



Innovation BIONd your Imagination!

Lecturer

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Background: Telecommunications Engineering and Medicine

Specialization: Head of Experimental Medicine and Surgery Service, Lecturer, Director Innovation Support Unit, Senior Scientist

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Lecturer

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Lecturer

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Lecturer

Name: Angel Hernández Bravo

Background: Informatics' Engineering

Specialization: IBM CTO Security and Defense, Executive Architect, Office of the CTO Europe SWG, Vice Chairman TEC SPGI, IEEE Working Group ICT.

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Lecturer

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Lecturer

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Specialization: Cardiology Imaging
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Lecturer

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Lecturer

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Lecturer

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Lecturer

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Lecturer

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Lecturer

Name: Jorge Méndez

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Lecturer

Name: Angel Navarro

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Specialization: Cardiology

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Course Description

Title: Innovation BIONd your Imagination!

Fields of activity: Tutorials, Laboratories, Lectures, Workshops, Field Work, Company Visits, Other method (Round Table)

Examination type: Project or Practical Work (presentations)

Number of ECTS credits issued: none

Learning Goals and Objective: In this course students will learn the basics concepts about biomedical imaging, all their applications, and the improvements that are being done in this area and the impact is going to have in our day to day.

Students will learn about new technologies and media within the present paradigm for healthcare. Understanding the main concepts about molecular imaging, main medical imaging modalities and their multimodal information, cognitive imaging, cardiovascular imaging, X-ray imaging and image reconstruction, products and services, and how all this can be implemented in biomedical imaging with demos, laboratory practices, lectures, field works, company visits, round table,

Syllabus

Name of activity	Imaging in Medicine: Lights and shadows
Number of working hours	1,5 hours
Type of activity	Lecture
Lecturer	Juan Manuel Desco
Short summary of content	In this talk we will discuss the role of new technologies within the present paradigm for healthcare. The concept of placebo can be extended to high-technology devices, and the role of alternative medicines is under debate. From a historical perspective on the technical advances in Medicine and innovation.
Bibliography	N/A
Expected effect	Students to discuss what is a sensible position of scientists and engineers regarding these issues.

Name of activity	Functional Imaging
Number of working hours	1,5 hours
Type of activity	Lecture
Lecturer	Juan Jose Vaquero
Short summary of content	<p>Molecular imaging is undergoing an intense activity, mainly due to the availability of new detection and image reconstruction technologies, which in recent years have improved significantly both the resolution and sensitivity of these methods. The greatest potential for innovation comes from multimodality imaging, which combines information from more than one imaging technique and exploits the synergies between them. The main arguments in favour of these devices are the possibility of performing intrinsically registered scans in a minimum time and without moving the animal. Currently, the combination of PET and MRI as a hybrid imaging modality is receiving great attention and although its potential is clear, as it was with the PET/CT, this technology must overcome certain limitations and demonstrate its value for different applications.</p>
Bibliography	N/A
Expected effect	Students to understand the main concepts about molecular imaging.

Name of activity	Biomedical Modalities
Number of working hours	1,5 hours
Type of activity	Lecture
Lecturer	Mónica Abella
Short summary of content	<p>All different modalities for biomedical imaging will be shown. Analyzing their differences based on the physics of acquisition, the instrumentation involved and the mechanisms of image formation</p>

Bibliography	N/A
Expected effect	The objective of this session is to acquire a basic understanding of main medical imaging modalities: X-Ray imaging, Nuclear medicine, Magnetic Resonance and Ultrasound.

Name of activity	Immersive Media for Biotechnology
Number of working hours	1,5 hours
Type of activity	Lecture
Lecturer	Álvaro Villegas
Short summary of content	Immersive Media (Virtual Reality, Augmented Reality, 360 video) is quickly becoming the foundation of many new applications in all areas of society, from entertainment to education and professional environments. Nokia Bell Labs Spain, whose research activities are primarily focused on these technologies, will show in this presentation how the field of biotechnology will be impacted by immersive media, and how health care in general may be benefited from the dramatic advances that are expected in this field in the near future
Bibliography	N/A
Expected effect	Students will get a general overview of how media can have an impact over all areas, especially on biotechnology and healthcare.

Name of activity	IBM Watson
Number of working hours	1,5 hours
Type of activity	Lecture
Lecturer	Ángel Hernández Bravo
Short summary of content	General presentation about IBM Watson, with comments, examples and mentioning some projects, applications and products on the area of Watson Health

Bibliography	N/A
Expected effect	Students to understand how Watson works and all the improvements that can be done with Watson in terms of medicine and healthcare.

Name of activity	Sedecal Healthcare Division
Number of working hours	4 hours
Type of activity	Company Visit
Lecturer	Juan Manuel Arco
Short summary of content	SEDECAL leads fields such as medical radiology, PET and PET/CT, medical ozone generation, and many others
Bibliography	N/A
Expected effect	Students to understand what the company works for, and how they do it. Getting to see the machinery and the different areas.

Name of activity	Basic perceptive and cognitive processes
Number of working hours	1 hour
Type of activity	Lecture
Lecturer	Susana Carmona
Short summary of content	Presentation about the basic perceptive and cognitive processes
Bibliography	N/A
Expected effect	Students will get to learn about sensation, perception, attention and executive functions as well as the brain bases involved in these processes. And how all this is put into practice inside a hospital.

