Supervisor Project Idea

Supervisor

Insert a brief CV and/or external link, the total number of publications, the ORCID link, 5 of the most significant/recent publications, and a list of funded projects and awards.

Since 2006 Laura Burattini (https://orcid.org/0000-0002-9474-7046) joints the Department of Information Engineering of the Università Politecnica delle Marche (Italy) where she is currently faculty member as Full Professor of Bioengineering and President of the Unified Council of the Biomedical Engineering Degree and she manages the "Cardiovascular Bioengineering Lab" and "Bioengineering Lab". She is promoter of the Erasmus exchanges with University of Leiden (The Netherlands) and University of Saragoza (Spain). She joins several scientific associations and is member of the Board of Directors of the Italian National Group of Bioengineering (GNB), of the International Society for Computerized Electrocardiology (ISCE) and of the Computing in Cardiology society (CinC). She contributed to found B.M.E.D. Bio-Medical Engineering Development srl, an academic spin-off that she served as CEO and President from 2012 to 2016. She participated, often as PI of the project or of a workpackage to many research projects, the most recent of which are: KET project titled ChAALenge (€ 8848000); POR MARCHE project titled W2BIOS - Wireless Wearable Biometric Sensors (€1256000); PON MISE project titled SADABI-IT - Smart Awareness in Digital Automation and Business Intelligence with Integrated Tools (€4000000). She is currently associate Editor of "Frontiers in Network Physiology" and Editorial Board of "Annals of Noninvasive Electrocardiology". Her main research interests are processing, modelling and classification of biomedical signals and images, also AI-based, particularly of the cardiac, nervous, motor, and metabolic physiological systems. She is author more than 100 journal papers and 150 proceedings of international conferences. For her research, she won several prizes among which Microsoft Grant Award 2020 with the project titled: "AI4Health" (2020) and the UBORA Design Competition 2020 with the project titled "aiCOVID-19" (2020).

Following there are 5 among the most significant publications:

1. DOI: 10.1088/1361-6579/ace241
2. DOI: 10.1093/europace/euac159
3. DOI: 10.1016/j.bspc.2022.104185
4. DOI: 10.1016/j.bspc.2021.103210
5. DOI: 10.1016/j.jelectrocard.2021.10.005

Research Group Description

Provide the name the reference department and a brief description of the research group, including external links, and available instrumentations and infrastructures.

The postdoctoral candidate will carry out his/her research activity at CARDIOVASCULAR BIOENGINEERING LAB (https://www.dii.univpm.it/laboratori?language=en#3), in the context of the BR3IN research group (Bioengineering Research Innovation, https://br3in.dii.univpm.it/) at the Department of Information Engineering, Università Politecnica delle Marche, Ancona, Italy (UnivPM). The group is composed by experts in biomedical engineering applied on cardiovascular signal and image processing with different expertise, thus providing to the candidate the opportunity to have full support and supervision for all aspects of the project. Key personnel of the research group is:
-Prof. Laura Burattini (Full Professor in Biomedical Engineering): supervision of the whole project.
- Dr. Micaela Morettini (Tenure-Track Assistant Professor in Biomedical Engineering): supervision of activities related to mathematical modeling of cardiovascular system.
-Dr. Agnese Sbrollini (Post-doc researcher in Biomedical Engineering): supervision of activities related to the cardiovascular signal and image processing, also based on artificial intelligence.
-MHD Jafar Mortada (PhD student in Biomedical Engineering): participation to activities related to cardiovascular signal and image processing, also based on artificial intelligence.

For this project, the candidate will conduct his/her activity collaborating with researchers from other Italian as well as international institutions, with whom Prof. L. Burattini is having long-term collaborations.
Notably, the candidate will take advantage of several research facilities located at UnivPM Department of Information Engineering, in addition to those at the CARDIOVASCULAR BIOENGINEERING LAB. In particular, all equipment, devices and tools available at the two laboratories below will be made available for the project:
BIOENGINEERING LAB, managed by Prof. Burattini.
DIABETES LAB, managed by Dr. Morettini.
And, in general, all the labs affiliated to Br3in group (https://br3in.dii.univpm.it/bioengineering-lab/)

Title and goals

Provide the title of the topic and a short summary of the project idea.

PhysioECG: toward the next-generation digital electrocardiography

Despite electrocardiographic testing being a proven clinical tool, the physiological content provided by the electrocardiogram (ECG) has grown little in the last decades and several issues related to its physiological interpretation remain unsolved. These limitations are mainly due to its characterization in terms of temporal and/or morphological features, typically provided by traditional signal processing techniques. Thus, this project aims at exploiting explainable artificial intelligence (XAI) and innovative data analysis techniques to further investigate the ECG physiological content. Data from all kinds of digital electrocardiography (from the standard 10-second 12-lead ECGs, to the 24/48-hour Holter ECGs, to the body surface ECGs) acquired in either humans and animal models will be analyzed and fused with data from different sources (demographic, related to other physiological systems, and metadata) with the aim to achieve new insights on the electrical physiology and pathophysiology of the heart, not only in relation to age and gender, but also to lifestyle (especially physical activity and diet) and living environment. Hence, this project will provide a contribution to a more modern digital electrocardiography, ultimately finalized to noninvasively identify subjects at increased risk of major cardiac events to be treated with preventive actions.

Contact details (*including email address of the supervisor*)

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