



Pontificia Universidad
JAVERIANA
Bogotá

Emerging Technologies to Support Health Care and Independent Living 2019

Challenges of the Digital Ecosystem in
the health service for the elderly

Infrastructure, Technology, Productivity
and Environment Area

Full time course



Hourly Intensity
Face to face Modality 40 hours

Schedule

25 – 29 June, Tuesday to Saturday, from 8:00 a.m. to 6:00 p.m.

Value Proposal

This course aims to introduce attendees with the new challenges of the digital ecosystem in the health service for the elderly and the role of the emerging technologies (eHealth, IoT, Big Data, smart monitoring systems, medical informatics and wireless technology) with their potential applications to contribute to healthy aging, to explore its impact on clinical research and to identify new trends and 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), the International Federation for Medical and Biological Engineering (IFMBE) and Engineering in Medicine and Biology Society, IEEE/EMBS. Different academic activities to be held during the Summer School are as follows: high standard lecturers, student seminars, industry workshops, labs and technical industry meetings for standards and assessment methods of medical devices. The postgraduate programs in Medicine and Bioengineering of the Pontificia Universidad Javeriana will be involved.

The infrastructure and access to advanced technologies of the university allow promoting innovation processes in the activities of the summer school and allows interaction with international and local professors. The active participation of the



biomedical industry, of scientific societies, of the government and of health professionals allows development of ideas for real projects for improving the digital ecosystem in the health service for the elderly.

The attendance certification will be granted to those who meet a minimum of 80% of the hours of the program.

Objectives

General

- Introduce the participants to the new challenges of the digital ecosystem in health service for the elderly and the role of the emerging technologies in Cardiac and Neurorehabilitation (eHealth, IoMT, Big Data, smart monitoring systems, medical informatics, wireless technology and telemedicine).
- Identify the active social role of the engineer in the field of Bioengineering, Biomedical Engineering and Medical Physics, in collaboration with other professionals in the area of health for the design, development and innovation of self-care technologies and independence for elderly.

Specifics

- Promotion of the concept of “Active and Assisted Living Ecosystem for the Elderly”. A novel ecosystem will be presented to promote the physical, emotional and psychic health and well-being of the elderly.
- Presenting challenges on the digital ecosystem in health service for elderly.
- Presenting and analyzing the most relevant emerging technologies (e-health, IoMT, wearables technologies, smart monitoring systems, health informatics, big data, artificial intelligence, connectivity and medical devices) for the processes of diagnosis, treatment, therapy, rehabilitation and follow-up of the elderly.
- Presenting successful models and methodologies for designing, innovation, optimization and transfer of technologies in the rehabilitation market from a social and inclusion perspective.



- Promoting in the participants the skills to develop new products at low cost and transferable to the productive context for the target population implementing a hackathon experience with the collaboration of international companies.

Addressed to

Students of master programs, doctorate and/or post doctorate in Bioengineering, Biomedical Engineering, Electronics, Computer Science, Biology, Medical Physics or similar disciplines, also medical doctors, physicians, physiotherapist, occupational therapists and researchers in the field of eHealth digital technologies (eHealth, IoMT, Big Data, smart monitoring systems, medical informatics, wireless technology and telemedicine).

Methodology

Oral sessions combined with workshops, seminars, hackathon on eHealth and informatics, case of studies in rehabilitation and medical devices, technical visits to the University local Hospital and its Clinical Simulation Centre (clinical training in biological signals evaluation) and the gait analysis lab.

Interdisciplinary seminars will be organized for promoting the interaction between students and the international experts from diverse areas of knowledge on digital technologies, eHealth, medicine and ethics. During the course, low-cost innovation and development projects will be introduced with support of experts from academia, industry and health services in order to respond to the real needs of the elderly for their autonomy and active old age by using the updated technologies and techniques.



Academic Content

Module 1. Introduction (June 25th Tuesday).

