Emerging Technologies to Support Health Care and Independent Living 2018
Infrastructure, technology, productivity and environment

International course
Department of Electronic Engineering
Start date
June 25, 2018

Finish date
June 29, 2018

Hourly intensity
40 hours

Schedules
Monday to Friday, from 8:00 a.m. to 6:00 p.m.

Objectives

General

☐ Introduce participants to emerging technologies in Cardiac and Neurorehabilitation and their applications to assist clinical specialists in the diagnosis, treatment, physical rehabilitation and follow-up of older adults for active old age.

☐ Identify the active social role of the engineer in the field of bioengineering, in collaboration with professionals in the area of health for the development and innovation of self-care technologies and independence of the elderly.

Specifics

☐ Present the older adult as an integral being, with abilities, needs and deficiencies in their health conditions.

☐ Contextualize the health problems of older adults in Latin America and their needs mediated by emerging technologies in Cardiac and Neurorehabilitation.

☐ To present the most relevant emerging technologies (e-health / IoT / connected health) for the processes of diagnosis, treatment, physical rehabilitation and follow-up of the elderly for independence in daily life.

☐ Present successful models and methodologies for the design, development and transfer of innovative technologies in this area from a social and inclusion perspective.

☐ To promote in the participants the skills to develop new products at low cost and transferable to the productive context for the target population.
Value proposal
This course aims to familiarize attendees with emerging technologies (IoT, e-healthy and connective-health) with their potential applications to contribute to healthy aging, to know its impact on clinical research and to identify new trends, future challenges of digital technologies to assist in the diagnosis, control and monitoring of the diseases of the elderly and the use of innovative technologies to achieve their independence and autonomy in their home, in their daily environment for an active old age, a global issue and of high relevance, for example, for the European Commission Program, Horizon 2020.

This summer school offers an international high standard course sponsored by the most relevant scientific societies in the field of bioengineering at the international level: Regional Council of Biomedical Engineering for Latin America (CORAL) and the International Federation for Medical and Biological Engineering (IFMBE). Different academic activities held during the Summer School as follow: high standard lecturers, student seminars, workshops, labs and technical industry meetings for standards and assessment methods of medical devices. The Medical and the Engineering schools of the local University were involved. The infrastructure and technological facilities were appropriate to promote innovation student activities and interaction with the international and local lectures. Technical and cultural activities will be carried out, which will allow attendees to interact with invited speakers and the technical support of metrology in medical devices industry. Attendance certification will be issued to those who meet a minimum of 90% of the program hours.

The Scientific Academic Committee is made up of:
- **Professor Andrew Laine Ph.D.** Columbia University. New York. EMBS Past President 2017. Professor of Biomedical Engineering, Chair, Department of Biomedical Engineering.
- **Professor Ratko Magjarevic Ph.D.** University of Zagreb. Croatia. (Doctorate in Electrical Engineering and experience in Biomedical Instrumentation and emerging technologies for the management of diabetes).
- **Professor Metin Akay Ph.D.** Houston University. USA. (Ph.D. in Electrical Engineering and experience in Neuroengineering and Assistive Technology for Rehabilitation).
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- **Professor Martha Lucía Zequera Ph.D.** Full Professor Electronics Department. Faculty of Engineering. Pontificia Universidad Javeriana. BASPI Research Group. Coordinator research laboratory in Biomedical Instrumentation, medical devices to assist the elderly and Foot Biomechanics, FootLab in the Attic Center. (With a Master's and Ph.D. in Bioengineering from the University of Strathclyde in the UK, with emphasis on Biomechanics and Rehabilitation Technologies).

- **Professor Virginia Ballarin Ph.D.** Full professor Electronics Department. Faculty of Engineering. Universidad Nacional de Mar de Plata. Argentina. (Doctorate in Medical Image Processing).

- **Engineer Ricardo Suárez Venegas Ph.D.** Professor, Department of Industrial Engineering. Faculty of Engineering. Pontificia Universidad Javeriana. Director of the Master's Degree in Bioengineering (PhD from Delft University of Technology in the Netherlands).

- **Engineer Eric Laciar Leber Ph.D.** Full professor Electronics Department. Faculty of Engineering. Universidad Nacional de San Juan. Argentina (Doctorate in Biological Signal Processing).

- **Engineer Luis Miguel Zamudio MSc.** Instituto Politécnico Nacional de México. (MSc. in Digital Design).

Academic Coordinator:

- **Professor Martha Lucía Zequera Ph.D.** Full Professor Electronics Department. Faculty of Engineering. Pontificia Universidad Javeriana.

The International Student Summer Committee is made up of:

- **Academic Monitor: Juan Camilo Garcés**, Student of Electronic Engineering.
- **Engineer Jhonathan Sora**, Student of master in Bio and electronics.

