Multivariate Analysis

Course Outcome:

Upon completion of this course, students will be able to:

1. Evaluate and apply various multivariate data visualization techniques such as mosaic plots, scatterplot matrix, bivariate qq-plots, spider web plots, DD plots, parallel coordinate plots, and trellis displays to effectively visualize complex multivariate data sets.

2. Analyze and interpret multivariate probability distributions including random vectors, mean vectors, dispersion matrices, and probability mass/density functions to understand the underlying distributional properties of multivariate data.

3. Compute and interpret marginal and conditional distributions, multiple and partial correlation coefficients, multinomial distribution, Dirichlet distribution, and properties of the multivariate normal distribution to make informed statistical inferences.

4. Demonstrate proficiency in sampling from multivariate normal distribution, including understanding sampling distributions for mean vectors and variance-covariance matrices, Wishart distribution, Hotelling T^2 statistic, and Mahalanobis D^2 distance for hypothesis testing.

5. Define and analyze copulas, understand their basic properties, and utilize copula functions for modeling multivariate distributions independently of their marginal distributions.

6. Apply multivariate techniques such as principal component analysis, independent component analysis, factor analysis, correspondence analysis, canonical correlation analysis, discriminant analysis, cluster analysis, and multidimensional scaling to decompose data matrices, identify patterns, reduce dimensionality, and explore relationships among variables in multivariate data sets.