COURSE DATA

Data Subject	
Code	44660
Name	Data science in biomedicine
Cycle	Master's degree
ECTS Credits	6.0
Academic year	2021 - 2022

Study (s)

Degree	Center	Acad. year	Period
2221 - Master's Degree in Data Science	School of Engineering	1	Second term

Subject-matter

Degree	Subject-matter	Character
2221 - Master's Degree in Data Science	12 - Data science in biomedicine	Obligatory

Coordination

Name	Department
SERRANO LOPEZ, ANTONIO JOSE	242 - Electronic Engineering
SORIA OLIVAS, EMILIO	242 - Electronic Engineering

SUMMARY

This subjects deals with the application of Data Science to Health Sciences (Medicine, Pharmacy and Biomedicine). The analysis of –omic (genomic, proteomic, metabolomic, …) data plays a relevant role, as they have involved great progresses in personalized medicine in the last few years. The second part of the subject analyses different kinds of expert systems for diagnosis, control of processes and time series prediction.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

Students enrolled in this subject must already have taken the following subjects: Machine Learning (I and II), and Exploratory Data Analysis.

COMPETENCES (RD 1393/2007) // LEARNING OUTCOMES (RD 822/2021)

2221 - Master's Degree in Data Science

- Students should be able to integrate knowledge and address the complexity of making informed judgments based on incomplete or limited information, including reflections on the social and ethical responsibilities associated with the application of their knowledge and judgments.
- Students should communicate conclusions and underlying knowledge clearly and unambiguously to both specialized and non-specialized audiences.
- Students should demonstrate self-directed learning skills for continued academic growth.
- Students should possess and understand foundational knowledge that enables original thinking and research in the field.
- Be able to assess the need to complete their technical, scientific, language, computer, literary, ethical, social and human education, and to organise their own learning with a high degree of autonomy.
- Be able to defend criteria with rigor and arguments and to present them properly and accurately.
- Capacidad de organización y planificación de actividades de investigación, desarrollo y consultoría en el área de ciencia de datos.
- Capacidad para trabajar en equipo para llegar a soluciones de problemas interdisciplinarios usando técnicas de análisis de datos.
- Ser capaces de acceder a herramientas de información (bibliográficas y de empleo) y utilizarlas apropiadamente.
- Ser capaces de asumir la responsabilidad de su propio desarrollo profesional y de su especialización en uno o más campos de estudio, aplicando los conocimientos adquiridos en la identificación de salidas profesionales y yacimientos de empleo.
- Saber realizar las labores propias de su profesión incluyendo, entre otras, la adquisición y clasificación de datos de forma eficiente, aplicación de las técnicas de análisis de datos avanzado para llegar a la extracción de información (científica, de mercado,
  ?etc.) a partir de los mismos.
- Diseñar y poner en marcha soluciones basadas en análisis de datos en el ámbito de la medicina y de los negocios, teniendo en cuenta los requisitos específicos de este tipo de casos de uso.

LEARNING OUTCOMES (RD 1393/2007) // NO CONTENT (RD 822/2021)

Learning the peculiar characteristics of biomedical data. Knowing –omic (proteomic, genomic and metabolic) data. Being aware of applications of data science in biomedicine. Applying already-known methods in biomedical problems. Extracting knowledge from databases in biomedicine. Implementing expert systems that are applied in biomedicine.

DESCRIPTION OF CONTENTS

1. Data-driven models and algorithms for clinical decision problems

The models and algorithms described in the subject are chosen for their suitability to solve clinical decision problems, thus becoming to the remainder of the master.

2. Acquisition, processing and analysis of omic data

-Omic data are described and characterized in comparison to classical data.

3. E-health

Description of applications of new technologies in Health information (E-health).

4. Expert systems in Healthcare.

Description of the usefulness of expert systems in Healthcare, highlighting their personal, social and economic advantages.

5. Expert systems for diagnosis.

Expert systems used for clinical diagnosis. Historic examples are given as well as the forecast for next years.

6. Predictive models in Healthcare.

Analysis of predictive expert systems applied to Healthcare. Examples from the fields of Pharmacokinetics and Pharmacodynamics.

7. Control systems in Healthcare. Solution of real cases.

Expert systems for the solution of optimization problems in Healthcare. Examples of problems related to administration of drugs.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theoretical and practical classes	60,00	100
Development of individual work	20,00	0
Study and independent work	12,00	0
Readings supplementary material	3,00	0
Preparation of evaluation activities	12,00	0
Preparing lectures	15,00	0
Preparation of practical classes and problem	13,00	0
Resolution of case studies	15,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

Theoretical activities. Interactive lectures about the subject with the participation of the student in the resolution of specific issues. Conducting individual evaluation questionnaires.

Work in laboratory and / or in computer room. Learning by performing activities individually or in small groups and conducted in computer rooms.

EVALUATION

The educational evaluation of knowledge and skills achieved by the students will be made continuously throughout the course, and will consist of the following blocks of evaluation:

1. Exercises and class works submitted during the course and/or partial exams: 80% of the final grade.
2. Final exam: 20% of the final grade.

REFERENCES

Basic

- Machine Learning and AI for Healthcare: Big Data for Improved Health Outcomes Arjun Panesar. Apress, 2019.
- Analytics in Healthcare : A Practical Introduction, Christo El Morr, Hossam Ali-Hassan, Springer 2019.
- Bioinformatics, Pierre Baldi, MIT Press, 2001.
- Bioinformatics with R cookbook : over 90 practical recipes for computational biologists to model and handle real-life data using R. Paurush Praveen Sinha, Packt Publishing, 2014
- Machine Learning and AI for Healthcare: Big Data for Improved Health Outcomes, jun Panesar, Apress, 2019

Additional

- Data-driven healthcare : how analytics and BI are transforming the industry, Laura Madsen, Wiley, 2014
- Bioinformatics : an introduction, Jeremy J. Ramsden, Springer 2015
- Algorithmic and AI methods for protein bioinformatics / edited by Yi Pan, Jianxin Wang, Min Li Martin McCarthy, Wiley, 2014

ADDENDUM COVID-19

This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council

English version is not available