The student committee is organized by postgraduate and undergraduate students, medical doctors and similar areas from several countries such as Argentina, Mexico, Costa Rica, Peru, Ecuador and Colombia.
The advanced technological infrastructure of the Pontificia Universidad Javeriana and the support of the Faculty of Engineering with its PhD programs, Master's in Bioengineering and Electronics and the IoT and Attic centers will allow the development of a program of high quality and relevance in the context of innovation and development of new technologies for the inclusion of older adults in society.

Addressed to
Students of masters, doctorate and/or postdoctorate in system, electronic, biomedical or related engineering studies, and to physicians and researchers in the field of emerging technologies in health (IoT, e-health, Security, Standards and connective-health).

Minimum requirements
Intermediate-advanced English, engineering knowledge in medical applications and signal processing, basic knowledge in IoT and communications standards in medical devices.

Methodology
Master's sessions combined with workshops, work seminars, technical visits to the San Ignacio Hospital, the Center for Simulation of Biological Signals, the Laboratory of movement and animation analysis and creative room of the Attic Center.

Interdisciplinary seminars will be made up of students attending the course, international experts and professionals in the area of health. During the course, low-cost innovation and development projects are planned to respond to the needs of the elderly for their autonomy and active old age.

Presentation of the program
With the growth of the older adult population in Latin America and the need to improve their quality of life by guaranteeing their inclusion in society, the use of new technologies or emerging IoT, e-health and connective health technologies to assist health specialists in the processes of diagnosis, treatment, physical rehabilitation and follow-up of the elderly, such as continuous monitoring of vital biological signals, medical devices, movement analysis for the prevention of biomechanical alterations, monitoring and assistance in the physical rehabilitation process with the use of intelligent robots for their independence in daily life and the evaluation of the effectiveness of the use of these technologies.
The course is aimed at facilitating academic cooperation and interaction between Biomedical Engineering and related experts, health professionals and Master's and PhD students for the construction of solutions, as a whole, that respond to the real needs of the studied population, supported by emerging technologies for the early diagnosis of chronic diseases, their control and follow-up in order to contribute to the well-being and quality of life of the elderly. Each course participant will have the opportunity to develop a project during the course with the assistance and guidance of a group of tutors from different areas of knowledge such as: Instrumentation, Biomechanics, IoT, biological signal processing, diagnostic image processing and digital control.

Contents

Module 1. Healthy adult
- The older adult as an integral being, their needs and health conditions in Cardiovascular & Neuromuscular System and Rehabilitation.

Module 2. Emerging technologies in monitoring systems
- Implantable technologies and signal processing.
- Clinical simulation center of the School of medicine.

Module 3. Therapeutic Instrumentation for Cardiac Rehabilitation
- Emerging technologies for the continuous monitoring of the vital systems of the older adult for the prevention of health risks.
- Technologies for the continuous monitoring of oxygen levels, blood glucose and for the orientation of physical activity in the elderly (Wearable technologies).
- Emerging technologies for health risk surveillance systems:
  - Implantable devices
  - Devices for the monitoring of sleep apnea and its complications.
  - Devices for the monitoring of dysfunctions of the respiratory system.

Module 4. Diagnosis of Neurological disorders and disabilities
- Assistive technologies for the analysis of Neurological disorders and their disabilities.
  - Rehabilitation technologies (Neuroprosthesis, bio-robotics).
  - Neurophysiology of human movement.
Module 5. Wearable Sensors and Robots
- Strategies to evaluate the appropriate use of rehabilitation technologies implemented for the elderly in the home and in the clinical setting.
- Methods of analysis for the evaluation of technologies and their appropriate implementation.

Module 6. Design, innovation and technology in bio robotics.
- Neuro-Musculoskeletal Biomechanics and biorobotics.

Module 7. Biomedical Engineering, Education and society.
- Technics to improve Engineering in the global society.

Module 8. Design, innovation and technology to the global market.
- Methods for innovation, development and transfer of new technologies to the adult market.
- Strategies for innovation and development.

This agenda may have variations, being a proposal of flexible training, which seeks the maximum performance of the participants, according to the specific needs of the same ones.
Guest international speakers

**Professor Metin Akay Ph.D.** University de Houston. USA.
(Neurosciences and Assistive Technology for Rehabilitation)

Prof. Metin Akay is currently the founding chair of the Department of Biomedical Engineering at the University of Houston. He completed his doctoral studies at Rutgers University. Dr. Akay has contributed to the development and promotion of education in Biomedical Engineering worldwide. He is one of the professors of greater trajectory and recognition of the American society of Engineering, in Medicine and Biology (EMBS) of the IEEE. He is the author of several books and publications in scientific journals of high prestige internationally. Professor Akay has delivered more than one hundred lectures, plenary sessions at international conferences, symposiums and workshops on emerging technologies in biomedical engineering. He is editor-in-chief of the publication: "The Biomedical Engineering Book Series," published by Wiley and IEEE Press and the publication: "The Wiley Encyclopedia of Biomedical Engineering". He is also editor of the publication: "The Neural Engineering Handbook", published by Wiley / IEEE Press. Prof. Akay is currently chair of the "IEEE / EMBS Neuroengineering Technical Committee" of EMBS / IEEE.

