



POLITÉCNICA

INTERNATIONAL
CAMPUS OF
EXCELLENCE

COORDINATION PROCESS OF
LEARNING ACTIVITIES
PR/CL/001



E.T.S. de Ingenieros
Informáticos

ANX-PR/CL/001-01

LEARNING GUIDE

SUBJECT

103000371 - Biomedical Informatics

DEGREE PROGRAMME

10AJ - Master Universitario en Inteligencia Artificial

ACADEMIC YEAR & SEMESTER

2020/21 - Semester 1

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1. Description

1.1. Subject details

Name of the subject	103000371 - Biomedical Informatics
No of credits	5 ECTS
Type	Optional
Academic year of the programme	First year
Semester of tuition	Semester 1
Tuition period	September-January
Tuition languages	English
Degree programme	10AJ - Master Universitario en Inteligencia Artificial
Centre	10 - Escuela Técnica Superior de Ingenieros Informáticos
Academic year	2020-21

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Miguel Garcia Remesal	2206	miguel.garcia.remesal@upm.es	Tu - 11:00 - 14:00 Th - 11:00 - 14:00
Victor Manuel Maojo Garcia (Subject coordinator)	2102	victormanuel.maojo@upm.es	Tu - 12:30 - 15:30 W - 12:30 - 15:30
David Perez Del Rey	2104	david.perez.rey@upm.es	Sin horario.

* The tutoring schedule is indicative and subject to possible changes. Please check tutoring times with the faculty member in charge.

3. Prior knowledge recommended to take the subject

3.1. Recommended (passed) subjects

The subject - recommended (passed), are not defined.

3.2. Other recommended learning outcomes

- Artificial Intelligence

4. Skills and learning outcomes *

4.1. Skills to be learned

CEIA1 - Capacidad de integrar tecnologías y sistemas propios de la Inteligencia Artificial, con carácter generalista, y en contextos más amplios y multidisciplinares

CEIA2 - Capacidad de conectar la tecnología puntera en Inteligencia Artificial con las necesidades de los clientes

CEIA9 - Comprensión del mercado, sus hábitos y necesidades de productos o servicios en el ámbito de la Inteligencia Artificial.

CG11 - Integración del conocimiento a partir de disciplinas diferentes, así como el manejo de la complejidad.

CG12 - Comprensión amplia de las técnicas y métodos aplicables en una especialización concreta, así como de sus límites.

CG8 - Planteamiento y resolución de problemas también en áreas nuevas y emergentes de su disciplina

CG9 - Aplicación de los métodos de resolución de problemas más recientes o innovadores y que puedan implicar el uso de otras disciplinas.

CG11 - Adquirir conocimientos científicos avanzados del campo de la informática que le permitan generar nuevas ideas dentro de una línea de investigación.

CG13 - Capacidad para valorar la importancia de las fuentes documentales, manejarlas y buscar la información para el desarrollo de cualquier trabajo de investigación.

CG14 - Capacidad de leer y comprender publicaciones dentro de su ámbito de estudio/investigación, así como su catalogación y valor científico.

CG15 - Que el estudiante adquiera el conocimiento necesario sobre los mecanismos de financiación de la investigación y transferencia de la tecnología, y sobre la legislación vigente sobre protección de resultados

4.2. Learning outcomes

RA85 - Once the aforementioned points have been understood, students should be able to successfully apply them to the analysis and solution of problems with a complexity proportional to their level of experience

RA86 - To be able to use the terminology appropriately and perform public presentations on the topics of the module

RA84 - To be able to analyse the state of the art in a given subject, understanding what the main achievements and challenges are, and draw conclusions for one's own work

RA83 - To be able to analyse and solve biomedical informatics problems

* The Learning Guides should reflect the Skills and Learning Outcomes in the same way as indicated in the Degree Verification Memory. For this reason, they have not been translated into English and appear in Spanish.

5. Brief description of the subject and syllabus

5.1. Brief description of the subject

An often-cited definition of the area has been proposed by Ted Shortliffe: The rapidly developing scientific field that deals with the storage, retrieval, and optimal use of biomedical information, data, and knowledge for problem solving and decision making. It accordingly touches on all basic and applied fields in biomedical science and is closely tied to modern information technologies, notably in the areas of computing and communications. Many areas have been established, including topics such as decision support systems, electronic health records, hospital information systems, data and text mining, information retrieval, bibliographic systems, medical imaging, etc. Over the last 20 years, new areas have been introduced, such as merging medical informatics with bioinformatics, into what is called biomedical informatics. Then, areas such as translational bioinformatics have emerged. Fundamental new topics include precision medicine, Web-based applications, the introduction of social networks, biomedical ontologies, semantic interoperability, Big Data research and others. We emphasize topics of biomedical informatics related to artificial Intelligence, such as ontologies, machine learning, text mining or knowledge-based systems.

