Pattern Recognition. Overview

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Outline

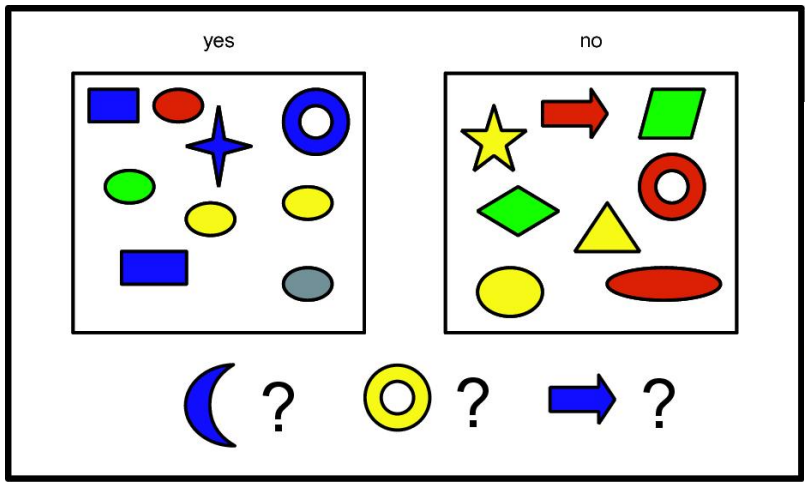
What is pattern Recognition

Finding Pattern and regularities in data usually to solve more complex problem.

Basic Type of learning problem

- Supervised Learning
  - Naive Bayes
  - Support vector machine
  - Decision Tree
- Unsupervised Learning
  - Clustering, k-mean.
  - Dimensionality reduction. PCA
- Reinforcement learning

Classification



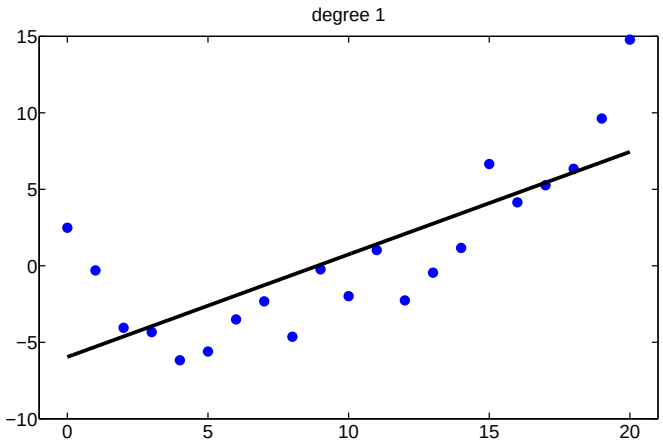
D features (attributes)

