MY-ATRIA

Newsletter 03
2020

Jaca Summer School

During the second summer school planned for MY-ATRIA project, ESRs have been hosted by the University of Zaragoza in the University residence in Jaca. Given the expertise in both modelling and signal processing of the group headed by Prof. Pablo Laguna, the event in Jaca was mainly focused on the numerous applications of these two techniques to uncover atrial fibrillation (AF) mechanisms leading to a better diagnose and treatment of the arrhythmia. The activities gathered research groups from universities, hospitals and industries resulting in high quality discussions as well as network connections for future collaborations.

Contents

Edited and reviewed by the ESRs

From the 22nd until the 25th of September 2019 Jaca became the center of thought-provoking discussions between ESRs, professors, engineers coming from industry and medical doctors, all with the same aim, develop tools to detect, treat and monitor AF. During these days, the ESRs showed their cutting-edge results and received keynote lectures from experts coming from different fields. It was also the opportunity to have constructive debates and conversations immersed in the beautiful setting of this little aragonese town.

ESRs Presentations and Panel Discussion

The organization of Jaca Summer School had dialogue and discussion of students' breakthroughs as one of its main motivations, therefore an entire day has been dedicated to research projects presentations by each ESR.

First panel discussion moderated by Johan De Bie

Divided into morning and afternoon sessions, the twelve young researchers had enough time to deeply explain the progress achieved and to discuss their preliminary results with colleagues, professors, doctors and engineers. The time for debate and questions became a moment of exchange of ideas and suggestions, an occasion of improvement both for students and the attendees to the talks.

Second panel discussion moderated by Helena Hernandez

The presentations were complemented by two panel discussions moderated by Johan De Bie and Helena Fernandez, who have great experience in the industrial and commercial fields. The ESRs were asked about the impact and relevance of their project in the market and the procedures for intellectual property protection, such as patents and copyright licensing.

Keynote Lectures

The following two days of Jaca Summer School were set up with morning lectures and afternoon activitis. Keynote speakers from a variety of fields and with different experience gave important notions about several approaches to identify and monitor AF, study its complexity, terminate the propagation of the fibrillatory event, with a special focus on limitations and improvements to be done. Lectures and talks pointed out also the importance of keeping in mind what the nature of research is, providing helpful advices on how to face the ups and downs of investigation and how to build the path of their own research. Multidisciplinary training, one of the milestones of MY-ATRIA project, was also keyword of this Summer School; during panel discussions and lectures, ESRs examined this crucial theme in its positive and negative aspects, sharing their experience and reflecting on them.

The take-home message: Communication may be hard at first, but integration is necessary and worthy to gain a wider perspective and get the best out of one's research.

All the attendees of Jaca Summer School: MY-ATRIA supervisors, ESRs, and invited guests

At the end of the lectures, ESRs and professors could take a break and enjoy being all together at the afternoon 'social event' planned by the summer school organizers: a visit to the Royal Monastery of San Juan De La Peña and the characteristic village of Santa Cruz De Las Seros. Walking inside the partially carved-in-stone complex and churches, ESRs and supervisors had the opportunity to get closer to Aragon ancient history and religious traditions.

In the middle of Pyrenees region, ESRs and the main coordinator could not miss the chance to compete at table-football, showing their competitive attitude.

Prof. Luca Mainardi and some ESRs playing table-football

Jota aragonesa

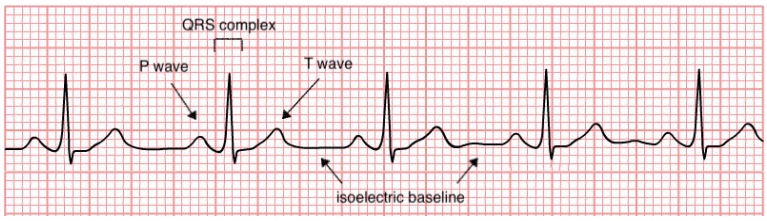
Every night in Jaca, buffet and gala dinners were organized along with the exhibition of a local folkloric group who performed some typical songs, called 'Jota', while dancing and playing music. The group of artists dedicated a 'Jota' to engineers and doctors entertaining the group.

Members of 'Grupo Folclórico Santiago Sabiñanigo'

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No.766082

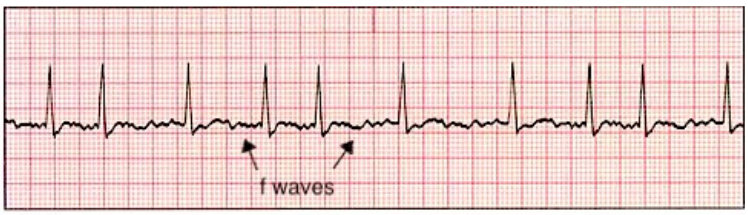
How to read an ECG

The standard electrocardiogram (ECG) at rest is recorded by placing ten electrodes on the body surface, six on the chest and four more on the ankles and wrists, while the patient lies down almost flat, with the head and chest raised slightly. This system of electrodes measures the differential potentials of the electrical activity of the heart resulting in twelve different representations, each providing information about distinct regions of the organ. Every heartbeat produces an electrical wavefront that spreads across the heart and causes it to contract.



