

# Introduction

## 1. Welcome

Machine Learning

Grew out of work in AI

New capability for computers

Examples:

Database mining

Applications can't program by hand

Self-customizing programs

Understanding human learning(brain, real AI)

## 2. 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  $E$ .

Machine learning algorithms

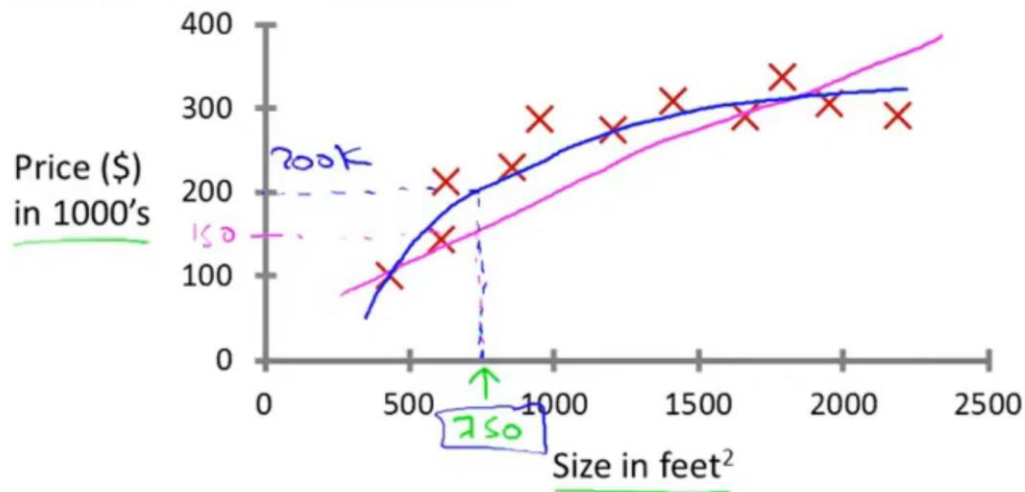
Supervised learning

Unsupervised learning

Others: Reinforcement learning, recommender systems.

## 3. Supervised Learning

Housing price prediction

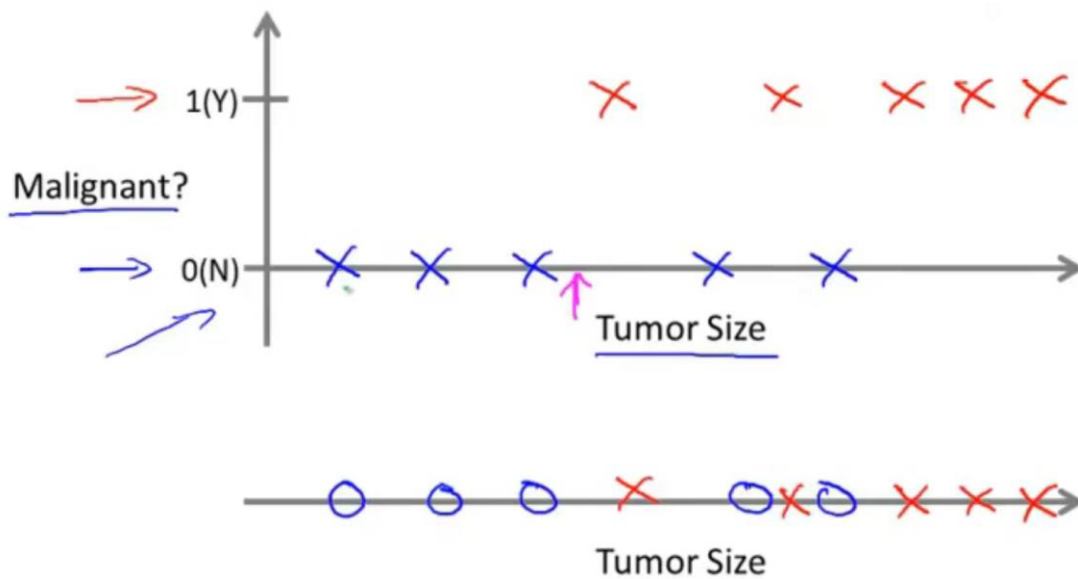


Supervised Learning: "right answers" given

Regression: Predict continuous valued output(price)

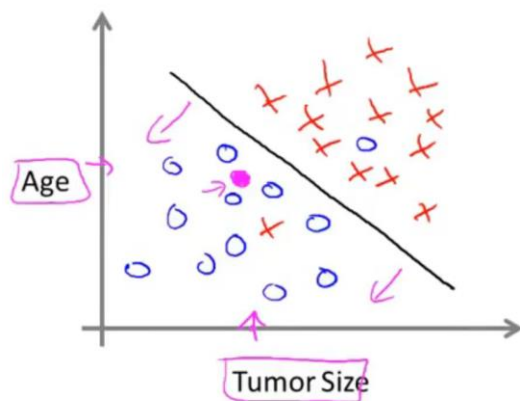
another example:

Breast cancer(malignant, benign)



Classification: Discrete valued output(0 or 1)

more features:



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

...

even infinite features

a question:

➤ 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.

➤ 0 - not hacked  
➤ 1 - hacked

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.

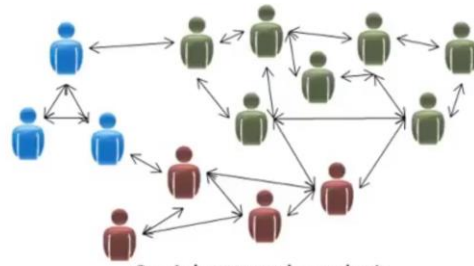
## 4. Unsupervised Learning

we are not giving the algorithm the right answer for the examples in my data set, this is Unsupervised Learning.

examples of clustering:



Organize computing clusters



Social network analysis



Market segmentation

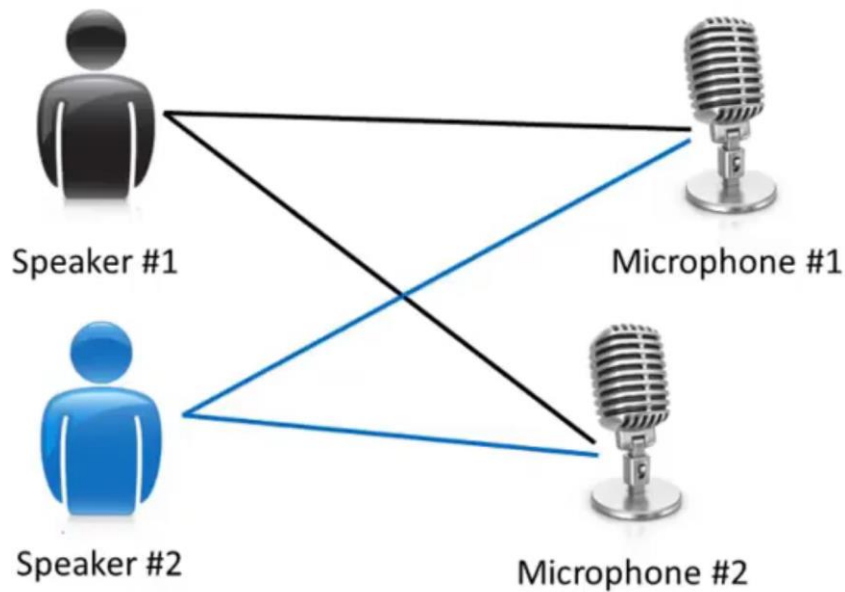


Astronomical data analysis

Andrew Ng

cocktail algorithm:

## Cocktail party problem



just one line of code:

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

a question:

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.