The AMPS Insider

An AMPS LLC Magazine

Executive Overview

About AMPS, CardioCalm and the University of Milan, Dr. Moklesur Rahman, Decoding Music of the Heart.

Editorial

In this issue of TAI, we congratulate Dr. Md Moklesur Rahman on the awarding of his Doctoral Degree at the University of Milan, which was completed earlier this month under the supervision of Professors Massimo Walter Rivolta and Roberto Sassi. This achievement represents a significant milestone for AMPS, and our Italian sister company CardioCalm, which financially sponsored the doctoral program. Furthermore, it consolidates a collaboration with the University that dates back several years. Dr. Rhaman was also co-supervised by AMPS' chief scientist Fabio Badilini. Dr. Rhaman's research focused on the analysis of atrial tachyarrhythmias on continuous ECG data from Holter recordings extracted from the AMPS-PMB database (ref). In addition to the doctoral thesis, a few manuscripts have been published (refs) and more are to follow. During his PhD work, and enriching his experience, Moklesur spent a semester at UCSF, hosted at the Center for Biosignal Research (CBR), collaborating with top clinical scientists in the AI field, such as Dr. Geoffrey Tison, co-director of CBR with Fabio Badilini.

Decoding Music of the Heart is the title of an article appeared on the December issue of HeartLine, the magazine of the Division of Cardiology at the University of California, San Francisco. The article is about the UCSF Center for Biosignal Research, which uses advanced tools to study continuous, measurable physiological signals to better diagnose, treat and prevent heart disease.

The full article can be found on the AMPS web site.

About AMPS, CardioCalm and the University of Milan

The collaboration between AMPS, Prof. Roberto Sassi and the Biomedical image and Signal Processing laboratory (BiSP lab) at the Department of Computer Science of the University of Milan, Italy, dates back several years. During this time, common interests spanned different aspects of digital electrocardiology, like the detection of atrial arrhythmia from continuous ECGs which led to the previously mentioned PhD thesis of Dr Moklesur Rahamn. Also, in 2014, a significant common achievement was the development of PDF-ECG, a long-term preservation ECG format based on the PDF that maximizes the interchangeability of digital ECG signals, which culminated in a POC article published in the Journal of Electrocardiology in 2017. At present, any large-scale industrial adoption of PDF-ECG is still far from being a reality, however the format has been incorporated into the entire AMPS product line and is widely used in research.

Today this collaboration is very lively with both AMPS/CardioCalm and BiSP lab/University of Milan beneficiaries of the EU Marie Skłodowska-Curie Actions (MSCA) project INSIDE-HEART ("multI-discipliNary, multi-Sectoral and multi-national trainIng network on Digital biomarkErs for supraventricular arrHythmia charactErizAtion and Risk assessment"). The consortium, led by Politecnico di Milano (Italy) also includes other fine institutions like the Universities of Lund (Sweden), Zaragoza (Spain), and Turku (Finland), Technion (Israel), Medtronic (Nederland), Nuubo (Spain) and Centro Cardiologico Monzino (Italy). Each beneficiary has obtained EU funding to support a "doctoral candidate" (DC). In particular, one of the ten DC will soon start a three-year research path working at our Montichiari premises in Italy, while enrolled as a PhD student in Computer Science at the University of Milan. The focus of their research is to be in the context of AI-based monitoring platforms, based on ECG waveform data acquired from wearable devices.

About Dr. Moklesur Rahman

Dr. Md Moklesur Rahman is a computer scientist from Bangladesh who recently completed his PhD at the University of Milan, Italy, under the supervision of Dr. Massimo W. Rivolta, Prof. Fabio Badilini, and Prof. Roberto Sassi. Using his expertise in artificial intelligence (AI) applied to medicine, he has made significant efforts to address critical challenges in atrial arrhythmia detection from continuous ECGs. His doctoral research was funded by and tied to CardioCalm which led to the development of a deep learning (DL) model for arrhythmia detection, based on residual attention blocks, from a retrospective clinically relevant and highly curated dataset of 1,346 Holter recordings. The research included a comprehensive cross-comparisons with state-of-the-art DL models and with two rule-based algorithms: (1) ABILE, a commercial software by AMPS LLC, and (2) CBR-AF, a solution developed at UCSF's Center for Biosignal Research. The AI model performed similarly with respect to state of the art and commercial solutions, while excelling in atrial flutter detection. The reliability of the model was also assessed through uncertainty quantification (results not published yet).

Dr Rivolta, Dr Rahaman and Prof. Sassi

His research represented a significant advancement in atrial arrhythmia detection through DL, offering potential improvements in clinical diagnostics and patient monitoring using Holter recordings. The methodologies and insights presented in his PhD work provide a solid foundation for future research, addressing key challenges and enhancing clinical applicability.

Products News

The AMPS team has progressed on:

- ✓ Continued development of ECGMaster, the AMPS advanced digital ECG data management system. The 1st prototype planned for 1Q25.
- ✓ Continued development of CER-S 4.8.0 (mainly graphical improvements).
- ✓ Continued development of CER-SCor, introducing:
  - o Imbedded Antares as an option for ECG extractions from Holter strips
  - o Merge-feature to combine Holter records
  - o Security and flow improvements

Looking forward

The development of a new AMPS product is moving forward, the AMPS Cloud Gateway, or **ACG**, borne from the experience accumulated via the CER-SCor platform and responds to the requests from several customers. ACG's main purpose allows the usage of the most popular AMPS tools such as CalECG, Antares, ECGScan, and CER-S remotely, via an internet connection, removing the need to install the tools on the local workstations. The first prototype is planned for the end of 2Q25.

The AMPS team looks forward to welcoming you to the ISCE 2025 conference taking place on the beautiful southeast shore of the Garda Lake in the village of Bardolino. The Conference begins on Sunday, March 23rd with a welcome reception and runs through the night of Wednesday, March 26th with the traditional Gala dinner.