Universitat Autònoma de Barcelona

2018/2019

Smart Data Acquisition and Analysis

Code: 44023
ECTS Credits: 6

Degree	Type	Year	Semester
4316624 Internet of Things for e-Health	OB	0	1

Contact

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Use of languages

Principal working language: english (eng)

Teachers

Katerine Diaz Chito

Aura Hernández Sabaté

External teachers

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Prerequisites

Knowledge of programming languages (prefearably C++, Python or Matlab) and good mathematical background is highly recommended

Objectives and Contextualisation

This module will provide students with the techniques and algorithms necessary to extract and analyse patient data that have relevance in the field of EHealth. On the one hand, you will be provided with image and video processing algorithms to obtain information on the anatomy and physiology of the relevant patient from the point of view of the health application. We will explain the methods of artificial intelligence necessary for the analysis of patterns and decision making in the field of EHealth. Finally, an introduction to statistical methods of comparison of populations necessary for the validation of algorithms and methodologies will be made.

Skills

- Analyse and model phenomena with data, graphics and complex images in the context of IoT in the area of health using techniques of probability, statistics and artificial intelligence.
- Apply the ethical rules applicable in the health sector.
- Communicate and justify conclusions clearly and unambiguously to both specialist and non-specialist audiences.
- Continue the learning process, to a large extent autonomously.
- Solve problems in new or little-known situations within broader (or multidisciplinary) contexts related to the field of study.
- Solves problems of health and health services which require elements of the value chain of the IoT using specific concepts and technologies.

- Understand, analyse and evaluate theories, results and developments in the language of reference (English) as well as the mother tongue (Catalan, Spanish) in the area of IoT in health.

Learning outcomes

1. Apply anonymisation techniques to sensitive patient data in order to protect their privacy.
2. Communicate and justify conclusions clearly and unambiguously to both specialist and non-specialist audiences.
3. Continue the learning process, to a large extent autonomously.
4. Correctly interpret the result of a test or statistical model for the population analysis of experimental data or algorithm validation.
5. Define the best mixed regression model for the statistical analysis of data and algorithm validation in the area of health.
6. Implement and evaluate IoT data-processing techniques: filtering and pre-processing of sensor signals, image processing and medical and video scanners.
7. Solve problems in new or little-known situations within broader (or multidisciplinary) contexts related to the field of study.
8. Understand, analyse and evaluate theories, results and developments in the language of reference (English) as well as the mother tongue (Catalan, Spanish) in the area of IoT in health.

Content

• Filtering and pre-processing of sensor signals
• Medical image processing and scanner techniques

• Video processing techniques
• Estimation of parameters and confidence intervals

• Simple and multiple hypothesis Test

• Supervised learning and unsupervised learning
• Neural networks and deep learning

Methodology

We will follow a problem based methodology, so learning will we based on the solution of usage cases related to real applications in the field of Iot. Students will be provided with the basic materials and tools required to solve each usage case. Teachers will also give some explanations at some lectures in order that students can understand usage cases and the provided tools. The remainining lectures will focus on helping students to solve the proposed usage cases and extending explanations related to techniques.

Activities

Title	Hours	ECTS	Learning outcomes
Type: Directed			
Lecture Sessions	50	2	1, 4, 5, 6
Type: Supervised			
Tutorized classroom activities (resolution of usage cases)	92	3.68	1, 3, 4, 5, 6, 7, 8

Evaluation

Resolution of Usage Cases. Following a PBL methodology, students will solve some usage cases in groups and with the help of the teacher (who will take the role of expert) during the course.

Individual Tests. Students' capability to apply the techniques will be also evaluated individually.

Evaluation activities

Title	Weighting	Hours	ECTS	Learning outcomes
Individual Tests	up to 50%	2	0.08	1, 4, 5, 6
Resolution of Usage Cases (Project)	up to 50%	6	0.24	1, 2, 3, 4, 5, 6, 7, 8

Bibliography

Richard O. Duda, Peter E. Hart, David G. Stork, Pattern classification, Wiley, 2001

Steel, R. and Torrie, J. H. (1976), Introduction to Statistics -McGraw-Hill

Fisher, R.A. (1925), Statistical Methods for Research Workers - Edinburgh: Oliver & Boyd.

Curs online (MOOC Coursera): Image and video processing: From Mars to Hollywood with a stop at the hospital. (https://www.coursera.org/course/images)

Curs online (MOOC Coursera): Machine Learning. (https://es.coursera.org/learn/machine-learning)

Bruce Eckel, Thinking in PYTHON (on line at http://www.bruceeckel.com).

Paul Suetens, Fundamentals of medical imaging

David A. Forsyth and Jean Ponce, Computer Vision: A Modern Approach (2nd Edition), Prentice Hall 2011