He is currently an active member of the advisory board of several international journals and several review panels of NIH and NSF. Dr. Akay is a member of recognized agencies: IEEE, Institute of Physics (IOP), American Institute of Biological Medical Engineering (AIMBE) and American Association for the Advancement of Science (AAAS). His Laboratory of Neural Engineering and Computer Science is currently developing an intelligent system for the monitoring of motor functions in hemiplegic patients because of post-stroke and detection of coronary disease. In addition, the development of neuroimplants and neurochips among others.

**Professor José Luis Pons Rovira Ph.D.** Instituto Cajal - CSIC. Centro de Neurología. Madrid, España. (Rehabilitation Technologies and Medical Robotics)

He is currently the Director of the Cajal Institute - CSIC. It belongs to the Neuro-Rehabilitation Group oriented to the development of methods and technologies to facilitate the understanding and control of human biological systems and their interaction with the environment. In particular. Its center has an interdisciplinary research program.
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for the development of innovative methodologies, interventions and assistance devices to improve the quality of care and the quality of life of people with disabilities. Analysis and evaluation of neuromusculoskeletal and cognitive systems that allow humans to produce movement and decisions in unstructured environments. He leads a group of researchers in the areas of Neurology, Physical Therapy, Biomechanics, Control, Robotics and Modeling of Computational Learning.

Professor Krishnan Shankar Ph.D. Boston University. USA.
(Innovation and development medical devices)

Dr. Shankar Krishnan is the founding chairman of the Biomedical Engineering program and senior lecturer at the Wentworth Institute in Boston since 2008. He completed his PhD studies at the University of Rhode Island. He held the position of assistant director of Massachusetts General Hospital. Dr. Krishnan has been a professor in Illinois, Miami and Singapore. He was the founding Director of the BME Research Center and the founding Director of the Division of Bioengineering at NTU University in Singapore. He was Principal Investigator of several projects of Biomedical engineering with funds over 15 million dollars. He also worked in R & D in Miami and in hospital design and operations management at Bechtel for sanitary mega-projects. He has served on the National Medical Research Council in Singapore. His research interests are biomedical signals and image processing, telemedicine, medical robotics and BME education. He has contributed with innovative models in the curricular design of BME, based on the interdisciplinary work and the development of projects. It is an active member of the following organizations: AAMI, ASEE, ASME, BMES, IEEE, BMES, IFMBE and ASME. He has served the Administrative Council of the International Federation of Medical and Biological Engineering (IFMBE) for the last ten years and is currently the President-elect for the next period of that organization. He was elected a member of the American Institute of Medical and Biological Engineering and member of the CIMIT Kennedy, Innovation Award in Boston.
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**Professor Paolo Bonato Ph.D.** Spaulding Rehabilitation Hospital. Boston. USA. (Rehabilitation Technologies, Assistive Technologies and Medical Robotics)

Doctor Bonato is an electronic engineer at the Polytechnic of Turin, Turin, Italy and has completed his PhD studies. In Biomedical Engineering of the Universita di Roma "La Sapienza" in 1995. He is currently the Director of the Laboratory of Movement Analysis at Spaulding Rehabilitation Hospital, Boston MA. He is an Associate Professor in the Department of Physical Medicine and Rehabilitation at Harvard Medical School, Boston MA, and is an Adjunct Professor of Biomedical Engineering at the MGH Institute of Health Practitioners, Boston MA. Dr. Bonato is an associate member of the Institute for Biologically Inspired Engineering, and is an adjunct professor of Electrical and Computer Engineering at Northeastern University. He has been a visiting lecturer at MIT, the University of Ireland in Galway and the University of Melbourne in Australia. His research work has focused on the development of emerging technologies in the field of Rehabilitation with special emphasis on (wearables technologies) and Robotics. Dr. Bonato was Editor-in-Chief of the magazine called "Journal on NeuroEngineering and Rehabilitation". He is a member of the Advisory Board of the IEEE Journal entitled "Journal of Biomedical and Health Informatics" and the journal "Journal of Biomedical and Health Informatics" and is also an Associate Editor of the journal IEEE Journal of Translational Engineering in Medicine and health". Dr. Bonato was a member of the Administrative Committee of the Society of Engineering in Medicine and Biology (EMBS) of the IEEE and President of the International Society of Electrophysiology and Kinesiology. Dr. Bonato was Chairman of the Technical Committee: "Wearable Biomedical Sensors and Systems" of the IEEE. He was also the Scientific Chairman of the 33rd Annual International Conference of the IEEE EMBS (2011). He recently served as Vice President of Publications for IEEE EMBS (2013-2016).

