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| Multivariate Statistics |
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**Academic Year: ( 2019 / 2020 )**                                    **Review date: 10-12-2019**

**Department assigned to the subject:**

**Coordinating teacher: DELGADO GOMEZ, DAVID**

**Type: Electives  ECTS Credits : 6.0**

**Year : 2 Semester : 1**

## OBJECTIVES

COMPETENCES

1. Capacity for identifying problems associated with statistical data in several variables.
2. Basic knowledge for handling vectors and matrices.
3. Acquire skills in multivariate data description.
4. Capacity for making and interpreting plots of multivariate datasets.
5. Know the properties of multivariate distributions.
6. Capacity for making hypotesis testing on a multivariate population.
7. Acquire skills in principal component analysis and factorial analysis.
8. Acquire skills in heterogeneity problems such as outlier detection, hypothesis testing for different means, classification and clustering.
9. Handle statistical software for multivariate analysis.

SKILLS
1. Aptitude to understand a real problem and to analyze it as an statistical problem.
2. Modeling and solving problems.
3. Capacity of analysis and synthesis.
4. Oral and written skills.
5. Aptitude to work in a group.

## DESCRIPTION OF CONTENTS: PROGRAMME

1. Multivariate Data
1.1 Multivariate descriptive statistics
1.2 Visualization of multivariate data
2. Principal Component Analysis
2.1 Introduction
2.2 Principal Components
2.3 Standardized Principal Components
2.4 Real Examples
3. The Multivariate Gaussian Distribution.
3.1 Introduction
3.2 Basic concepts
3.3 Parameter estimation
3.4 Hypothesis Testing
3.5 Mixture of Gaussians
4. Discriminant Analysis
4.1 Introduction
4.2 Bayes based classifiers
4.3 Linear and quadratic discriminants
4.4 Fisher linear discriminant Analysis
5. Kernel Dimensionality Reduction
5.1 Kernel PCA
5.2 Kernel FDA
6. Cluster Analysis
6.1 Introduction
6.2 Distances
6.3 Hierarchical techniques
6.4 Partition based models
7. Factor Analysis

## LEARNING ACTIVITIES AND METHODOLOGY

Theoretical classes with support material taken from the web.
Problem solving classes. Computing classes in computer halls. Oral presentations.
Individual tutorials.

## ASSESSMENT SYSTEM

Final exam: 50%
Three Projects: 50%
In order to pass the subject a 5 out of 10 must have been obtained in the final exam.

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| **% end-of-term-examination:** | 50 |
| **% of continuous assessment (assigments, laboratory, practicals…):** | 50 |

## BASIC BIBLIOGRAPHY

- Alan Julian Izenman Modern multivariate statistical techniques, Springer, 2008

- Richard A. Johnson and Dean W. Wichern Applied Multivariate Statistical Analysis, Pearson Education, 2007

## ADDITIONAL BIBLIOGRAPHY

- Dillon, W., Goldstein, M. (1984). Multivariate Analysis.,  New York, Wiley..

- Krzanowski, W.J. (1988). Principles of Multivariate Analysis: A. User's Perspective., Oxford University Press, Oxford..
- Mardia, K.V., Kent, J.T. y Bibby, J.M. (1979). Multivariate Analysis., New York, Academic Press..

- Seber, G.A.F. (1984). Multivariate Observations., New York, Wiley..