Machine Learning Algorithms
Assignment - 5

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Q. What is likelihood ? How can you compute Maximum Likelihood Estimates ?

Ans: In statistics, the likelihood function (or simply called the likelihood) measures the goodness of fit of a statistical model to a sample of data for given values of the unknown parameters. It is formed from the joint probability distribution of the sample, but viewed and used as a function of the parameters only, thus treating the random variables as fixed at the observed values.

Maximum Likelihood Estimation (MLE) is a method that determines values for the parameters of a model. The parameter values are found such that they maximize the likelihood that the process described by the model produced the data that were actually observed.

Calculation :

Example:
A coin is flipped 100 times. Given that there were 55 heads, find MLE for probability p of heads on a single toss.

$$P(55 \text{ heads} \mid p) = \binom{100}{55} p^{55} (1-p)^{45}$$

Diff wrt. p,

$$\frac{d}{dp} p(\text{data} \mid p) = \binom{100}{55} (55 p^{54} (1-p)^{45} - 45 p^{55} (1-p)^{44}) = 0$$

$$\Rightarrow 55 p^{54} (1-p)^{45} = 45 p^{55} (1-p)^{44}$$

$$55(1-p) = 45p$$

$$55 = 100p$$

MLE is $\hat{p} = 0.55$

For gaussian distribution μ and σ :

PDF :

$$P(x; \mu, \sigma) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\left(\frac{(x-\mu)^2}{2\sigma^2}\right)}$$

μ and σ resulting in maximum value thus MLE is differentiation of above is equated with zero and then a double derivative test to check for maxima & minima.