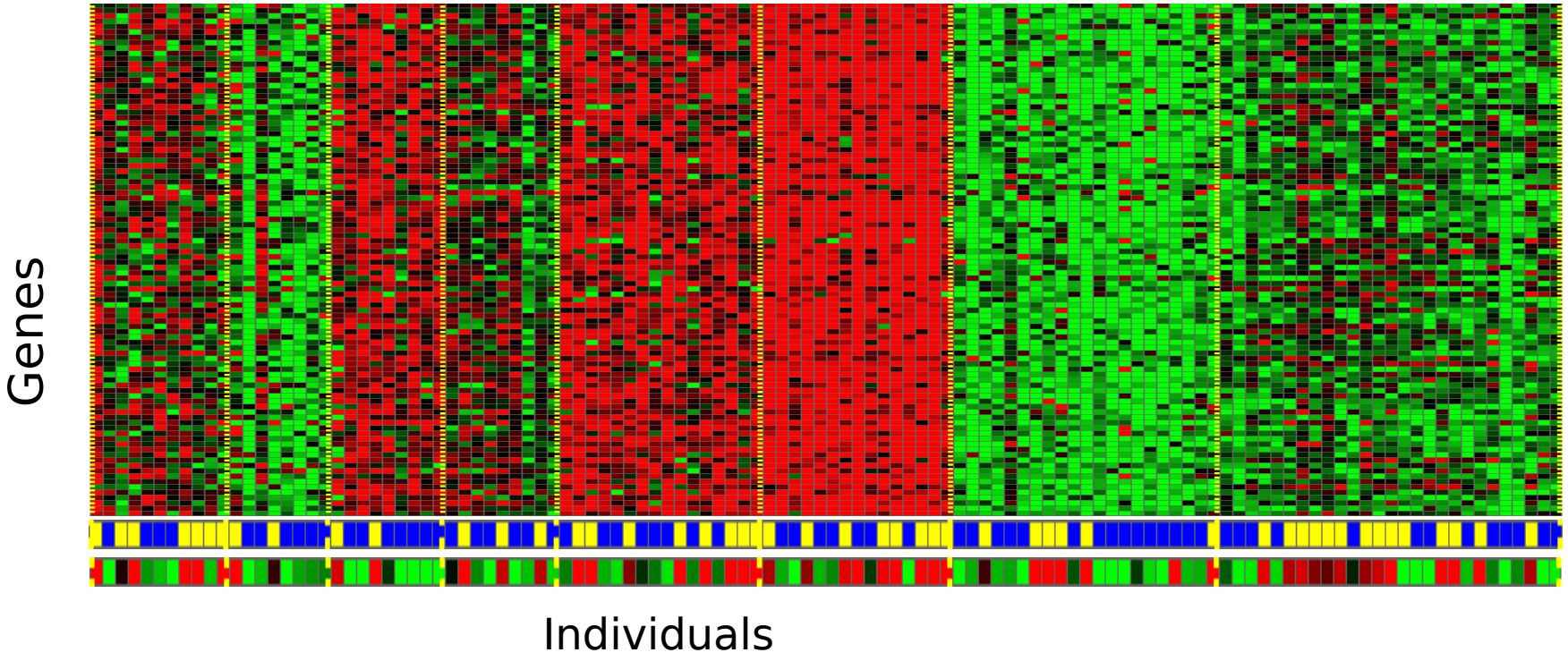
BP has set up a $20bn compensation fund after the Deepwater Horizon disaster, which has so far paid out 19,000 claims totalling more than $240m
Julia Kollewe
guardian.co.uk, Monday 20 September 2010 08.33 BST
Article history

