

AI model for automatic detection of P, T waves and QRS complex in ECG signals implemented using Brazilian data from the largest public health system in the world

Abstract

Cardiovascular diseases are the leading cause of death worldwide. According to the World Health Organization data, in 2021, 17.7 million people die each year due to cardiovascular diseases. In Brazil, heart diseases account for 30% of deaths, according to the country's Ministry of Health. In this context, the use of the machine learning in medicine, especially in cardiology, is crucial to improve the effectiveness of diagnoses and treatments. Building upon this, this study presents an artificial intelligence algorithm aimed at segmenting ECG signals adapted to the Brazilian clinical reality. Adequate segmentation of electrocardiogram signals in an ECG is essential for effective medical care, enabling precise diagnoses, continuous monitoring, cost reduction, informed clinical decision-making, and more efficient time management for healthcare professionals. Our model was trained using data from the world's largest public health system, the SUS (Unified Health System), which serves more than 190 million people and faithfully represents the characteristics of the complex ethnic diversity of the Brazilian population. The following results were obtained regarding the evaluation of each point in the real ECG signals used for assessment. The ACC is 0.911. The F1 scores for detecting intervals representing the onset e offset of P, T waves, and QRS complexes are 84%, 88%, and 90%, respectively. Precision measures are 86%, 88%, and 93%, respectively. Recall measures are 81%, 88%, and 91%. Through these predictions, it was also possible to estimate the RR, PR, ST, and QTc intervals and times. These preliminary results achieved suggest a potential positive impact on clinical medical practice, with possible benefits for the management and treatment of patients with cardiovascular diseases in Brazil and around the world.