5.2. Syllabus

1. Introduction

- 1.1. Biomedical informatics: the concept.
- 1.2. Historical analysis of biomedical informatics development since the 50s.
- 1.3. Differences among areas (Medical Informatics, Bioinformatics, Biomedical Engineering and Biotechnology).
- 1.4. Future trends

2. Data Management in Biomedicine

- 2.1. Data, information and knowledge.
- 2.2. Types of data in biomedicine
- 2.3. Acquisition, storage and management of data

3. Artificial Intelligence in Biomedicine

- 3.1. Medical reasoning methods.
- 3.2. Information extraction. Data and text mining
 - 3.2.1. Information retrieval

3.2.2. Database integration

3.3. Advanced decision support systems

4. Medical Information Systems

4.1. Electronic Health records; concept and clinical contents

4.2. Electronic Health Records: models and tools.

4.3. Hospital Information Systems

5. Vocabularies and Standards

5.1. Medical vocabularies and terminologies.

5.2. Models and standards.

5.3. Ontologies

6. Internet and Medicine

6. Schedule

6.1. Subject schedule*

Week	Face-to-face classroom activities	Face-to-face laboratory activities	Distant / On-line	Assessment activities
1	Introduction to biomedical informatics Duration: 02:00 Lecture		Es posible que las clases se realicen mediante teleenseñanza según evolución de la pandemia Duration: 00:00 Lecture	Participation in teaching activities, in class and on-line Individual work Continuous assessment Not Presential Duration: 00:00
2	Data, information and knowledge in biomedicine Duration: 02:00 Lecture		Es posible que las clases se realicen mediante teleenseñanza según evolución de la pandemia Duration: 00:00 Lecture	Participation in teaching activities, in class and on-line Individual work Continuous assessment Not Presential Duration: 00:00
3	Artificial Intelligence in medicine: medical reasoning and diagnosis Duration: 02:00 Lecture		Es posible que las clases se realicen mediante teleenseñanza según evolución de la pandemia Duration: 00:00 Lecture	Participation in teaching activities, in class and on-line Individual work Continuous assessment Not Presential Duration: 00:00
4	Artificial Intelligence in medicine: expert systems Duration: 02:00 Lecture		Es posible que las clases se realicen mediante teleenseñanza según evolución de la pandemia Duration: 00:00 Lecture	Participation in teaching activities, in class and on-line Individual work Continuous assessment Presential Duration: 00:00
5	Artificial intelligence in medicine: text mining and Natural Language Processing Duration: 02:00 Lecture		Es posible que las clases se realicen mediante teleenseñanza según evolución de la pandemia Duration: 00:00 Lecture	Participation in teaching activities, in class and on-line Individual work Continuous assessment Not Presential Duration: 00:00
6	Artificial intelligence in medicine: text mining and Natural Language Processing (II) Duration: 02:00 Lecture		Es posible que las clases se realicen mediante teleenseñanza según evolución de la pandemia Duration: 00:00 Lecture	Participation in teaching activities, in class and on-line Individual work Continuous assessment Presential Duration: 00:00
7	Biomedical Vocabularies and ontologies (I) Duration: 02:00 Lecture		Es posible que las clases se realicen mediante teleenseñanza según evolución de la pandemia Duration: 00:00 Lecture	Participation in teaching activities, in class and on-line Individual work Continuous assessment Not Presential Duration: 00:00

8	Biomedical vocabularies and ontologies (II) Duration: 02:00 Additional activities		Es posible que las clases se realicen mediante teleenseñanza según evolución de la pandemia Duration: 00:00 Lecture	Presentation of assignment Individual presentation Continuous assessment Not Presential Duration: 00:00
9	Electronic Health Records Duration: 02:00 Lecture		Es posible que las clases se realicen mediante teleenseñanza según evolución de la pandemia Duration: 00:00 Lecture	Participation in teaching activities, in class and on-line Individual work Continuous assessment Not Presential Duration: 00:00
10	Database integration and semantic interoperability Duration: 02:00 Lecture		Es posible que las clases se realicen mediante teleenseñanza según evolución de la pandemia Duration: 00:00 Lecture	Participation in teaching activities, in class and on-line Individual work Continuous assessment Not Presential Duration: 00:00
11	Artificial Intelligence in medicine: Big data and machine learning (I) Duration: 02:00 Lecture		Es posible que las clases se realicen mediante teleenseñanza según evolución de la pandemia Duration: 00:00 Lecture	Participation in teaching activities, in class and on-line Individual work Continuous assessment Not Presential Duration: 00:00
12	Artificial Intelligence in Medicine: Big data and machine learning (II) Duration: 02:00 Lecture		Es posible que las clases se realicen mediante teleenseñanza según evolución de la pandemia Duration: 00:00 Lecture	Participation in teaching activities, in class and on-line Individual work Continuous assessment Not Presential Duration: 00:00
13	Biomedical standards (I) Duration: 02:00 Lecture		Es posible que las clases se realicen mediante teleenseñanza según evolución de la pandemia Duration: 00:00 Lecture	Participation in teaching activities, in class and on-line Individual work Continuous assessment Not Presential Duration: 00:00
14	Biomedical standards (II) Duration: 02:00 Lecture		Es posible que las clases se realicen mediante teleenseñanza según evolución de la pandemia Duration: 00:00 Lecture	Participation in teaching activities, in class and on-line Individual work Continuous assessment Not Presential Duration: 00:00
15	Final summary Duration: 02:00 Additional activities		Es posible que las clases se realicen mediante teleenseñanza según evolución de la pandemia Duration: 00:00 Lecture	Presentation of a classwork assignment Individual presentation Continuous assessment Not Presential Duration: 00:00
16				
17				Final examination (if the student was not able to complete the course assignments due to some justified reason). Written test Final examination Not Presential Duration: 02:00

