Chapter 9
Web-Based Application for Physical to Digital ECG Signal Analysis for Cardiac Dysfunctions

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ABSTRACT

Electrocardiogram (ECG) acts as a symptomatic tool that routinely analyzes the functions of the heart. Till recently, most ECG records were kept on thermal paper. The evaluation of ECG charts needs considerable training and can be time-consuming and daunting process. The evaluation of ECG charts needs considerable training and can be time-consuming and daunting process. We can perform diagnosis and analysis with automation by digitizing the paper ECG. We can perform diagnosis and analysis with automation by digitizing the paper ECG. The main goal of this chapter is physical to-digital fusion of ECG signal and implement machine learning algorithm. This can be achieved by extracting the P, QRS, and T waves in ECG signals to demonstrate the heart's electrical activity using various techniques. The web-based application can make use of a machine-learning algorithm that analyzes and diagnoses cardiac disorders and normal conditions by uploading the ECG image. Thereby it reduces the time-consuming and daunting process for the analysis of ECG reports.

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1. INTRODUCTION

According to the World Health Organization, cardiovascular disease is the primary factor of death. This has persisted as the major cause of death for the last 20 years. This paper emphasizes more on Signal and image processing of ECG image reports. By digitizing ECG records, the need for prolonged manual influence can be eliminated. Digitization provides the analysis and the diagnosis with less computational efficiency. The study developed and validated an algorithm for the digitization of ECG paper images. The algorithm showed a high degree of accuracy in identifying and extracting relevant ECG features such as waveforms, intervals, and segments. The algorithm was also able to produce digital ECG tracings that were comparable to those generated by standard ECG machines. The study used a dataset of 1,000 ECG paper images to develop and validate the algorithm. The images were digitized using a high-resolution scanner, and the algorithm was developed using a combination of image processing and machine learning techniques. The algorithm was trained and tested using the dataset and the performance is evaluated. One of the main limitations of the study is that it only evaluated the algorithm performance on a single dataset. Further studies are needed to evaluate the algorithm's performance on a larger and more diverse dataset. Additionally, the study did not compare the algorithm's performance to other existing methods for ECG digitization, which could provide insights into the strengths and weaknesses of the proposed approach (Randazzo et al., 2022). The study used a deep learning approach to develop a fully-automated paper ECG digitization algorithm. The algorithm was developed and trained using a large dataset of over 10,000 ECG paper images. The algorithm used a convolutional neural network (CNN) to automatically detect and extract relevant ECG features such as waveforms, intervals, and segments. The algorithm was analyzed using an individual test set of ECG paper images. The proposed algorithm achieved high accuracy in digitising ECG paper images. The algorithm provides high sensitivity and specificity in detecting various ECG abnormalities, including left bundle branch block, ST depression, and ST elevation. The algorithm has the potential to be used in clinical settings to improve ECG analysis and diagnosis. The study only evaluated the proposed algorithm's performance on a single dataset, which was relatively small. Further studies are needed to evaluate the algorithm's performance on larger and more diverse datasets. The study did not provide a detailed analysis of false positives and false negatives, which could help identify areas for further improvement. The study did not compare the proposed algorithm to other existing methods for ECG digitization, which could provide insights into the strengths and weaknesses of the proposed approach (Wu et al., 2022). The study used a deep learning approach to digitize ECG paper records and diagnose abnormal ECG signals. The dataset comprised 1000 ECG paper records, which were scanned and pre-processed to remove noise and improve image quality. The paper used a convolutional neural network (CNN) to identify ECG features such as QRS complexes, P waves, and T waves. The study also used a recurrent neural network (RNN) to classify the ECG signals as normal or abnormal. The proposed algorithm achieved high accuracy in digitizing ECG paper records. The RNN-based classification model also achieved high accuracy, with an overall accuracy of 95.6% in classifying ECG signals as normal or abnormal. The study demonstrated that the proposed technique has the ability to enhance the efficiency of ECG diagnosis. The main limitation of the study is that it only evaluated the algorithm's performance on a single dataset. Further studies are needed to evaluate the algorithm's performance on a larger and more diverse dataset. Additionally, the study did not compare the proposed approach to other existing methods for ECG diagnosis, which could provide insights into the strengths and weaknesses of the proposed approach. Finally, the study did not provide a detailed analysis of false positives and false negatives, which could help identify areas for