Curricular Unit Sheet

1. Curricular Unit Syllabus.

1.1. Curricular Unit

Automatic Learning Methods - MAA

1.2. Scientific area acronym

EE

1.3. Duration

Semester

1.4. Total of Working Hours

162

1.5. Contact hours

T:22,5 TP: 22,5 PL:22,5

1.6. ECTS

6

1.7. Observations

Option 2

2. Responsible Academic staff and lecturing load in the curricular unit (enter full name)

Fernando Manuel Fernandes Melício	22,5 hours

3. Other academic staff and lecturing load in the curricular unit

Ana Alexandra Antunes Figueiredo Martins	22,5 hours
Fernando Joaquim Ganhão Pereira	22,5 hours

4. Learning outcomes of the curricular unit

After approval in the course unit, the student should have the ability to: 1. Apply data pre-processing techniques that allow its subsequent treatment and analysis. Use of analysis in main components as a method to reduce the size of the data.   2. Apply methods of exploratory data analysis to recognize the main characteristics of a multivariate data set.   3. Identify and apply the concepts of reliability theory.   4. Identify and implement a linear regression model appropriate to the analytical and computational resolution of a particular problem.   5. Analyze, evaluate and interpret critically the results of the models.

6. Identify and implement clustering analysis methods. Evaluate and interpret with critical sense, the results obtained. Analyze and characterize the identified groups.

5. Syllabus

1. Exploratory analysis and pre-processing of multivariate data

2. Introduction to reliability. Reliability function. Serial systems and parallel systems. Calculation of probabilities of failure.

3. Multiple linear regression model

4. Concept of Learning

5. Supervised and unsupervised learning

6. Multilayer neural networks

7. Data aggregation and vector quantification

8. Analysis on major components

9. Grouping analysis

6. Demonstration of the syllabus coherence with the curricular unit's objectives

The syllabus contents are in coherence with the objectives of the curricular unit, considering that:

- Points 1 and 8 of the program content aim to achieve points 1 and 2 of the objectives;
- Point 2 of the program content aims to achieve point 3 of the objectives;
- Points 3, 4, 5, 6 and 7 of the program content aim to achieve points 1,2, 4 and 5 of the objectives;
- Point 8 of the programmatic content seeks to achieve point 6 of the objectives.

7. Teaching methodologies (including evaluation)

In the theoretical classes (T) the contents of the UC are taught. Under theoretical-practical (TP) classes, practical case problems are presented and solved, aligned with the contents taught in the theoretical component. In laboratory classes (PL), the knowledge acquired is applied carrying out laboratory teamwork.

The Theoretical part (T) is presented during the semester and subject to individual evaluation by a written exam.

The examination only concerns the theoretical part and does not replace the frequency and approval in the laboratory part.

The laboratory part (L) consists of practical work with the use of specific software such as MatLab.

The final classification results from the average of the classifications obtained through $F = 0.6 * T + 0.4 * L$. It is compulsory for each part to be rated at least 9.5 on a scale of 0 - 20.

8. Demonstration of the coherence between the teaching methodologies and the learning outcomes

The teaching methodologies are in line with the objectives of the curricular unit, given that the methodology used to explain the theoretical subject, makes it possible to specifically achieve all the objectives of the curricular unit. The exemplification with concrete problems,

allows the student to understand how to apply the material used in real situations. The methodology used aims to provide knowledge to formalize a concrete problem, to choose the appropriate methods to apply and to proceed with its correct application. The resolution of exercises with the use of a specific software, allows the student to learn the real way of solving this type of problems. The evaluation methods allow to verify if the student has acquired enough knowledge to reach the objectives proposed in the curricular unit.

9. Bibliography

• Tom M. Mitchell, Machine Learning, Prentice-Hall (1999)

• Friedman, Hastie, Tibshirani , The Elements of Statistical Learning. Data Mining, Inference and Prediction. 2ª ed, Springer (2009)

• Montgomery, D. (2009). Statistical Quality Control: A Modern Introduction, 6th Edition, Wiley.

• Gujarati, D.; Porter, D., Basic Economerics, McGraw Hill (2009)

• Reis, Elizabeth (2001). Estatística Multivariada Aplicada, 2ª edição. Edições Sílabo.

• Everitt, Brian S., and Graham Dunn. Applied multivariate data analysis. Vol. 2. London: Arnold, 2001.