Andrew Ng



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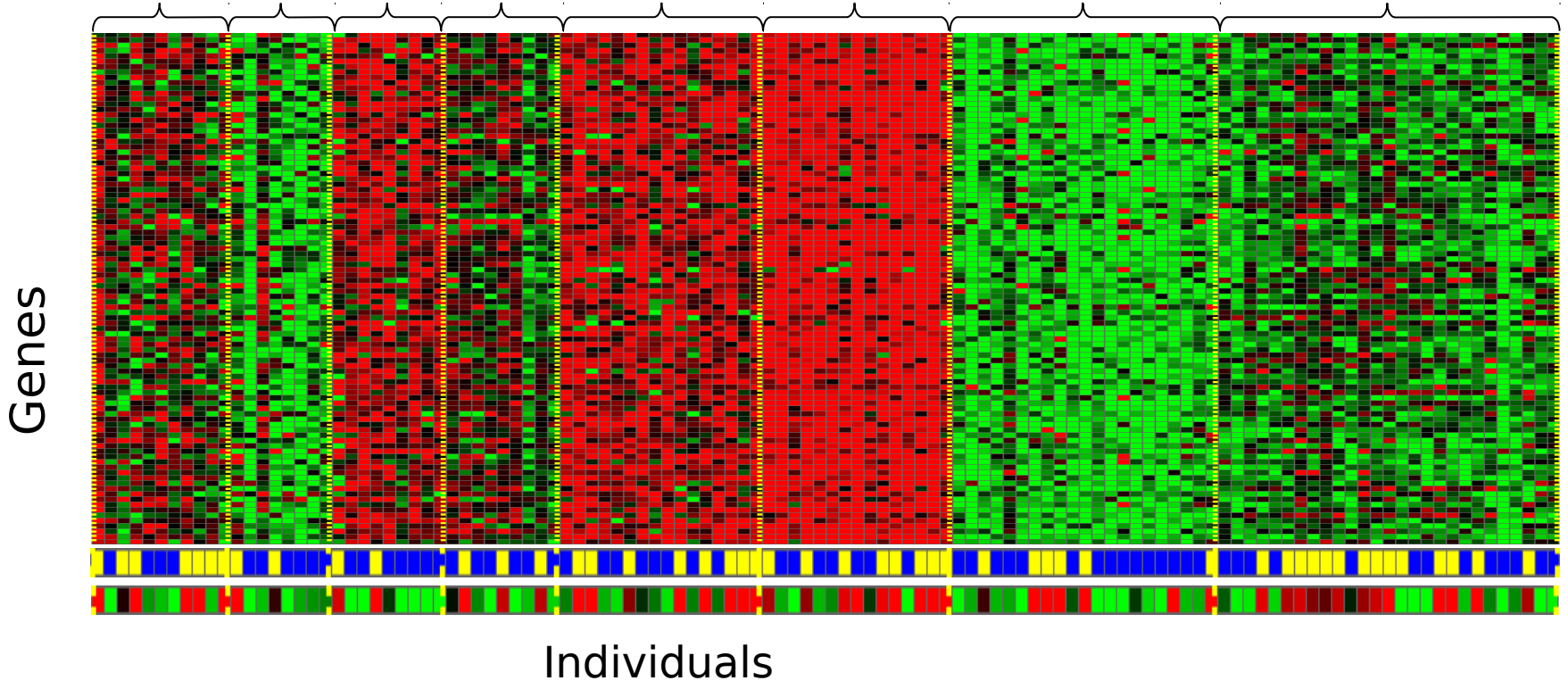

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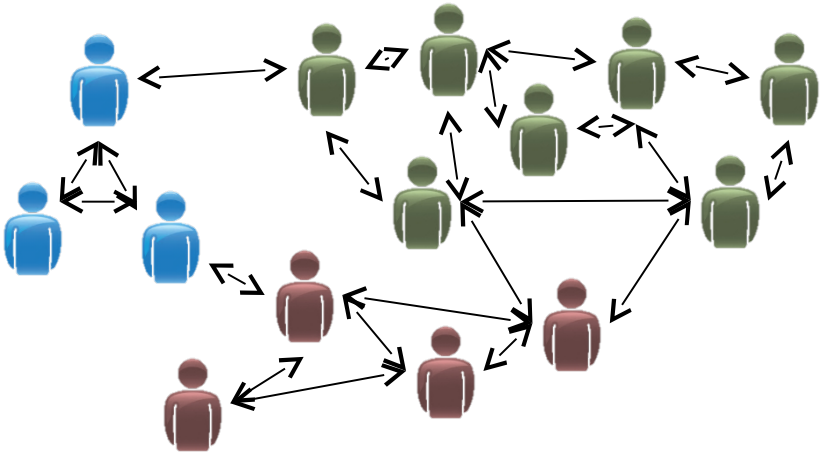
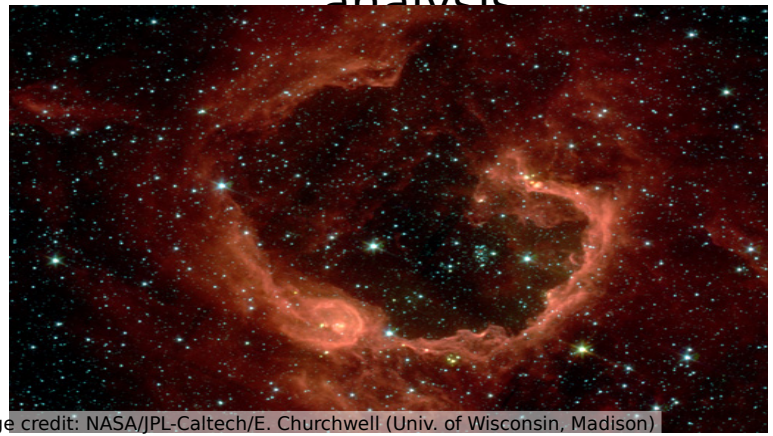
Organize computing clusters



