DEEP LEARNING APPROACH FOR THE PREDICTION OF CARDIAC ARREST

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Introduction:

Sudden Cardiac Death (SCD) is invariably preceded by Sudden Cardiac Arrest (SCA), which is caused by the heart's inability to adequately pump blood to various organs, resulting in oxygen deprivation and loss of consciousness within one minute. SCA patients are resuscitated with an implantable cardioverter-defibrillator (ICD), which delivers an electrical shock to the heart to reset its electrical activity. Furthermore, cardiopulmonary resuscitation (CPR) can help SCA patients survive until medical help arrives. When SCA happens outside of the hospital, patients have only a 1-2 percent chance of survival compared to those in the hospital. The goal of research on this serious health issue has been to establish an effective means of forecasting the risk of SCA utilizing aggressive and noninvasive methods. The deep learning approach is proposed in this suggested work for the prediction of cardiac arrest from obstructive sleep apnea using prior knowledge such as the apneahypopnea index and some features. There are currently no widely approved methodologies, hence a deep learning strategy for cardiac arrest prediction is in high demand. The use of CNN in the prediction of cardiac arrest using various variables, including OSA as a major attribute, has not yet been widely used. These included missing value detection and classification algorithms, which were particularly useful for the given collection of heart-related characteristics problems, which involved a large amount of data and required a lot of time and energy if done manually. As a result, a thorough understanding of recognition and classification procedures is critical for the development of Neural Network systems, particularly in the field of medicine. A large number of people die each year as a result of these cardiovascular diseases, with estimates ranging from 40 to 50 percent of heart disease patients dying from Sudden Cardiac Deaths, characterized by A sudden irregular heart rhythm, and only about 1% of people worldwide surviving it; however, it is closer to 5% in the United States and other developed countries due to increased excessive alcohol intake, poor diet, and lack of physical activity. This study forecasts the likelihood of a person experiencing cardiac arrest shortly.

Objectives:

The risk stratification for SCD, a major cause of mortality, is difficult. OSA is linked to cardiovascular diseases and arrhythmias, and has been shown to increase the risk of nocturnal SCD. It is unknown if OSA independently increases the risk of SCD. Therefore, the main objective of the project is to identify the risk of sudden cardiac arrest associated with obstructive sleep apnea along with other attributes.

Methodology:

A convolutional neural network and a collection of pre-processing subsystems are utilized in the algorithm to detect the possibilities of cardiac arrest in terms of percentage. The suggested system's system architecture diagram is shown in Figure 1. The primary goal of the pre-processing subcomponents is to reduce the amount of data that the convolutional neural network, which is the classification subsystem, must use as input. The background of the systems before the CNN will be reviewed, as well as the basic theory behind the use of CNNs. The candidates are classified using the final layer, a sigmoid classifier. The system receives patient medical reports as input. The initial phase of the system is to eliminate attributes with less than 70% data. The data must then be imputed in the position of the missing value. The mean or median technique will be used to impute the dataset. The selection of features as shown in Fig. 1. System architecture Diagram of Cardiac Arrest Detection. The feature selection will be done using the PCA technique. PCA is a high dimensional method that reduces by translating a large number of variables into a smaller set that still contains the majority of the information in the original set, one can reduce the dimensionality of huge data sets. For feature extraction, CNN is utilized.

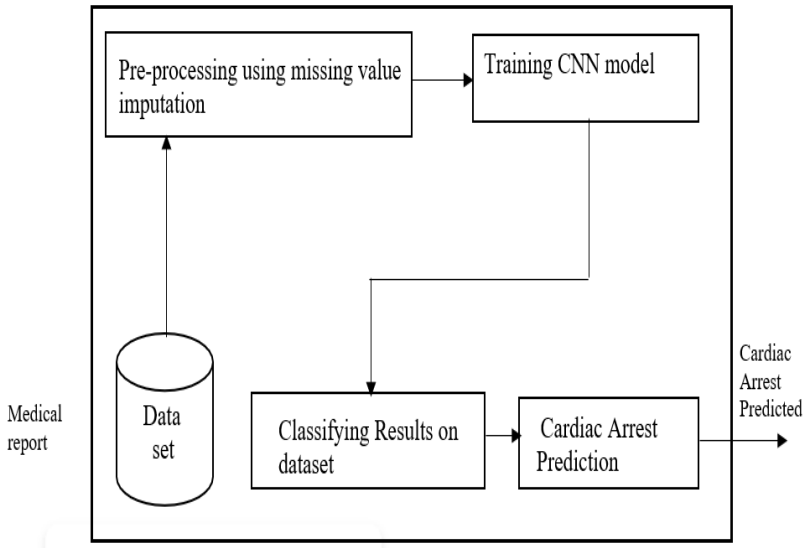

Fig. 1. System architecture Diagram of Cardiac Arrest Detection.

Conclusion:

The proposed work's outcomes were positive, with good accuracy and sensitivity in the prediction of cardiac arrest in terms of percentage. Because the information contained in a medical report is too long, the preprocessing methods utilized to limit the quantity of data supplied have proven to be there for the classification effective. The construction of

these subsystems achieved the goal of utilizing just the most important data. The data augmentation procedure has proven to be beneficial and effective. The CNN had the best performance of all the classification methods used in this study, despite two major drawbacks: the quantity of time it takes to train it and the amount of memory it requires. The system's considerably high false positives, which means that precision is extremely low, are the most serious flaw in the project's outcomes. In conclusion, the method created is beneficial for analyzing data from medical reports to determine the chance of cardiac arrest. After the CNN has been trained, it takes about seven minutes to examine a medical report, including preprocessing processes, which saves time for the expert cardiologist.

Scope for future work:

1. It is designed to predict the cardiac arrest one could get from the given data, which helps in the further diagnosis.
2. To provide high accuracy in the prediction of the cardiac arrest.
3. To reduce the mortality rate by providing proper treatment before itself.
4. It can be adapted for use with many different end-user interfaces including desktop applications, web-based browser applications and mobile applications.
5. Future research in cardiac arrest prediction should focus on identifying additional CNN compositions that outshine the one employed in this study. Modifying its architecture, which comprises numerous convolutional and pooling layers, as well as the activation and error functions employed, even though they were determined by its properties, are examples of this. Because the search procedure was thorough and thorough, future work should not be limited to adjusting hyperparameters using the same structure. The proposed model should be made available to the common users who can install and check whether the person’s health condition is at risk to consul doctors.