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PREMATURE VENTRICULAR CONTRACTION (PVC) CAUSED BY DISTURBANCES IN CALCIUM AND POTASSIUM CONCENTRATIONS: A STUDY USING ARTIFICIAL NEURAL NETWORKS

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Statement of the Problem: Abnormalities in the concentrations of metallic ions such as calcium and potassium can, in principle, lead to cardiac arrhythmias. Unbalance of these ions can alter the electrocardiogram (ECG) signal. Changes in the morphology of the ECG signal can occur due to changes in potassium concentration, and shortening or extension of this signal can occur due to calcium excess or deficiency, respectively. The determination of this disorders in a conventional manner may require a long and thorough analysis of the ECG signal and specific blood tests. Besides, the diagnosis of these disorders can be complicated, making the modeling of such a system complex.

Methodology & Theoretical Orientation: An Artificial Neural Network (ANN) was utilized to model the relationships between disturbances in calcium and potassium concentrations and the morphology of the ECG signal and also for pattern recognition of an ECG signal of an individual. The procedure can be, in principle, used to identify changes in the morphology of the ECG signal due to alterations in calcium and potassium concentrations. An arrhythmia database of a widely used experimental data was considered to simulate different ECG signals and for training and validation of the methodology.

Findings: The proposed approach can recognize premature ventricular contractions (PVC) arrhythmias, and tests were performed on ECG data of 47 individuals, showing significant quantitative results, on average, with 94% of confidence. The model was also able to detect ions changes and showed qualitative indications of what ion is affecting the ECG.

Conclusion & Significance: These results indicate that the method can be efficiently applied to detect arrhythmias as well as to identify ions that may contribute to the development of cardiac arrhythmias. Accordingly, the actual approach might be used as an alternative tool for complex studies involving modifications in the morphology of the ECG signal associated with ionic changes.

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