ECG at sinus rhythm

The ECG trace for a heartbeat first shows a small peak called the P wave, this represents the depolarization of the atria; the smaller chambers of the heart. Then the trace shows a larger spike, the QRS complex, that corresponds to the depolarization of the larger chambers: the ventricles. Finally, there is another upward deflection, the T wave, representing the repolarization of the ventricles. Allowing heart rhythm documentation, the ECG is a fundamental tool in AF assessment at diagnostic and treatment stage.



ECG in AF

A typical ECG in AF patients usually does not present an isolectric baseline and is characterized by a totally irregular RR intervals; distinct P waves are replaced by fibrillatory waves or minute oscillations, names f-waves.

AF causes

AF typically develops in certain groups of individuals who share common features as advanced age and clinical history of cardiovascular pathologies (such as heart valve problems, coronary artery disease, heart attack, congenital defect), or/ and pulmonary diseases (as chronic obstructive pulmonary disease, pulmonary embolisms, emphysema). AF can also rise as a consequence of metabolic and endocrine disorders, along with wrong lifestyle factor like obesity, smoking or alcoholism. A short percentage of the overall AF cases are asymptomatics. This has been related to genetic alterations of the genome, thus revealing the heritability component of this disease.

Beneficiary Profile: University of Zaragoza

The University of Zaragoza was founded in 1542 and is situated in the heart of Aragon, flanked by the Pyrenees and the Iberian mountain range. It is one of the oldest universities in Spain. The modern-day University of Zaragoza has colleges and academic facilities that are spread out throughout the city. The University finds its roots in the old Ecclesiastical Schools, one of which was the ancient School of Zaragoza, created in the 7th century. But it was really in the time of the Renaissance during 16th century when the University was first recognized as a leading institution for its support and research in science, literature and art. It was Felipe III himself who confirmed the status of the University and also acquired a degree from there in 1599. With an impressive history dating back to the Roman period, it is no wonder that the university is very popular with international students. It currently hosts a total of about 40,000 students and it is composed by around 3,000 a teaching staff with different positions and 2,000 members of the administrative and technical staff.

The Aragon Institute of Engineering Research (I3A)


Prof. Pablo Laguna Lasaosa


Assoc. Prof. Esther Pueyo Paulés


Assoc. Prof. Juan Pablo Martinez Cortes

The demands of the knowledge society require qualitative changes from the scientific and technological community in order to improve quality and effectiveness. To meet this challenge, the Government of Aragón established the Aragón Institute of Engineering Research (I3A) in 2002. This is the first institute of its kind created at the University of Zaragoza. It is based on inter-departmental collaboration and is highly multidisciplinary. The I3A is an Interdisciplinary University Research Institute specialising in engineering. It emerged from a strong conviction of the importance of the synergy that can be obtained in research planned in an interdisciplinary manner. The Biomedical Engineering Division is a clear example of the multidisciplinary approach of the I3A, as it brings together specialists in Biology, Medicine, Physics, Mathematics and Engineering who cooperate to develop technological applications to improve human health and quality of life.

Researcher profiles

ESR4

Muhamed Vila (UMIL)

Atrial complex networks in endocavitary recording during atrial fibrillation

I come from Bosnia and Herzegovina, where I obtained a master's degree in electrical engineering at the University of Sarajevo. During the final years of my studies, I started working as a control and instrumentation engineer in a local company. When I was five years old, they diagnosed me with supraventricular extrasystoles and now I have 10 to 15 thousand premature emissions of electric impulses in my heart every day. Seeing myself as a potential atrial fibrillation case in the future, as soon as I found out about MY-ATRIA project, I knew I wanted to apply. I think that all engineering disciplines seek to improve our quality of life, but what interests me in biomedical engineering is that it can directly affect and improve our health and well-being. Now I am living in Milan with my wife, the city often called a centre of fashion, but it is certainly much more than that. We really enjoy discovering together rich Italian history, food, art and culture. I think the opportunity to live and work abroad, that MY-ATRIA gave me, really helped me grow as a person. It is truly something more than just an academic experience.

ESR5

Ricardo Salinas Martínez (MORTARA)

Paroxysmal atrial fibrillation: Continuous tracking of arrhythmia progression

Coming all the way from Mexico, I decided to join the Biomedical Signal Processing field after graduating in Electronic Engineering. Since I started the university, I've been fascinated on how signal processing can improve medical outcomes and life quality. I like hanging around with friends either to drink a beer, playing sports, going dancing, or even better, camping by the river (as my hometown is full of them). I also like traveling to discover new cultures, traditions, and lifestyles. MY-ATRIA brought me to Italy, where I can find time to do all these things and more; like joining a group of acting or music. What I like most about MY-ATRIA is that all its members are welcome to teach, learn, and enjoy. It is organized so that the different ESRs gain experience working within an international research network. The project also promotes participation in leading conferences on the subject. MY-ATRIA also offers a great opportunity to live abroad and learn a new language, in my case, I moved to Bologna. I couldn't have asked for a better city, it is full of life and cultural diversity from all over the world, as it is a university city inhabited by foreign students.