Depending on the programme study plan, total values will be calculated according to the ECTS credit unit as 26/27 hours of student face-to-face contact and independent study time.

* The schedule is based on an a priori planning of the subject; it might be modified during the academic year,

especially considering the COVID19 evolution.

7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Continuous assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
1	Participation in teaching activities, in class and on-line	Individual work	No Presential	00:00	%	/ 10	CG11
2	Participation in teaching activities, in class and on-line	Individual work	No Presential	00:00	%	/ 10	
3	Participation in teaching activities, in class and on-line	Individual work	No Presential	00:00	%	/ 10	
4	Participation in teaching activities, in class and on-line	Individual work	Face-to-face	00:00	%	/ 10	
5	Participation in teaching activities, in class and on-line	Individual work	No Presential	00:00	%	/ 10	
6	Participation in teaching activities, in class and on-line	Individual work	Face-to-face	00:00	%	/ 10	
7	Participation in teaching activities, in class and on-line	Individual work	No Presential	00:00	%	/ 10	
8	Presentation of assignment	Individual presentation	No Presential	00:00	50%	5 / 10	CG11 CGI1 CGI3 CGI4 CG8 CG9 CEIA2 CEIA9 CG12 CGI5 CEIA1
9	Participation in teaching activities, in class and on-line	Individual work	No Presential	00:00	%	/ 10	
10	Participation in teaching activities, in class and on-line	Individual work	No Presential	00:00	%	/ 10	
11	Participation in teaching activities, in class and on-line	Individual work	No Presential	00:00	%	/ 10	
12	Participation in teaching activities, in class and on-line	Individual work	No Presential	00:00	%	/ 10	

13	Participation in teaching activities, in class and on-line	Individual work	No Presential	00:00	%	/ 10	
14	Participation in teaching activities, in class and on-line	Individual work	No Presential	00:00	%	/ 10	
15	Presentation of a classwork assignment	Individual presentation	No Presential	00:00	50%	5 / 10	CGI3 CGI4 CG11 CG11 CG8 CG9 CEIA2 CEIA9 CG12 CG15 CEIA1

7.1.2. Final examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
17	Final examination (if the student was not able to complete the course assignments due to some justified reason).	Written test	No Presential	02:00	100%	5 / 10	CGI3 CGI4 CG8 CG9 CEIA2 CEIA9 CG12 CG15 CEIA1 CG11 CG11

7.1.3. Referred (re-sit) examination

No se ha definido la evaluación extraordinaria.

7.2. Assessment criteria

Se presentarán cuatro trabajos dentro del calendario de la asignatura

8. Teaching resources

8.1. Teaching resources for the subject

Name	Type	Notes
Belmonte, M., Coltell, O., Maojo, V., Mateu, J and Sanz, F. (Eds). Manual de Informática Médica. Decembre de 2003. M.R.A.	Bibliography	
de la Calle, G., García-Remesal, M., Chiesa, S., de la Iglesia, D., and Maojo, V. ?BIRI: a new approach for automatically discovering and indexing available public bioinformatics resources from the literature?. BMC Bioinformatics. 2009 Oct 7; 10:320.	Bibliography	
Bernstam, E.V., Smith, J.W., and Johnson, T.R. ?What is biomedical informatics?? J Biomed Inform. 2010 Feb;43 (1):104-10.	Bibliography	
Greenes, R.A. (ed). (2014) Clinical Decision Support: The Road Ahead. Springer	Bibliography	
Shortiffe, E.H. and Cimino, J. (2013) Medical Informatics. Computer Applications in Health Care. 4th Edition. New York: Springer Verlag.	Bibliography	

Revistas libres: JAMIA; JBI; IJMI	Bibliography	
Dispositivos para teleenseñanza (ordenador, tablet, móvil)	Equipment	Para teleenseñanza si es necesario por la pandemia de coronavirus

9. Other information

9.1. Other information about the subject

The attendance to the course is required and the student will be required to sign everyday