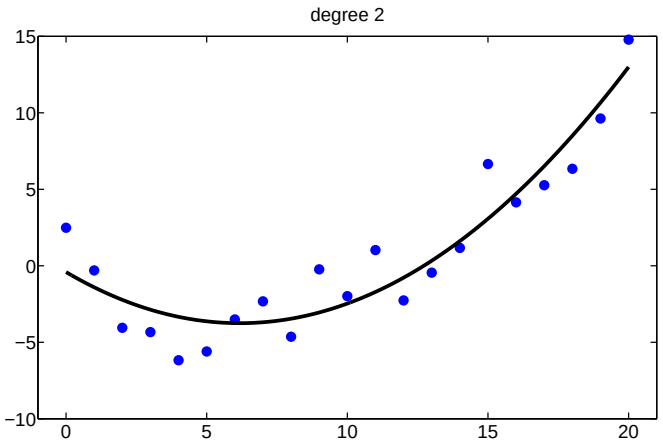
N cases

Color	Shape	Size (cm)
Blue	Square	10
Red	Ellipse	2.4
Red	Ellipse	20.7

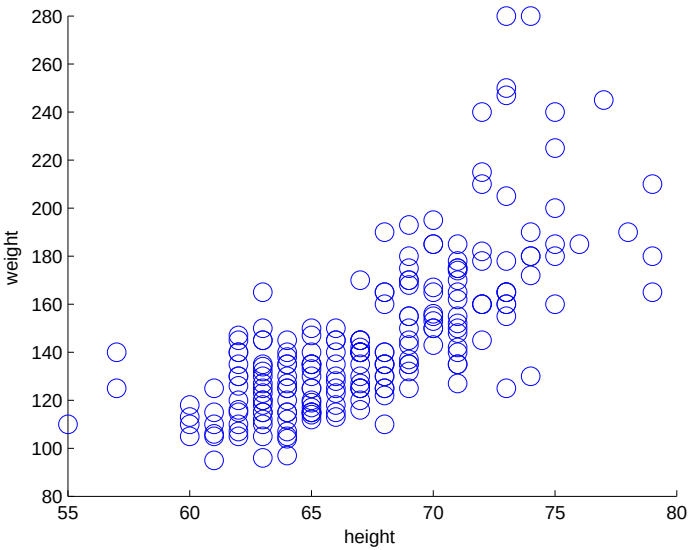
Label
1
1
0

Regression





Clustering


weight
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280
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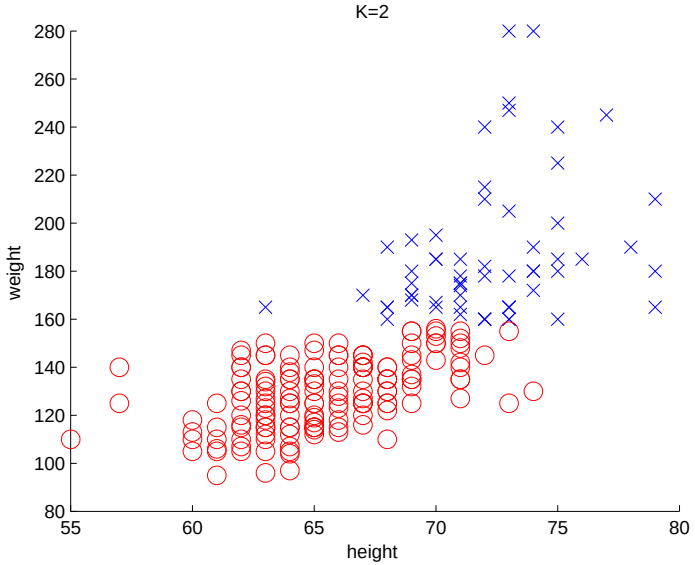
K=2
weight
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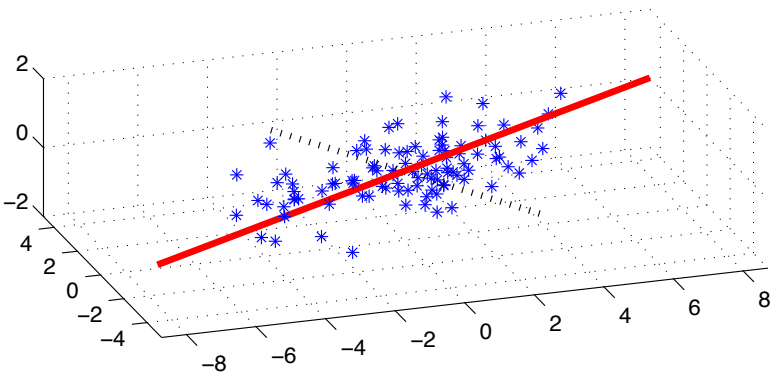
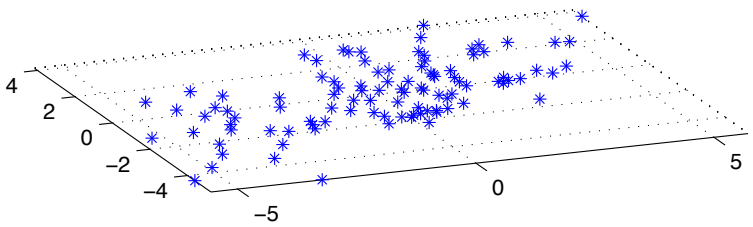
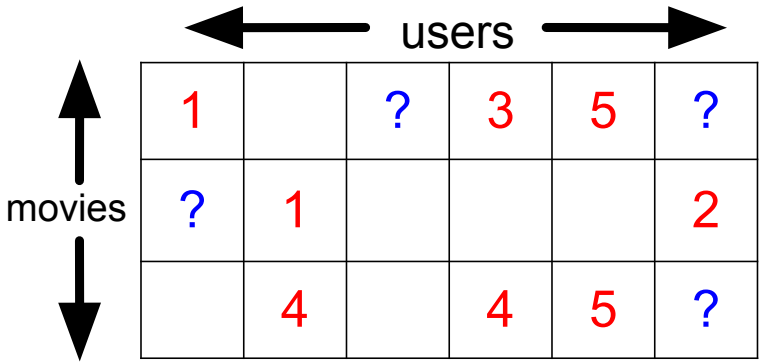
Discovering latent factors. Manifold Learning





