Assignment One: Model Selection, Probability Theory and Distributions

Show that the variance of a sum is $\text{var}[X+Y] = \text{var}[X] + \text{var}[Y] + 2\,\text{cov}[X,Y]$.

Suppose $\theta \sim Beta(\alpha, \beta)$, derive the mean, mode and variance.

Since a positive definite matrix Σ can be defined as the quadratic form $U^T \Lambda U$, show that a necessary and sufficient condition for Σ to be positive definite is that all the eigenvalues λ_i of Λ are positive.

Derive the maximum likelihood solutions for the mean and the variance of a univariate Gaussian distribution by maximize the log likelihood function with respect to μ and Σ.

Write a pseudo-code for using cross-validation to determine the best K value of K nearest neighbors classifier.