

# **Analysis of atrial and ventricular premature contractions using the Short Time Fourier Transform with the window size fixed in the frequency domain**

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## **Abstract-**

**Electrocardiograms (ECGs) are the most useful available tool to diagnose heart diseases. In this paper, we focus in the comparison of subjects with atrial premature contractions (APC), premature ventricular contractions (PVC) and normal sinus rhythm. Signals are analyzed in the time-scale domain using the Short Time Fourier Transform with the Window Size Fixed in the Frequency Domain (STFT-FD), which introduces a modification to the methodology of the standard Short Time Fourier Transform. It allows to identify differences not only in the impulses of the R wave, but also in the lower frequency components. Signals from the MIT-BIH Arrhythmia Database are studied. The graphical representation of ECGs using the STFT-FD in the time-scale domain shows a regular pattern in this domain in healthy patients, where associated to the impulses, mainly two low frequency (high scale) components appear. In the case of APCs, these two low frequency components are altered around the time instant of APC. For PVCs, the triangle representation associated to the impulses allows distinguishing PVC from APC and normal sinus rhythm. In order to study the whole database, we define a set of features that characterize, in a simplified way, the graphical results, and analyze them. There is a statistical association between these features and the categories (normal sinus rhythm, APC and PVC). Preliminary results using discriminant analysis and pre-trained deep learning models are also obtained, confirming that the graphical representation provides information about irregular beats. The STFT-FD shows to be an alternative to obtain the time-scale domain, this kind of representation having potential to complement the time domain representation.**

**Index Terms-** Electrocardiogram, Fourier Transform, time-scale domain, artificial neural networks, discriminant analysis, statistical analysis, frequency, atrial premature contractions, premature ventricular contractions, heart disease.

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