PCA

Collaborative filtering(S1.3.4.2)



Applications

- Recommendation system of Google and . ▸ Amazon
- Object detection in images. Essential component of self driving car etc. ▸ imagenet ▸ MNIST
- Medical dignosis. ▸ diabetic-eye
- Fraud detection in credit card transaction.
- Timeseries prediction. Natural Language Processing, Machine translation etc, Financial market etc. For e.g. Real time translation on skype. Chat bot in customer services.

Parametric vs non-parametric models

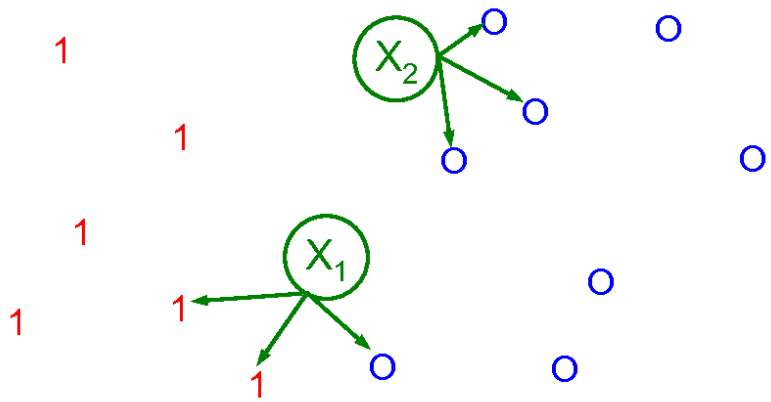
Parametric: Model has a fixed number of parameters.

non-parametric: Number of parameters grow with training data.

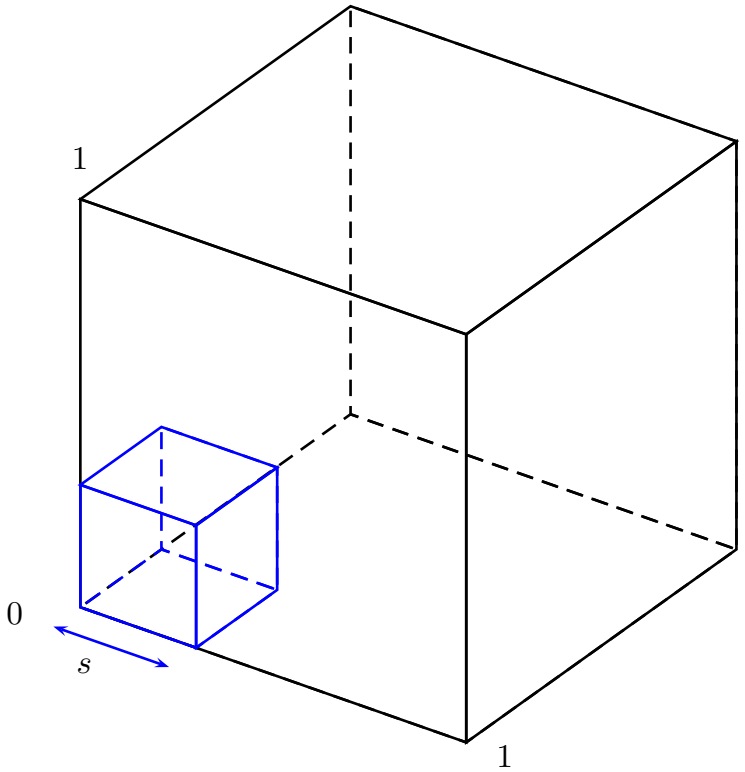
Note: hyperparameters are parameters whose values are set before starting the learning process

