# Cardiac Tachyarrhythmia Detection by Poincaré Plot-Based Image Analysis

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Tachyarrhythmia detection through RR interval analysis could improve performance of monitoring devices as implantable loop recorders with limited computational capacity, or single lead external monitoring devices with noisy signal acquisition. For this reason, a Poincarè plot-based image approach for rhythm classification is presented in this paper.

Normal sinus rhythm (NSR), atrial fibrillation (AF) and atrial bigeminy (AB) were analyzed in this study. Using different MIT-BIH databases, 27955, 3363 and 76 images were generated for NSR, AF and AB respectively using 2-minute windows with a 50% overlap. The 80% of the data available for each rhythm was used to create a reference rhythm image atlas describing the ventricular pattern of each of the chosen rhythms. The remaining 20% was classified into one of the three categories using mutual information. The process was iterated 10 times, in which images used to construct the atlas and those used to create the test set were randomly selected. NSR was correctly classified in 80.70±0.54% of times, 17.64±0.69% was classified as AF and 1.62±0.29% as AB. AF images were classified correctly in the 94.12±0.45% of the cases, as NSR in 5.34±0.54% and as AB in 0.53±0.23%. Finally, AB was successfully categorized as AB in 72.00±11.24%, as NSR in 2.00±.22% and as AF 26.00±9.14% of the times.

Poincaré plot analysis has been widely used to classify different rhythms.

However, previous studies were limited by the definition of parameters and thresholds to describe particular patters in the plot, successfully characterizing only a type of rhythm. The presented reference-image approach gathers all characteristic rhythm-specific parameters implicitly and based on the obtained results, it seems to enable the identification of different rhythms by studying the RR patterns as a whole, without relying in specific parameters and thresholds.
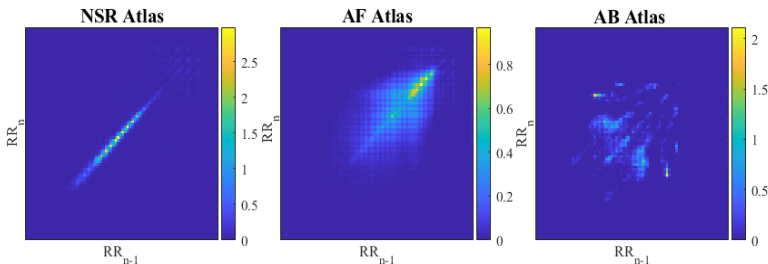


Figure 1. Atlas images computed during the study representing normal sinus rhythm (NSR), atrial fibrillation (AF) and atrial bigeminy (AB).