Social network analysis

Market segmentation



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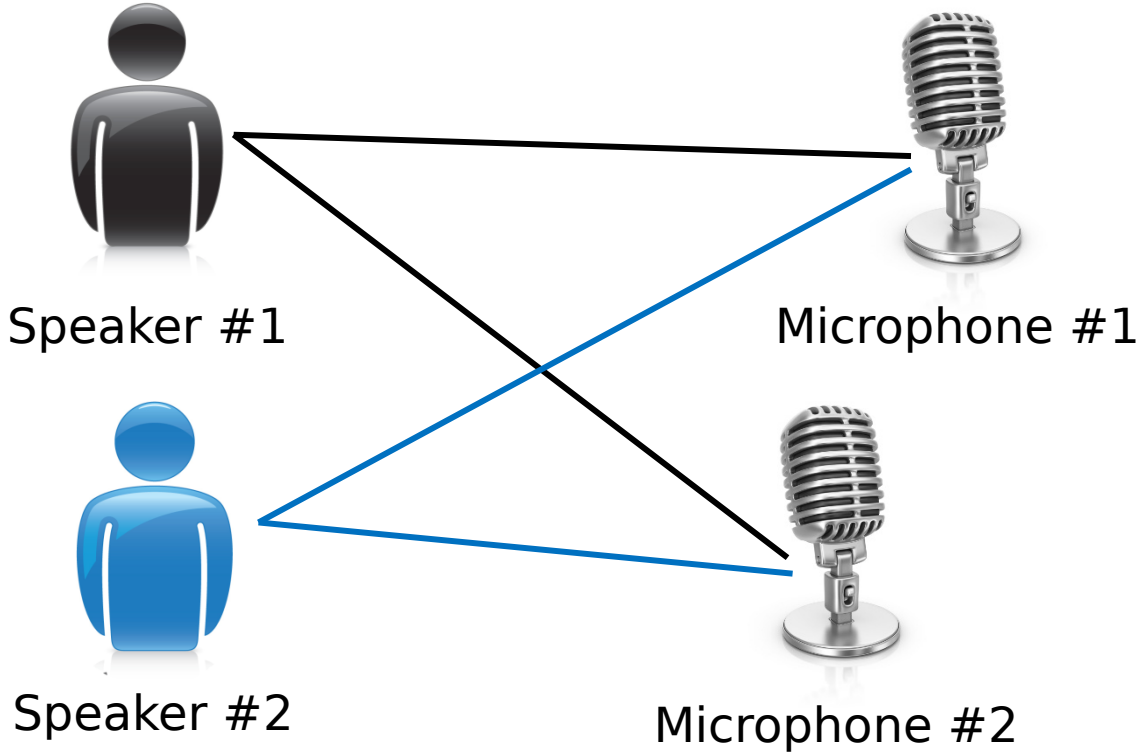
Astronomical data analysis

Cocktail party problem



Microphone #1: Output #1:

Microphone #2: Output #2:

Microphone #1: Output #1:

Microphone #2: Output #2:

udio clips courtesy of Te-Won Lee.]

Cocktail party problem algorithm

```
[W,s,v] =
svd((repmat(sum(x.*x,1),size(x,1),1).*x)*x');
```

rce: Sam Roweis, Yair Weiss & Eero Simoncelli]

Of the following examples, which would you address using an unsupervised learning algorithm? (Check all that apply.)

- ☐ Given email labeled as spam/not spam, learn a spam filter.
- ☐ Given a set of news articles found on the web, group them into set of articles about the same story.
- ☐ Given a database of customer data, automatically discover market segments and group customers into different market segments.
- ☐ Given a dataset of patients diagnosed as either having diabetes or not, learn to classify new patients as having diabetes or not.