**Professor Ratko Magjarevic Ph.D.** University of Zagreb, Croatia. (Biomedical Instrumentation and personalized smart mobile health systems)

Full Professor at the Faculty of Electrical Engineering and Computing, Department of Electronic Systems and Information Processing, University of Zagreb, Croatia. His doctorate is in Electrical Engineering of the University of Zagreb, Faculty of Electrical Engineering. He belongs to the group of Electronic Measurement and Biomedical Engineering of the same university. He teaches various courses in Electronic Instrumentation and Biomedical Engineering in undergraduate, postgraduate and postgraduate courses. His scientific and
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Professor Magjarevic is a senior member of the Engineering in Medicine and Biology Society (EMBS) of the Institute of Electrical and Electronic Engineers (IEEE) and was recently President of the International Federation of Medical and Biological Engineering (IFMBE), a global international society with affiliated societies of Biomedical Engineering, Bioengineering and Medical Physics more than 60 countries of Europe, America, Asia, Africa and Latin America. He has been professor of the intersemestral course of Biomedical Instrumentation and e-health of the Department of Electronics of the Faculty of Engineering of Pontificia Universidad Javeriana since 2011 to date and has collaborated in research and consulting with the BASPI Research Group and the laboratory FootLab by Professor Martha Zequera of the Department of Electronics.

Professor Piotr Ladyzynski Ph.D. Nalecz Institute of Biocybernetics and Biomedical Engineering, Warsaw Poland. (Biomedical Engineering)

Prof. Piotr Ladyzynski received his Ph.D. (1997) and D.Sc. i.e. habilitation (2009) degrees in biocybernetics and biomedical engineering. He is a Professor at the Nalecz Institute of Biocybernetics and Biomedical Engineering, Polish Academy of Sciences (Warsaw, Poland) and a Director of the International Centre of Biocybernetics PAS. Prof. Ladyzynski’s scientific research and interests are concentrated on artificial internal organs including artificial pancreas and diabetes treatment, technical support for intensive monitoring and treatments, application of the information and telecommunication technologies in monitoring and treatment of chronic diseases, tele homecare, telemonitoring and telemedicine, medical databases, decision support and application of artificial intelligence in medicine. He is an author of 200 journal and conference papers and 4 patents. He is a Head of the IFMBE Industry Working Group. In 2016 he became a President Elect of the European Society for Artificial Organs.
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Professor Yasemine Akay Ph.D. Rutgers University, New Jersey (Biomedical Engineering)

Assistant Professor at the Department of Biomedical Engineering, Cullen College of Engineering, University of Houston. She received her B.S in Pharmaceutical Sciences from the Hacettepe University, Ankara, Turkey in 1980 and M.S and Ph.D in Biomedical Engineering from the Rutgers University, Piscataway, NJ, USA in 1991 and 1998, respectively. Her research focuses on novel technologies for cost-effective high-throughput screening of novel cancer drugs and therapeutics and assessment of treatment responses. She is currently exploring the effect of maternal smoking during pregnancy by analyzing the mRNA expressions of a single cell analysis of the infant rats dopamine neurons patch-clamp electrophysiology and DNA microarrays.

Guest Professors

Carlos Alberto Cano Gutierrez Md. Geriatrician, Director of the aging institute Pontificia Universidad Javeriana. Geriatrics Unit Department of Internal Medicine. University Hospital San Ignacio.


Gustavo Hernando Castro Md. Neurologist, Universidad del Bosque.

Nurse Liliana Quevedo León Ms. Nurse. Magister in Nursing with emphasis in Family Health and Primary Health Care. Direction Department of Nursing of Health of the Collectives and teacher Master's Degree in Nursing Care for the Elderly Faculty of Nursing - Pontificia Universidad Javeriana.

Engineer Catalina Alvarado Rojas Ph.D. (Workshop sensors and IoT). Assistant Professor Department of Electronics of the Faculty of Engineering of the Pontificia Universidad Javeriana. With a PhD in Multi-level approach to high frequency oscillations in human epileptic networks.

Engineer Alice Rueda MSc. Electrical and Computer Engineering. Ryerson University. Doctorate Student.
Invited Companies

VICON USA (Demo VICON)
Amy August. Senior Account Manager. Latin American Business Development Manage.

Set & Gat – FLUKE Biomedical. (Workshop Metrología dispositivos médicos)
Engineers
Eduard Sastoque. Specialist in Process Integration.

The academic committee reserves the right to modify the assignment of speakers.

Certification
Certification will be granted to those who have attended at least 80% of the scheduled hours.

Note: Individuals who register through the collection account will receive this diploma of assistance once the company made the payment.