



Application of Artificial Intelligence in the Diagnosis of Supraventricular Cardiac Arrhythmias and Ventricular Bundle Branch Blocks

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ABSTRACT

Introduction: Cardiac arrhythmias are one of the most common causes of death at different ages. Diagnosing cardiac arrhythmia is a complex process in medicine, and accurate determination of the type of cardiac arrhythmia based on electrocardiography (ECG) and medical knowledge can lead to the right decision regarding the patient's condition. The use of intelligent systems helps identify heart problems. The fundamental problem in these systems is accurately identifying the heartbeat complex components in the ECG and precise classification. Various methods have been proposed to classify ECG signals, such as fuzzy logic (FL) and wavelet transform (WT). FL is an area of AI application in decision-making that enables a computer to make a definitive decision based on non-deterministic data, limiting the decision-making to only two situations, right and wrong (unlike human decision-making, which uses a range of conditions to make a decision). WT also provides a detailed analysis of the frequency content of the signal, and the resulting details can effectively represent the input data content.

Search Strategy: This review was conducted by searching the keywords "artificial intelligence", "cardiac arrhythmia", "wavelet transform", and "fuzzy logic" in Scopus, PubMed, Web of Science, and Google Scholar databases. After applying the entry and exit criteria, five articles were included in the study from 2015 to 2024.

Results: The input data were received by ECG and analyzed based on usual and abnormal PQRST database based on FL, which determines the state of health or disorder in ECG. In the analysis of WT, PQ, PR, PT, and RR intervals, the timing of P wave occurrence, and T wave occurrence, as well as the heights of the R wave, P wave, and T wave were evaluated within a single heartbeat. The combination of WT and FL was used to detect the presence and type of arrhythmia.

Conclusion and Discussion: The combination of FL and WT with other methods significantly outperforms non-combination techniques for classifying and detecting arrhythmias. The diagnosis of premature contractions, right and left bundle branch block, supraventricular tachycardia, and normal rhythm can be achieved with high accuracy (up to 96%) by combining morphological features extracted from ECG by WT and FL.

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Keywords: Cardiac arrhythmia, Fuzzy logic, Wavelet analysis