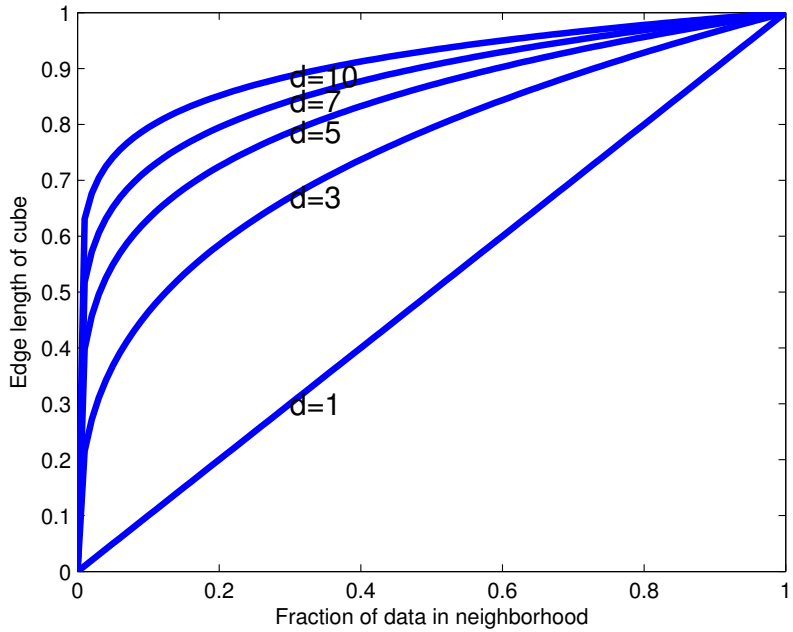
K-nearest neighbors

$$p(y = c|\mathbf{x}, \mathcal{D}, \mathcal{K}) = \frac{1}{K} \sum_{i \in N_k(\mathbf{x}, \mathcal{D})} \mathbb{I}(y_i = c)$$



Curse of dimentionality

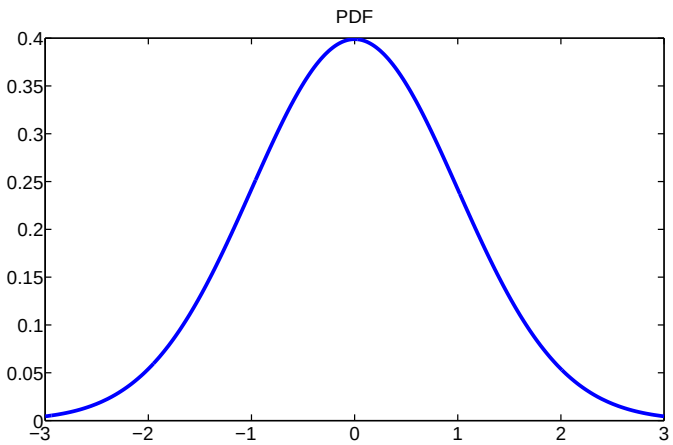




1..4.4: Parametric models for classification and regression

$$y(\mathbf{x} = W^T\mathbf{x}) + \epsilon = \sum_{j=1}^{D} w_j x_j + \epsilon$$

Where $\epsilon \sim \mathcal{N}(\mu, \sigma^2) = \frac{1}{\sqrt{(2\pi\sigma^2)}} \exp(-\frac{2\sigma^2}{(x-\mu)^2})$



Thank you!