Active and Assisted Living Ecosystem for the Elderly

- The older adult as an integral being, their needs and health conditions in Cardiovascular & Neuromuscular System and Rehabilitation.
- Innovation in medical education using emerging technologies
- Eco-system for wellness of physical and mental health of elderly
- A novel eHealth digital ecosystem.
- IBM-Workshop: Digital environment of the elderly (Section I and II)

Module 2. Data Acquisition

Presenting challenges on the digital ecosystem in health service for elderly.

- The challenges of the interaction between IoMT, eHealth, Telemedicine, medical devices, e-record, acquisition and processing data techniques to ensure the wellbeing of the patient.
- Diabetes digital ecosystem
- Neurological diseases - digital ecosystem
- Cardio digital ecosystem
- IBM-Workshop: Digital environment of the elderly (Section III and IV)

Module 3. Connectivity / Standards / Services

Presenting and analyzing the most relevant emerging technologies.

- Internet of Medical Things and smart monitoring systems.
- How to transfer and analyze data from different sources in the cloud.
- The importance of telemedicine in the digital ecosystem.
- Panel: Challenges in the regulation and implementation of connectivity standards for access to services for the elderly.
- Technologies to overcome motor and cognitive impairments in older adults.
- HCG–Tech/VICON Workshop: Integration of emerging technologies and rehabilitation. (Section I)
- PUJ IoT Workshop. EEG signal acquisition (epilepsy case of study)



- PUJ – HUSI: Evaluation and performance of medical devices and remote maintenance
- PUJ – Clinic Simulation Center: EEG signal acquisition (Myocardial stroke case of study)

Module 4. Therapy and Rehabilitation.

Models and methodologies for designing and innovation

- Methodologies and strategies for the design of low-cost and high-impact products.
- Marketing strategies to promote and sell a new product.
- Workshop: CDIO
- Workshop: HCG TECHNOLOGIES -VICON USA (Demo VICON)

Module 5. How to bring innovation to the market.

Implementing low cost products to the digital ecosystem

- Workshop: Hackathon experience. Smart Health Technology solutions for the ecosystem of the elderly

Speakers

Professor Shankar Krishnan Ph.D. Wentworth Institute of Technology Boston, USA.
Innovation and development of medical devices

Dr. Shankar Krishnan is the founding chairman of the Biomedical Engineering program and senior lecturer at the Wentworth Institute of Technology in Boston since 2008. He completed his PhD studies at the University of Rhode Island. He hold 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 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.

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 professional interest is oriented to the Electronic and Biomedical Instrumentation, with emphasis in the analysis and stimulation of the cardiac potentials, in the investigation of new methods of administration of drugs based on the electropermeability and recently in the investigation of systems Smart mobile health particularly customized for the management of diabetes with the development of emerging and innovative technologies for glycemic control and physical activity for the elderly. He has studied implantable technologies and wearable technologies.

Professor Magjarevic is the President-elect 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 is a senior member of the Engineering in Medicine and Biology Society (EMBS) of the Institute of Electrical and Electronic Engineers (IEEE). He has been professor of the intersemester 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 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, telehomecare, 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.



Professor Andrew Laine Ph.D. Columbia University. Professor of Biomedical Engineering, Chair, Department of Biomedical Engineering.

He received a BS in biological science from Cornell University, an MS in chemistry from the University of Connecticut, and a DSc in computer science from Washington University, St. Louis. He is a fellow of the Institute of Electrical and Electronics Engineers and of the International Federation for Medical and Biological Engineering. He is also a member of Columbia's Data Science Institute. As director of the Heffner Biomedical Imaging Lab at Columbia, Andrew Laine focuses on the mathematical analysis and quantification of medical images, signal and image processing, computer-aided diagnosis and biomedical / imaging informatics. His work is based on imaging structures at the molecular, cellular, tissue, and organ levels of analysis. The goal is to develop biomedical technology for unmet clinical needs and to transition that technology into commercial products that will improve healthcare and save lives.

