ABSTRACT

Cardiovascular diseases, including arrhythmias, are a leading cause of death worldwide, making early detection crucial for timely intervention. Arrhythmias such as bradycardia and tachycardia can be detected through electrocardiogram (ECG) signals, but conventional methods often require complex infrastructure and lack efficiency. This study aims to develop a *portable* deep learning-based system for arrhythmia detection using ECG signals. The system employs a 1D Convolutional Neural Network (CNN-1D) algorithm for classification, utilizing data from the MIT-BIH Arrhythmia Database. The research methodology includes ECG signal acquisition using the AD8232 sensor, preprocessing (resampling and normalization), feature extraction, and classification with CNN-1D. Model optimization was performed by comparing optimizers (ADAM, SGD, RMSprop), *learning rate*s, batch sizes, and *epoch*s. The system was implemented on an ESP32 microcontroller with an OLED *display* and SD card storage. Results showed the model achieved 98.8% accuracy with optimal parameters (ADAM optimizer, *learning rate* 0.001, batch size 32, and 100 *epoch*s). The AD8232 sensor demonstrated 100% accuracy in calibration tests with the Fluke PS400. The system successfully detected normal and bradycardia conditions. In conclusion, this system is an effective *portable* tool for arrhythmia detection, offering high accuracy, computational efficiency, and user-friendliness. Future research could expand detection to more arrhythmia types and integrate IoT for remote monitoring.

Keyword: *heart, arrhythmia, convolutional neural network, electrocardiogram, deep learning, monitoring, CNN-1D, portable*