# A Fast and Robust Time-Series Based Decision Rule for Identification of Atrial Fibrillation Arrhythmic Patterns in the ECG

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Atrial fibrillation (AF) is a pathologic arrhythmic behaviour of the heart which occurs when the myocardium of the atrial chambers enter into a sustained chaotic and fractionated muscular contraction dynamic. AF is the major contributor to strokes in the elderly and nearly 34% of the hospitalizations by arrhythmias are AF. Reliable detection of AF episodes in long term ECG monitoring devices, such as in implantable cardioverters, is required for early treatment and health risks reduction. Methods: A decision rule for identifying AF arrhythmic patterns was derived from RR-intervals analysis of time-series generated from ECG recordings before, during and after AF episodes. Time-series elements were obtained by consecutive RR intervals time differences (deltaRR=presentRR-previousRR). The proposed decision rule used for the analysis of the deltaRR time-series consisted in two arguments to be satisfied for the identification of an AF episode. The first consisted in determining the number of deltaRR elements above 50ms absolute value within a window of 35 beats, and the first argument is satisfied if the quantity exceeds 10. Then, the second argument is operated within the same window of 35 beats which satisfied the first argument. For this, uniform dispersion of all the corresponding RR-interval elements within the window is evaluated. The latter is particularly aimed to rule out cases of type 2:1, 3:1 and 4:1 arrhythmias. Results: To assess the reliability of the AF identification scheme, two publically accessible databases were used: the MIT AF Database (N=25) and the MIT-BIH Arrhythmia Database, from which 10 non-AF ECG recordings were randomly chosen. Identification of AF using the proposed decision rule was achieved with 96% accuracy, 93% sensitivity and 97% specificity. In the computer program implementation, the processing time per ECG beat was of 129 ms. This manageable computing time requirement can enable real-time ECG processing for AF identification.