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 University 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 "Journal on Neuro Engineering and Rehabilitation". He is a member of the Advisory Board of the IEEE Journal entitled "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 Metin Akay Ph.D. University of Houston, USA. Neurosciences and Assistive Technology for Rehabilitation



Dr Akay is 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 and plenary sessions at international conferences, symposiums and workshops on emerging technologies in biomedical engineering. He is editor-in-chief of "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 Neural Engineering Handbook", published by Wiley / IEEE Press. Prof. Akay is currently chair of the "IEEE / EMBS Neuroengineering Technical Committee".

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 post-stroke patients and detection of coronary disease. In addition, he has interest in the development of neuroimplants and neurochips among others.

Professor Yasemine Akay Ph.D. Rutgers University, New Jersey, USA. 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 Gutiérrez Md. Geriatrician, Director of the Aging Institute, Pontificia Universidad Javeriana. Geriatrics Unit Department of Internal Medicine. University Hospital San Ignacio.

Leonar Giovanni Aguiar Martínez Md. Director of the Clinic Simulation Center. Pontificia Universidad Javeriana. Internal medicine specialist with a master on bioethics.



Liliana Quevedo León 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.

ALCATEL. Jorge Villa. Leader of Verticals for Latin America.

Hospital de San Ignacio. Jorge Corzo. Director of Biomedical Engineering Department.

The Scientific Academic Committee:

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 Andrew Laine Ph.D. Columbia University. New York. EMBS Past President 2017. Professor of Biomedical Engineering, Chair, Department of Biomedical Engineering.

Professor Metin Akay Ph.D. Houston University. USA. (Ph.D. in Electrical Engineering and experience in Neuroengineering and Assistive Technology for Rehabilitation).

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 Laciár 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).

Optician Nubia Arroyo. Member of the scientific committee of the optician's society.

Erika Ospina Roza. Pontificia Universidad Javeriana. Internalization of research. Research Directorate.

Juan Carlos Covo. Pontificia Universidad Javeriana. Viceresearch office.

Maria Fernanda Patiño. Pontificia Universidad Javeriana. Centro Javeriano de emprendimiento.

Maria Consuelo Zamora. Specialized Services Professional for Engineering Research. General Library Pontificia Universidad Javeriana

Ana Graciela Criado Aussant. Chemistry Pharmaceutica. University of Antioquia. Director of Medical Devices INVIMA.

Academic Chair:

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

Engineer Juan Camilo Garces Becerra. Electronic engineering from the Pontificia Universidad Javeriana

The Student Committee:

Academic Monitor: Juan David Ríos López, Student of Electronics Engineering.

The student committee is organized by graduate and undergraduate students, medical doctors and similar areas from several countries such as Argentina, Mexico, Costa Rica, Peru, Ecuador and Colombia.

Invited Companies

IBM

Monica Torres.

BDE. Education and University Relationship Manager Colombia



HCG TECHNOLOGIES -VICON USA (Demo VICON)

Carlos Vilchis Manager.

Set & Gat – FLUKE Biomedical. (Workshop Metrology medical devices)

Engineers

Luis Guillermo Uribe. Commercial manager. Eduard Sastoque. Specialist in Process Integration.

ALCATEL. Jorge Villa. Leader of Verticals for Latin America.

This proposal includes:

Course Description: With the growth of the population of older adults in Latin America and in the world, the need to improve their quality of life and their inclusion in society with the use of new digital technologies is required.

On the other hand, the trends of new models of health care supported by new technologies for the continuous monitoring of the elderly in their environment, allowing their autonomy, affectivity and interaction with their family demands new competences of the engineers and health professionals who develop the design of new technological solutions.

Modality: Face to face

Schedule: 25 – 29 June, Tuesday to Saturday, from 8:00 a.m. to 6:00 p.m.

Hourly Intensity: 40 Hours

Place: Facilities of the Pontificia Universidad Javeriana

The physical plant of the Directorate of Continuing Education - DEC, meets high quality standards in terms of location, comfort, parking, security and access. The rooms are for exclusive use for the Continuous Education activity, for which the participants in our programs have adequate spaces for their training.

The Directorate of Continuing Education-DEC has nineteen (19) lecture halls or seminars with an average capacity for 30 people equipped with basic audiovisual aids.