

Course Titles/Code: Introductory Multivariate Methods (Stat3063)

Credit: 5 EtCTS

Credit hours: 3hrs (3hrs lecture +2 hrs tutorial+1hr lab)

Instructor's Name: Enyew A.

Course description

Introduction; Review of Matrix algebra; Practical examples of multivariate data; Preliminary data analysis; Examination of a data matrix, reduction of a data matrix; definition and calculation of sample summary statistics: means, variances, covariance's, correlations; Examination and interpretation of sample correlation matrix; the multivariate normal distribution. Study of relationships (association); One-sample test of mean vector; simultaneous confidence intervals for detecting important components; test of structural relationship; Extension to two-sample tests; principal components and factor analysis as a means of reducing dimensionality: Calculation and interpretation of principal components and common factors.

Objectives

- to equip students with sound knowledge of extending the statistical ideas of univariate data analysis to that of multivariate;
- to equip them with skills of computing multivariate methods;
- to motivate them to apply the multivariate methods to solve real life problems.

Learning outcomes

At the end of the course students are expected to:

- state the basic statistical ideas of multivariate data analysis;
- use the basic multivariate statistical methods and interpret them.

Course Outline

1. Introduction

- 1.1 Introduction
- 1.2 Objectives
- 1.3 Areas of application
- 1.4 Organizing multivariate data
- 1.5 Descriptive statistics
- 1.6 Measures of linear association

2. Review of Matrix Algebra and Random Vectors

- 2.1 Basics concepts
- 2.2 Vector and matrix
- 2.3 Matrix algebra
- 2.4 Positive definite matrix
- 2.5 Square root matrix
- 2.6 Mean vectors and covariance matrices

3. Multivariate Normal Distribution

- 3.1 Multivariate normal density
- 3.2 Sampling from multivariate normal distribution
- 3.3 Maximum likelihood estimation
- 3.4 Sampling distribution of a sample multivariate mean and a covariance matrix

4. Inference about a Multivariate Mean Vector

- 4.1 Inference about a mean vector

- 4.2 Hypothesis testing
- 4.3 Hotelling's test statistic
- 4.4 Confidence regions and simultaneous comparison of components
- 4.5 Large sample inference about the mean vector

5. Comparisons of Several Multivariate Means

- 5.1 Paired comparisons and a repeated measures
- 5.2 Comparing mean vectors from two populations
- 5.3 Comparing several multivariate population means

6. Principal components and Factor analysis (8 lecture hours)

- 6.1 Population principal components
- 6.2 Summarizing sample variation by principal components
- 6.3 Large sample inferences
- 6.4 Common factors and estimation

Textbook

Johnson, R.A and Wichern, D.W. (2007). Applied Multivariate Statistical Analysis (6th Edition). Prentice-Hall, Inc., New Jersey.

References

1. Hair, J.F., Black, W.C., Babin, B.J., and Anderson, R.E. (2009). Multivariate Data Analysis (7th Edition).
2. Anderson, T.W. (2003). An Introduction to Multivariate Statistical Analysis (3rd Edition). Wiley, New York.
3. Ho, R. (2006). Handbook of Univariate and Multivariate Data Analysis and Interpretation with SPSS.
4. Montgomery, D.C. (2009). Design and Analysis of Experiments, MINITAB Manual.
5. Hair, J.F., Black, B., Babin, B. and Anderson, R.E. (2005). Multivariate Data Analysis (6th Edition).
6. Ho, R. (2006). Handbook of Univariate and Multivariate Data Analysis and Interpretation with SPSS.
7. Hair, J.F., Anderson, R.E., Tatham, R.L. and Black, W.C. (1995). Multivariate Data Analysis: With Readings.
8. Everitt, B.S. and Dunn, G. (2001). Applied Multivariate Data Analysis.
9. Grimm, L.G. and Yarnold, P.R. (1995). Reading and Understanding Multivariate Statistics.
10. Manly, B.F.J (2004). Multivariate Statistical Methods: A Primer (3rd Edition).
11. Raykov, T. and Marcoulides, G.A. (2008). An Introduction to Applied Multivariate Analysis.

Teaching and Learning Methods: Lecture, self reading, demonstration, exercises

Modes of Assessment

Continuous Assessment	50%
Final Exam	50%