SMAI Class 11

September 08, 2022

Parameter Estimation

Assumption

- Training samples
  - We know which class each sample belongs to
  - Classes are mutually exclusive. A sample can't have more than one class
- Samples in D_i does not influence $P(X|\omega_j)$ $i \neq j$
  - D_i is the class for training set.
- Samples are iid
  - What does independence of samples even mean?
    - Drawing one sample is independent of the other sample
- We know the function / form of $P(X|\omega_i)$ (density function).
  - Unknowns are parameters of the distribution

Problem

Given $\{x_1, x_2, \dots, x_n\} \in \omega_i$

Estimate θ of $p(x|\theta)$

Using the independent assumption,

$$p(D|\theta) = \prod_{k=1}^{n} p(x_i|\theta)$$

Maximum likelihood Estimate (MLE)

$$\begin{aligned} \hat{\theta}_{MLE} &= \arg\max_\theta p(D|\theta) \\ &= \arg\max_\theta \ln p(D|\theta) \quad \text{logarithm for convenience} \end{aligned}$$

Take derivative of $\ln p(D|\theta)$ and set it to zero (for maximum value).