VNIVERSITAT DE VALÈNCIA

Course Guide
36440 Health data analytics

COURSE DATA

Data Subject	
Code	36440
Name	Health data analytics
Cycle	Grade
ECTS Credits	4.5
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. year	Period
1406 - Degree in Data Science	School of Engineering	4	First term

Subject-matter

Degree	Subject-matter	Character
1406 - Degree in Data Science	17 - Health Data Analytics	Optional

Coordination

Name	Department
CIBRIAN ORTIZ DE ANDA, ROSA MARIA	190 - Physiology
SERRANO LOPEZ, ANTONIO JOSE	242 - Electronic Engineering
VILA FRANCES, JOAN	242 - Electronic Engineering

SUMMARY

Data Analytics in Health is an optional subject in the first four-month period of the fourth year of the Degree in Data Science with a course load of 4.5 ECTS credits. The aim of the subject is to give value to the knowledge acquired throughout the degree and apply it to a field as important and transcendent for people as health. The approach is eminently practical and oriented towards demonstrating the capabilities of machine learning in supporting the decisions faced by clinical professionals and in the exploitation of the enormous amount of information that is collected in hospitals, pharmaceutical companies and biomedical research centres. We will complement the theoretical and practical laboratory classes with visits to hospitals and data centres and talks by specialists in the field of health.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

OUTCOMES

1406 - Degree in Data Science

- (CG05) Analysis and synthesis capability in the preparation of reports and in the defence of ideas.
- (CG07) Ability to autonomously make decisions and to properly and originally elaborate reasoned arguments, in order to obtain reasonable and contrastable hypotheses.
- (CT01) To be able to access (bibliographical) information tools and appropriately use them in the development of their daily tasks.
- (CT02) To be able to complete technical, scientific, social and human training in general, and to organise self-learning with a high degree of autonomy.
- (CE03) Ability to solve classification, modelling, segmentation and prediction problems from a set of data.
- (CE12) Ability to design and start solutions based on data analysis in the field of medicine and business, taking into account the specific requirements of this type of use cases.
- (CB3) Students must have the ability to gather and interpret relevant data (usually in their field of study) to make judgements that take relevant social, scientific or ethical issues into consideration.
- (CB4) Students must be able to communicate information, ideas, problems and solutions to both expert and lay audiences.

LEARNING OUTCOMES

Know how to manage/optimise hospital resources based on data.
Know the special characteristics of medical images/signals.
Know the basics of a clinical decision support system.
Know how to implement a reinforcement learning system in the clinic.

DESCRIPTION OF CONTENTS

1. 1. Data Analytics in Health

1.1. Data-driven knowledge
1.2. Types of data in health
1.3. Most common problems
1.4. Machine Learning Approach
1.5. Interpretability of models

2. Clinical information systems

2.1. Digital Health Record (EHR)
2.2. Hospital Information Systems (HIS)
2.3. medical image storage system (PACS)

3. Clinical decision support system

3.1. Characteristics of a CDSS
3.2. Action protocols. Rule-based systems
3.3. Public health information and surveillance systems
3.4. Influence diagrams to optimise decisions
3.5. Visit to a hospital data centre.

4. Biomedical time series modelling

4.1. Biomedical signals EOG, ECG, EMG, EEG
4.2. Biomedical signal analysis
4.3. Pharmacokinetics and pharmacodynamics

5. Imaging systems for medical diagnosis

5.1. Imaging methods in medical diagnostics
5.2. Medical equipment in Digital Radiography
5.3. Quality control methods for different imaging techniques
5.4. Information systems in the hospital environment: Data analysis and processing. DICOM standard
5.5. Visit to the Department of Physiology/Medicine and the University Clinical Hospital.

6. Optimisation of resources

6.1. Improvement of hospital resources
6.2. Long-term optimisation

7. Laboratory practices

7.1. Clinical decision support systems.
7.2. Biomedical signal processing.
7.3. Drug level prediction.
7.4. Medical image processing.
7.5. Dose optimisation with reinforced learning.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	26,00	100
Laboratory practices	15,00	100
Classroom practices	4,00	100
Attendance at events and external activities	4,00	0
Development of individual work	12,00	0
Study and independent work	12,00	0
Readings supplementary material	6,00	0
Preparation of evaluation activities	6,00	0
Preparation of practical classes and problem	11,50	0
Resolution of case studies	10,00	0
Resolution of online questionnaires	6,00	0
TOTAL	**112,50**	

TEACHING METHODOLOGY

MD1 - Theoretical activities. Expository development of the subject with the participation of the student in the resolution of specific questions. Individual evaluation questionnaires.
MD2 - Practical activities. Learning by solving problems, exercises and case studies through which competences on the different aspects of the subject are acquired.
MD3 - Transversal competences. Visits to companies, attendance to courses, conferences, round tables and other types of activities organised and/or proposed by the CAT of the Degree.
MD4 - Laboratory and/or computer lab work. Learning through activities developed individually or in small groups and carried out in laboratories and/or computer rooms.

