MTL766: Multivariate Statistical Methods (3-0-0)

Instructor: Rahul Singh
Office: Room no. GPF 1, MGGP
email: sirahul@maths.iitd.ac.in

Course Content:

- Basic concepts of multivariate distributions, Geometrical interpretation of the sample, Expected values of sample mean and sample covariance matrix.
- Multivariate Normal distribution, Sampling from a multivariate Normal distribution, Maximum Likelihood estimation. Sampling distribution and Large-sample behavior of mean and covariance matrix. Wishart and Hotelling distribution.
- Likelihood ratio test, Confidence region, Hypothesis testing of simultaneous comparisons of component Means. Large sample inferences about a Population Mean Vector, Comparing Mean Vectors from Two Populations, Comparison of Several Multivariate Population means. Simultaneous confidence Intervals, Two-Way Multivariate Analysis of Variance (MANOVA).
- Multiple linear regression, Least squares estimation, Multivariate multiple regression, Inferences about the regression models and parameters, Linear discriminant analysis and classification.
- Principal component analysis, Summarizing sample variation by principal components, graphing the Principal Components. Factor analysis, orthogonal factor model, estimation methods, factor rotation, factor scores.
- (If time permits) Canonical correlation analysis.

References:

1. Johnson, R. A., and Wichern, D. W. (2002). Applied multivariate statistical analysis.
2. Marden, John I. (2015). Multivariate statistics. Urbana-Champaign: Department of Statistics, University of Illinois.

Supplementary texts:

1. Anderson, T. W. (1958). An introduction to multivariate statistical analysis. New York: Wiley.
2. Mardia, K. V., Kent, J. T., and Taylor, C. C. (2024). Multivariate analysis (Vol. 88). John Wiley & Sons.

Evaluation:

- Minor I: 25 marks
- Assignments ($2 \times 5 = 10$): There will be 2 assignments, 5 marks in each.
- Quizzes ($2 \times 5 = 10$): 2 Quizzes, 5 marks in each.
- Group project and presentation: 20 marks
- Major: 35 marks

Attendance and other policies:

- Cell phones and laptops are discouraged during class.
- While there is no weightage for attendance, students are highly encouraged to attend all lectures.
- There will be no make-up opportunity for the quizzes, assignments, or presentation.
- Discussion/collaborations for solving the assignments is encouraged. However, students are expected to write down the solutions on their own.
- Minor and Major exams will be open-book.