ESR6

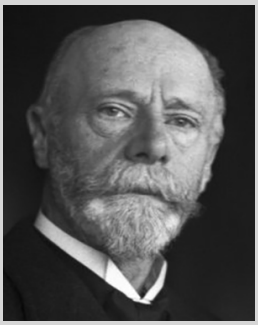
Hesam Halvaei (LU)

Atrial fibrillation screening using everyday sensors and data fusion

Multidisciplinary fields had been interesting to me as they bridge the gap between two distinct fields of study. My fascination with human physiology coupled with technological advances led me to study Biomedical Engineering. I grew up in Iran, where I got a master's degree in Biomedical Engineering. When I read MyAtria project plans and objectives, I found it compelling and well-structured at the very first glance. The chance to collaborate with different universities, partners, hospitals and companies, and living abroad for a while were the possibilities that one might not find altogether in other PhD programs! When I got the offer, I accepted it without a second thought! I lived for 8 years in Tehran, which has more than 10 million population. So I was quite worried when I moved to Lund with only 100,000! Luckily, with half of the population as students, one can experience an international and vibrant atmosphere in Lund, and I was able to quickly find the community that I enjoy spending time with. Plus, locating close to Malmö and Copenhagen gives you the many opportunities for outdoor activities, especially during the nice Spring and Summer.

Prof. Pablo Laguna, Helena Fernandez, MY-ATRIA ESRs, and Johan De Bie

Willem Einthoven



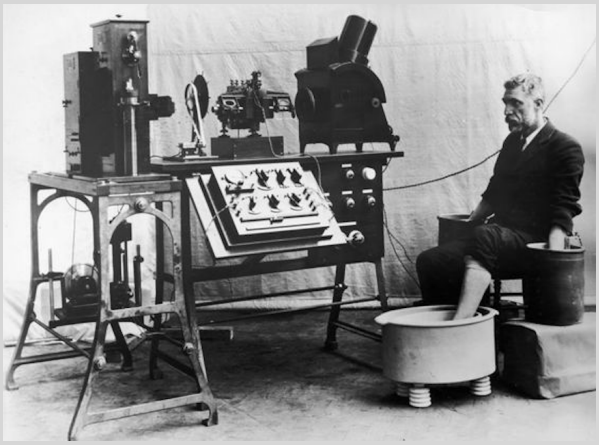
Willem Einthoven

Einthoven was born in Indonesia – then the Dutch East Indies – in 1860. His father, a doctor, died when he was just six, but he chose the same career, studying medicine at the University of Utrecht in the Netherlands. Soon after he graduated, he was appointed as professor of physiology at Leiden University. He died of cancer in 1927.

How doctors look into the heart : a glance from the outside

If a doctor has ever placed electrodes on your skin to record a trace of your heartbeat, you have a Dutch physiologist to thank, Willem Einthoven. His invention, the electrocardiogram (ECG) has been an essential tool in clinical practice for over 100 years, and is still one of the most widely used diagnostic tools in medicine nowadays. The medical community was initially sceptical about the technique's utility, but Einthoven's work was eventually recognised with a Nobel Prize in Medicine in 1924.

Son of a doctor, he followed in his father's footsteps, studying medicine at the University of Utrecht in the Netherlands. He became interested in the electrical activity of the heart after seeing a demonstration of a crude electrocardiogram device developed by Augustus Waller, the British physiologist. As Waller's device did not produce very accurate recordings, Einthoven developed a better one, which was called a string galvanometer. With this extremely sensitive instrument he was able to measure the changes of electrical potential caused by contractions of the heart muscle and to record them graphically. He coined the term electrocardiogram for this process.



Complete electrocardiograph

Einthoven achieved such amazing technical perfection that many modern electrocardiographs do not Barold in a 2003 paper about attain equally reliable and undistorted recordings", wrote Serge Einthoven's work. Einthoven made his first clinical recordings in 1902. The trace showed a waveform with three peaks and two troughs in each heartbeat. Einthoven used the letters P, Q, R, S and T to denote these features, a convention still followed today. Einthoven was convinced that the ECG would be hugely valuable for clinical diagnosis. He identified different patterns from healthy people and those with heart conditions such as arrhythmias (atrial flutter and fibrillations), heart blocks and ventricular hypertrophy – enlarged walls of the heart's main chambers.

CONTACT US MY-ATRIA
email: myatria@polimi.it
phone: +39 02 23993347

My-Atria

MY_ATRIA

https://www.newscientist.com/article/2203921-how-willem-einthoven-gave-doctors-a-window-on-the-heart/; https://www.hrsonline.org/search/Atrial%20fibrillation; https://www.topuniversities.com/universities/universidad-de-zaragoza; https://i3a.unizar.es/es/el-instituto;