

The AMPS Insider

An AMPS LLC Magazine

The AMPS Insider is a quarterly magazine dedicated to all AMPS' partners and customers. Published by AMPS, it provides news and information about AMPS' products and initiatives.

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Executive Overview

A Systematic Survey of Data Augmentation of ECG Signals for AI Applications. The AMPS collaboration with the University of Milan. Product news.

Editorial

We continue the AMPS' tradition of participation in research projects in this TAI issue, as we feature a new paper published in the past quarter:

A Systematic Survey of Data Augmentation of ECG Signals for AI Applications.

The abstract reads:

AI techniques have recently been put under the spotlight for analyzing electrocardiograms (ECGs). However, the performance of AI-based models relies on the accumulation of large-scale labeled datasets, which is challenging. To increase the performance of AI-based models, data augmentation (DA) strategies have been developed recently. The study presented a comprehensive systematic literature review of DA for ECG signals. We conducted a systematic search and categorized the selected documents by AI application, number of leads involved, DA method, classifier, performance improvements after DA, and datasets employed. With such information, this study provided a better understanding of the potential of ECG augmentation in enhancing the performance of AI-based ECG applications. This study adhered to the rigorous PRISMA guidelines for systematic reviews. To ensure comprehensive coverage, publications between 2013 and 2023 were searched across multiple databases, including IEEE Explore, PubMed, and Web of Science.

The records were meticulously reviewed to determine their relevance to the study's objective, and those that met the inclusion criteria were selected for further analysis. Consequently, 119 papers were deemed relevant for further review. Overall, this study shed light on the potential of DA to advance the field of ECG diagnosis and monitoring.

The full article can be read on the AMPS web site [here](#)

The manuscript, just published in Sensors, gives us the opportunity to expand about AMPS collaboration with the University of Milan.

Our partnership is the result of the long-term collaboration with Professor Roberto Sassi and his team. In 2022 it led to the sponsorship of a PhD fellowship in the doctoral program of Computer Science at the University. The goal of the research is the development and validation of algorithms for the automatic detection of atrial tachy-arrhythmias on ambulatory ECGs.

The PhD fellowship was assigned to Dr. Md Moklesur Rahman (the first author of the manuscript), a graduate from the University of Kushtia, Bangladesh, with previous experience in machine learning, who had previously collaborated with the University and Professor Sassi's team.

Today there is a rich body of literature that covers applications of machine learning to the ECG signal. However, the reliability of these algorithms is frequently limited by the type of data available (typically a small sample size and/or poor labelling) and by the variability of data acquisition.

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On the contrary, for this project, Dr. Raham will be able to exploit the large amount of clinical data available at AMPS-llc, and in particular the dataset of Holter recordings collected (the so-called [AMPS-PBM Holter database](#))

Presently this dataset includes about 400 24-hour Holter recordings with at least one episode of documented and accurately labelled atrial fibrillation, atrial flutter or atrial tachycardia, and a balanced number of records in normal sinus rhythm, which also include cases with frequent extrasystole (atrial and ventricular). The total burden of labelled atrial fibrillation is over 3,000 hours, whereas that of atrial flutter is slightly over 1,500 hours.

Dr. Raham will also investigate hybrid solutions, coupling traditional rule-based algorithms with machine learning methods, to build more powerful systems.

Products News

An updated version of Antares (v2.22) is now available. In addition to the ISHNE and Getemed format, this version of Antares includes the capability to load all the holters formats already accepted in input by CER-S and also to load the beat annotations from the “AMPS Continuous ECG Annotations” format when available. CER-S users can now process directly a recording generated by a Baxter H12+ after the CER-S beat detection.

In addition, with v2.22 it is possible to perform extractions from recordings with less than 12 leads, e.g., produced by 3-channels patch devices.

By the end of 3Q23, an updated version of CER-S (v4.6.0) is to be made available. This latest version will be compliant with the existing CE/FDA certifications.

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Troubles with your ecg data?? AMPS can help you!

- ❖ Conversion of ecg paper traces (or scanned images) into digital HL7 FDA xml ecg files
- ❖ Conversion of proprietary digital ecg files formats into the HL7 FDA xml ecg format
- ❖ Validation of HL7 FDA xml ecg and continuous recording ecg files prior to submission to the FDA ECG Warehouse
- ❖ Submission of HL7 FDA xml ecg files to the FDA ECG Warehouse
- ❖ Secondary analysis of already submitted or halted studies by performing state-of-the-art analysis such as: HRV, Holter Bin, Beat to Beat (B2B).

For further information or questions please contact: AMPS.Services@amps-llc.com