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Electrocardiogram-Based Heartbeat Classification Using Convolutional Neural Networks

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Abstract : Electrocardiogram (ECG) signal analysis and processing are crucial in the diagnosis of cardiovascular diseases, which are considered one of the leading causes of mortality worldwide. However, the traditional rule-based analysis of large volumes of ECG data is time-consuming, labor-intensive, and prone to human errors. With the advancement of the programming paradigm, algorithms such as machine learning have been increasingly used to perform an analysis of ECG signals. In this paper, various deep learning algorithms were adapted to classify five classes of heartbeat types. The dataset used in this work is the synthetic MIT-BIH Arrhythmia dataset produced from generative adversarial networks (GANs). Various deep learning models such as ResNet-50 convolutional neural network (CNN), 1-D CNN, and long short-term memory (LSTM) were evaluated and compared. ResNet-50 was found to outperform other models in terms of recall and F1 score using a five-fold average score of 98.88% and 98.87%, respectively. 1-D CNN, on the other hand, was found to have the highest average precision of 98.93%.

Keywords : heartbeat classification, convolutional neural network, electrocardiogram signals, generative adversarial networks, long short-term memory, ResNet-50

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