BASIC DETAILS:

Subject:	SISTEMAS INTELIGENTES		
Id.:	33381		
Programme:	DOBLE GRADO EN FARMACIA Y BIOINFORMÁTICA. PLAN 2018		
Module:	BIOINFORMÁTICA		
Subject type:	OBLIGATORIA		
Year:	2	**Teaching period:**	Segundo Cuatrimestre
Credits:	6	**Total hours:**	150
Classroom activities:	65	**Individual study:**	85
Main teaching language:	Inglés	**Secondary teaching language:**	Castellano
Lecturer:	MONASTERIO BAZAN, VIOLETA (T)	**Email:**	vmonasterio@usj.es

PRESENTATION:

This course provides an introduction on artificial intelligence techniques for bioinformatics. It gives an overview of basic concepts, techniques and algorithms in machine learning, knowledge representation and reasoning, and planning. The course will draw from numerous case studies and applications, so that students will learn how to apply these techniques to relevant bioinformatics problems.

PROFESSIONAL COMPETENCES ACQUIRED IN THE SUBJECT:

General programme competences	G01	Use learning strategies autonomously for their application in the continuous improvement of professional practice.
	G02	Perform the analysis and synthesis of problems of their professional activity and apply them in similar environments.
	G03	Cooperate to achieve common results through teamwork in a context of integration, collaboration and empowerment of critical discussion.
	G04	Reason critically based on information, data and lines of action and their application on relevant issues of a social, scientific or ethical nature.
	G05	Communicate professional topics in Spanish and / or English both orally and in writing.
	G06	Solve complex or unforeseen problems that arise during the professional activity within any type of organisation and adapt to the needs and demands of their professional environment.
	G07	Choose between different complex models of knowledge to solve problems.
	G09	Apply information and communication technologies in the professional field.
	G10	Apply creativity, independence of thought, self-criticism and autonomy in the professional practice.
Specific programme competences	E02	Develop the use and programming of computers, databases and computer programs and their application in bioinformatics.
	E03	Apply the fundamental concepts of mathematics, logic, algorithmics and computational complexity to solve problems specific to bioinformatics.
	E04	Program applications in a robust, correct, and efficient way, choosing the paradigm and the most appropriate programming languages, applying knowledge about basic algorithmic procedures and using the most appropriate types and data structures.
	E05	Implement well-founded applications, previously designed and analysed, in the characteristics of the databases.
	E06	Apply the fundamental principles and basic techniques of intelligent systems and their practical application in the field of bioinformatics.
	E07	Apply the principles, methodologies and life cycles of software engineering to the development of a project in the field of bioinformatics.
	E12	Apply the principles and techniques of protein computational modelling to predict their biological function, their activity or new therapeutic targets (Structural Bioinformatics, Computational Toxicology).
	E13	Apply omics technologies for the extraction of statistically significant information and for the creation of relational databases of biodata that can be updated and publicly accessible to the scientific community.
	E14	Use programming languages, most commonly used in the field of Life Sciences, to develop and evaluate techniques and/ or computational tools.
	E15	Infer the evolutionary history of genes and proteins through the creation and interpretation of phylogenetic trees.
	E16	Plan linkage and association studies for medical and environmental purposes.

	E17	Induce complex relationships between samples by applying statistical and classification techniques.
	E18	Apply statistical and computational methods to solve problems in the fields of molecular biology, genomics, medical research and population genetics.
	E21	Apply computational and data processing techniques for the integration of physical, chemical and biological concepts and data for the description and/ or prediction of the activity of a substance in a given context.

PRE-REQUISITES:

This course will be delivered in English. Academic reading and writing skills are expected from students. Also, theory will be complemented with programming examples, so students should be able to understand and write code in R or Python.

SUBJECT PROGRAMME:

Subject contents:

1 - What is artificial intelligence?
2 - Introduction to machine learning
3 - Supervised learning
3.1 - K Nearest Neighbors
3.2 - Naive Bayes
3.3 - Neural Networks
3.4 - Support Vector Machines
3.5 - Classification Trees
4 - Performance and meta-learning
4.1 - Evaluating performance
4.2 - Improving performance
5 - Unsupervised learning
6 - Knowledge representation and reasoning
7 - Planning

Subject planning could be modified due unforeseen circumstances (group performance, availability of resources, changes to academic calendar etc.) and should not, therefore, be considered to be definitive.

TEACHING AND LEARNING METHODOLOGIES AND ACTIVITIES:

Teaching and learning methodologies and activities applied:

Class sessions: during this course a variety of teaching methods will be used including lectures, exercises and laboratory sessions. It is important that students participate actively in class, either in the classroom or through the online platform.

- Theoretical explanations and lectures will be held on Mondays. The contents of Monday sessions will be mada available online, so that students can attend virtually or can work through the materials at their own pace.

  Attendance on Mondays is **optional**.

- Practical activities and programming labs will be held on Thursdays. Attendance on Thursdays is **mandatory**.

Tutorials: During these sessions, students can ask questions, clarify concepts, ask for additional feedback or bibliography either face to face or electronically.

Independent Study: Students are expected to complete all independent study tasks, which will be uploaded on the PDU regularly. Students are required to upload their completed tasks on the PDU before the deadline. It is therefore important that students check the PDU every week. All tasks must be completed in English.

Student work load:

Teaching mode	Teaching methods	Estimated hours
Classroom activities	Master classes	28
	Practical exercises	6
	Practical work, exercises, problem-solving etc.	10
	Coursework presentations	2
	Workshops	7
	Laboratory practice	4
	Other practical activities	4
	Assessment activities	4
Individual study	Tutorials	5
	Individual study	27
	Individual coursework preparation	31
	Research work	2
	Compulsory reading	10
	Portfolio	10
	Total hours:	150

ASSESSMENT SCHEME:

Calculation of final mark:

Final exam:	45	%
Lab coursework:	45	%
Tests:	10	%
TOTAL	100	%

*Las observaciones específicas sobre el sistema de evaluación serán comunicadas por escrito a los alumnos al inicio de la materia.

BIBLIOGRAPHY AND DOCUMENTATION:

Basic bibliography:

RUSSELL, Stuart J.; NORVIG, Peter. Artificial intelligence: a modern approach. Pearson Education Limited, 2016.
LANTZ, Brett. Machine learning with R. Packt Publishing Ltd, 2019.

Recommended bibliography:

Recommended websites: