

Academic Year: (2016 / 2017)

Review date: 27/04/2016 10:49:45

Department assigned to the subject: Mathematics Department

Coordinating teacher:

Type: Compulsory ECTS Credits : 3.0

Year : 1 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

High school mathematics, preferably in the sciences option

OBJECTIVES

While there are many applied mathematics techniques and concepts that are useful (and used) in the Big Data analysis context, this course focus on the basics of those based on linear algebra and graph theory, as they underlie many of the most important applications and algorithms. Thus, the course is intended to understand the mathematical ideas behind those applications and algorithms (usually implemented in black-box software) so practitioners have a deeper knowledge of the results arising from them, allowing for a better interpretation.

DESCRIPTION OF CONTENTS: PROGRAMME

1. Introduction.
 - 1.1 Basic concepts: review of linear algebra and connection to data analysis.
 - 1.2 Norms.
 - 1.3 Conditioning.
2. Dimensional reduction
 - 2.1 Singular value decomposition.
 - 2.2 Principal component analysis.
3. Solving linear systems.
 - 3.1 Gaussian elimination and the LU factorization.
 - 3.2 Cholesky factorization.
 - 3.3 Iterative methods.
4. Basics of linear regression.
 - 4.1 Gram-Schmidt and the QR factorization.
 - 4.2 Application to least-squares problems.
5. Eigenvalue problems.
 - 5.1 The power method, the inverse power method and Rayleigh quotients.
 - 5.2 The QR method for eigenvalue computation.
6. Graph theory.
 - 6.1 Basic concepts.
 - 6.2 Types of graphs and main results and algorithms about them.
7. Introduction to complex networks.
 - 7.1 Centrality.
 - 7.2 Cluster analysis.

LEARNING ACTIVITIES AND METHODOLOGY

There will be theoretical and practical classes, with the latter being based on R. Students will be asked to solve problems on an individual basis as homework, and may be also asked to present their results to the class.

ASSESSMENT SYSTEM

% end-of-term-examination/test: 40

% of continuous assessment (assignments, laboratory, practicals...): 60

Ordinary call: Participation in class, individual assignments, final exam.

Extraordinary call: final exam.