Name of activity	General Cardiovascular Image
Number of working hours	1 hour
Type of activity	Lecture
Lecturer	Javier Bermejo
Short summary of content	Introduction to cardiovascular imaging in a general way. Showing the different ways we can find this inside a hospital.
Bibliography	N/A
Expected effect	Students to understand how our brain works and how data about different diseases can be shown with images, always giving examples that can be found in the hospital

Name of activity	Gregorio Marañón Hospital
Number of working hours	3 hours
Type of activity	Field Work (Hospital)
Lecturer	Juan Manuel Desco
Short summary of content	After the lectures of specialized doctors and investigators had in the hospital, students will get the chance on going to see the hospital installations and the work environment of a biomedical engineer inside a hospital.
Bibliography	N/A
Expected effect	Students will learn how a day inside a hospital is. Getting to know what doctors do, and how the work is done inside the research area on biomedical imaging

Name of activity	Basic Principles of X-ray Computed Tomography (CT)
Number of working hours	1 hour
Type of activity	Tutorial

Lecturer	Mónica Abella
Short summary of content	Review the principles an X-ray imaging and image reconstruction in order to understand the following session of the laboratory
Bibliography	N/A
Expected effect	Students to understand all the material needed for a laboratory session of X-Ray and how it would be used all the material. Students will be able to understand the data and reasoning of the practical session later done in the laboratory

Name of activity	Basic Principles of X-ray Computed Tomography (CT)
Number of working hours	1 hour
Type of activity	Laboratory
Lecturer	Mónica Abella
Short summary of content	Everything explained in the tutorial will be put into practice using a small CT system specifically design for educational purposes
Bibliography	N/A
Expected effect	Students to understand the CT system

Name of activity	Image Guided Treatments
Number of working hours	1 hour
Type of activity	Tutorial
Lecturer	Javier Pascau
Short summary of content	Multimodal information coming from Magnetic Resonance, Computed Tomography or Positron Emission Tomography may improve the precision of many medical treatments and facilitates decision making in complex surgical scenarios. In this

	seminar students will learn how tracking systems provide position information in three dimensions that will allow relating the real patient and the image studies. Thanks to these techniques a physician will be able to precise locate a tumour during surgery, guide a needle to obtain a successful biopsy, find a lesion with ultrasound where it was previously detected with CT or synchronize radiation therapy with a respiratory signal.
Bibliography	N/A
Expected effect	In this seminar students will learn how tracking systems work, position, locating a tumour, and guiding.

Name of activity	Image Guided Treatments
Number of working hours	1 hour
Type of activity	Laboratory
Lecturer	Javier Pascau
Short summary of content	During this session students will interact with optical and electromagnetic tracking systems. Following the complete workflow that is necessary to guide a medical treatment using three dimensional images: calibration, tracking, registration and navigation.
Bibliography	N/A
Expected effect	Students to work and understand everything that will be done in the laboratory practice session.

Name of activity	Training environments on health and science
Number of working hours	1,5 hours
Type of activity	Lecture
Lecturer	Ángel Navarro and Jorge Méndez

Short summary of content	<p>Why Azierta bet on a technological product? Why a service company is determined to get a product?</p> <p>Does the product - service binomial serve for anything?</p> <p>Are simulators good for anything?</p> <p>Explanation of training environments, application of simulators in the science and health environment.</p>
Bibliography	N/A
Expected effect	Students will understand concepts such us products, services, training environments, and simulators, and how all this can be implemented into health and science

Name of activity	Current problems for diagnosis in different medical imaging lines. Challenges and proposals
Number of working hours	1,5 hours
Type of activity	Round Table
Lecturer	Javier Rodriguez, Carlos Oscar Lozano, Claudia de Molina and Eduardo Lage
Short summary of content	<p>Imaging is one of the technologies used widely in clinic and research, mainly as a diagnostic or research tool and companies related to this field play a big role on its development. In order to know how important it is this technology and how this field is affecting to this three important fields: science, medicine and industry a debate table has been proposed. The purpose of this debate table is to get opinions from different perspectives of the invited speakers having different backgrounds and involve participants so they can get better knowledge of this field through an active interaction with the speakers by asking and also giving their opinion in this topic. Through different questions which address the topic of interest, first speakers will be answering and giving their opinion by explaining their position and relation with their work and then participants will have the occasion to interact with them at the end of each question.</p>

Bibliography	N/A
Expected effect	<p>Discussion between professionals of the field and students, relevant to the following questions:</p> <p>In relation to your scientific background and research focus.</p> <p>How important do you consider is imaging to the fields of science and medicine?</p> <p>How industry can take advantage of this technology? Does it provide enough income to invest on it over other technologies?</p> <p>What do you consider are the main challenges which have to be overcome currently to continue improving in medical imaging specially? In your opinion, what could be done for it? Focus on your imaging modality of research or give a general answer about imaging.</p> <p>All these arguments and discussion will give students a broader development of their critical thought and how to develop all those ideas with a consistent reasoning.</p>

Name of activity	Evaluation preparation
Number of working hours	2 hours
Type of activity	Workshops
Lecturer	Javier Rodriguez And teachers from the lectures and other activities of the course (To be determined)
Short summary of content	Students will work on groups doing a presentation on the theme they got selected
Bibliography	N/A
Expected effect	To finish a presentation for the final evaluation

Name of activity	Evaluation
Number of working hours	1,5 hours
Type of activity	Practical Work (presentation)
Lecturer	Javier Rodriguez

	And teachers from the lectures and other activities of the course (To be determined)
Short summary of content	Different groups will be done at the beginning of the course in order to know what presentation they will have to do. All presentations will have to do with some specific parts of all the materials learnt in the course
Bibliography	N/A
Expected effect	Students in groups will do a small presentation that they will have been working on their free time and on the specific time for it the last day (2 hours). The presentation will last around (10 minutes aprox)

Pre-materials

Books or links have not been mentioned by any teacher for students to get to know or read before the course. As all the classes will be taught from the beginning assuming students only know what they have been learning in this course.