EVALUATION

SE2 - Assessment of practical activities based on the preparation of assignments and/or oral presentations. This section of the evaluation will count for 60% of the final grade of the subject. (CG5, CG7, CB3, CB4, CT1, CT2, CE3, CE12).
SE3 - - Continuous assessment of each student, based on the participation and degree of involvement of the student in the teaching-learning process, taking into account regular attendance at the scheduled classroom activities and the resolution of questions and problems proposed periodically. This section of the evaluation will count for 40% of the final grade of the course and is not recoverable (CG5, CG7, CB3, CB4, CT1, CT2, CE3, CE12).

Particular considerations about the evaluation:
- There will NOT be an exam at the end of the course on theoretical and practical issues (SE1).
- The final grade of the course will be calculated as the weighted average of the 2 sections (SE2, SE3), and the difficulty and workload of the activities will be taken into consideration.
- The evaluation criteria are the same in both calls.
- There are no sections that require a minimum mark.
In any case, the evaluation system will be governed by the one established by the Regulation of Evaluation and Grading of the University of Valencia for Degrees and Masters: (https://webges.uv.es/uvtaeweb/muestrainformacionedictopublicofrontaction.do?accion=inicio&idedictoseleccionado=5639).

REFERENCES

Basic

- Sörnmo, Leif, and Pablo Laguna. Bioelectrical Signal Processing in Cardiac and Neurological Application Technology, 2005.
https://trobes.uv.es/permalink/34CVA_UV/1093lvl/cdi_swepub_primary_oai_lup_lub_lu_se_ed8d618d_c1d3_4f0
- El Morr, Christo., and Hossam. Ali-Hassan. Analytics in Healthcare [electronic Resource]: A Practical Introduction / by Christo El Morr, Hossam Ali-Hassan. 1st ed. 2019., Springer International Publishing, 2019.
https://trobes.uv.es/permalink/34CVA_UV/um6gse/alma991009390126806258
- Cleophas, Ton J., and Aeilko H. Zwinderman. Machine Learning in Medicine - a Complete Overview. Springer International Publishing AG, 2020.
https://trobes.uv.es/permalink/34CVA_UV/1093lvl/cdi_askewsholts_vlebooks_9783030339708
- Medicina Nuclear. Los requisitos. 3ª Edición
Harvey A. Ziessman; Janis P. OMalley; James H. Thrall.
Editado por: Mosby/Doyma, Elsevier Publicado el: 5 Mayo 2007
- Fundamentos de Física para Profesionales de la Salud. Capitulos 9, 10 y 11
Alberto Nájera López; Enrique Arribas Garde; Juan de Dios Navarro López; Lydia Jiménez Díaz
Editado por Elsevier. Publicado el: 09/2014

Additional

- Kulkarni, Anand J., et al. Big Data Analytics in Healthcare [electronic Resource] / Edited by Anand J. Kulkarni, Patrick Siarry, Pramod Kumar Singh, Ajith Abraham, Mengjie Zhang, Albert Zomaya, Fazle Baki. 1st ed. 2020., Springer International Publishing, 2020, doi:10.1007/978-3-030-31672-3. https://trobes.uv.es/permalink/34CVA_UV/um6gse/alma991009409418506258
- Lee, Kun Chang. Data Analytics in Biomedical Engineering and Healthcare / Edited by Kun Chang Lee [and Three Others]. Academic Press, 2021. https://trobes.uv.es/permalink/34CVA_UV/um6gse/alma991009483873006258
- Dey, Nilanjan, and Nilanjan Dey. Big Data Analytics for Intelligent Healthcare Management [e-Book] / Volume Editors, Nilanjan Dey [and Three Others]. First edition., Academic Press, 2019. https://trobes.uv.es/permalink/34CVA_UV/um6gse/alma991009483801406258