PROJECT SUMMARY: GENERATIVE ADVERSARIAL NETWORKS FOR PCG ARRHYTHMIA DETECTION

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ABSTRACT

With the rapid growth of computational power and complex algorithms, we propose a novel approach to detect arrhythmias in Phonocardiograms (PCGs). Typically, Electrocardiograms are used to diagnose arrhythmias, requiring medical-grade equipment to recognize cardiac illnesses accurately. However, PCGs provide ease of access to everyone who has a device capable of recording audio, leading to early diagnosis. Thus, allowing medical professionals to treat arrhythmias in the developmental stages. The new design is comprised of two subsystems; one is based on the relationship between Electrocardiograms (ECGs) and PCGs, and the other between PCGs and arrhythmias. The first subsystem uses a Generative Adversarial Networks (GAN), in which both generated and real PCG signals are fed into the discriminator for classification. In subsystem two, ECG spectrograms are dimensionally reduced, then constructed into PCG spectrograms using a VQGAN. Ideally, these constructed PCG spectrograms, when converted back into time series, should be identical to the ground truth. This would allow us to convert ECG datasets into PCG datasets. After testing, the GAN model (subsystem one) achieved an accuracy of 94.98%, a specificity of 90.30%, and a sensitivity of 99.52% on the testing set. Furthermore, the VQGAN showed promising results, in that the VQGAN discriminator was able to construct the general shape of the PCG spectrogram, but missed import details in the fluctuation of important biomarkers (S1 and S2). With this data, our proposed method accomplishes exemplary statistics in abnormalities detection and shows promising results in increased arrhythmia construction.

Youtube Video https://www.youtube.com/watch?v=fIPS4PGCXjI

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