Chapter 9
Utilization of Artificial Intelligence-Based Wearable Sensors in Deep Residual Network for Detecting Heart Disease

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ABSTRACT

Recently, there has been growing attention to the advances in the areas of electronic and biomedical engineering and the great applications that these technologies can offer mainly for health diagnosis and monitoring. In the past decade, deep learning (DL) has revolutionized traditional machine learning (ML) and brought about improved performance in many fields, including image recognition, object detection, speech recognition, and natural language processing. This chapter discusses detection of heart disease using deep learning techniques. Here the input data has been collected based on wearable device-collected data with IoT module. This data has been preprocessed using adaptive histogram normalization, and the authors segment the image based on threshold method using Ostu thresholding technique. The segmented image feature has been extracted using generative adversarial network and classification of extracted features using deep residual network. The experimental analysis is obtained by the proposed GAN_DRN in terms of accuracy as 96%, precision of 85%, recall of 80%, F-1 score of 71%, and AUC of 75%.

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INTRODUCTION

With the growing global population and recent changes in human lifestyles, people with complex medical illnesses are on the rise. This has increased the number of individuals visiting hospitals, putting a strain on the Medicare healthcare system. As a result, there is a growing demand for remote health care systems that can help with these issues. Recently, there has been an increased focus on advancements in the fields of electrical and biomedical engineering, as well as the numerous applications that these technologies can provide, particularly in the areas of health diagnosis and monitoring. Many individuals worldwide now have access to smartphones and wearable sensors at low prices. When combined with artificial intelligence approaches, these gadgets can be used to monitor and diagnose patients with heart ailments, minimizing hospital visits and enhancing people's lives (Jiang et al., 2021).According to AHA (American Heart Association), heart disease, also known as CAD (coronary artery disease), is a term utilized to describe a variety of problems caused by plaque buildup in the walls of arteries, which causes the arteries to gradually narrow, making blood flow difficult and enhancing the risk of heart attack and stroke (Awotunde et al., 2021). Deep convolution neural network (CNN)-based techniques for authentic arrhythmia detection were used (Wu et al., 2020). Firstly, they created a deep convolution network model with higher levels. This model achieved stranded state-of-the-art performance on the PhysioNet/CinC AF Classification Competition 2017 dataset with the assistance of pre-processing. Systems with poor computer resource needs are preferable. A binarized model utilizes substantially less computational speed and storage space than a full-precision model, according to research. Using a Cascaded Convolution Neural Network (CCNN) and subjective description manner, (Yang et al., 2021) offers a 12-lead ECG arrhythmia classifier model. First and foremost, the one-dimensional (1-D) CNN is intended to automatically remove the features from the individual lead indicator. Following that, features are concatenated as a contribution to two-dimensional (2-D) densely linked ResNet modules for categorizing the arrhythmia, taking into account temporal relationships and spatial scales among different leads. CAD was a major cause of death globally in 2010, accounting for one out of nine deaths in the United States. People with HD (heart disease) may experience chest discomfort and exhaustion. However, many people have no symptoms until they have a heart attack (Ali et al., 2021).This was the primary motivation for evolving a smart method that can continuously monitor a person's heart as well as alert them to any heart-related issues. AI is a branch of computer science that tries to replicate human cognition in activities like object or pattern identification, planning, and problem-solving. The term "big data" refers to massive, heterogeneous data volumes that necessitate the use of computer tools such as AI to analyze and interpret. This comprises omics data, tabular data from electronic health records, and imaging data in health care. Individual measurable qualities or data points known as features exist inside big data. The quality, accuracy, and diversity of data elements are all important factors in AI model success.ML, a subfield of AI, allows computer techniques to learn as well as enhance over time by exposing them to large volumes of data. While there are numerous algorithmic approaches or models in machine learning, they always strive to accomplish one of two goals. First is supervised learning, which involves using a labeled data set to forecast a specific outcome. This entails selecting and weighting specific features iteratively in order to identify underlying patterns in data that best fit the outcome. Linear regression, SVM, and RF are examples of supervised learning techniques. Clustering and principal component analysis are examples of models that aim to capture correlations inherent in the structure of features themselves. DL is a type of ML that makes predictions directly from input data using multilayered ANN.CNNs are the most often utilized deep learning networks for image processing. Some of the most significant achievements of