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A Survey on Prediction of Heart Functionality Sound by Using Deep Learning Algorithm

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ABSTRACT:
The primary objective of this study is to enhance the precision of predicting cardiovascular illnesses by introducing a sophisticated system that leverages deep learning techniques. Traditional diagnostic methods have relied on the analysis of cardiac sounds, achieving an accuracy of approximately 87.5% through the use of machine learning algorithms such as Random Forest and Decision Trees. However, these conventional approaches have their limitations. In contrast, the proposed hybrid approach aims to surpass these limitations by focusing on capturing intricate patterns and temporal relationships within heart sound data using deep learning. This innovative approach seeks to demonstrate a substantial improvement in prediction accuracy when compared to existing methods. If proven effective, this deep learning-based diagnostic tool has the potential to provide a more nuanced understanding of heart function, enabling early identification of anomalies and ultimately leading to improved patient outcomes in cardiovascular health.

Keywords: Recurrent neural networks (RNN), Random Forest and Decision, cardiovascular disorders, and long short-term memory (LSTM).

INTRODUCTION:

Heart Diseases: One of the most vital organs in your body is your heart. The heart is a muscle that is divided into two halves and has four chambers that are separated by valves, making itessentially a pump. An atrium and a ventricle, two chambers, are present in each half. Blood is drawn into the heart by the ventricles contracting and the atria (plural of atrium) gathering blood. Blood with low oxygen contentis pumped by the right side of the heart to the lungs, where blood cells may absorb more oxygen. After then, the blood from the lungs enters the left atrium and left ventricle having been given fresh oxygen. The body's organs and tissues receive the freshly oxygenated blood thatis pumped by the left ventricle. Your body needsthis oxygen to function properly and to give you energy. Heart disease, or occasionally cardiac disease (the word "cardiac" from Latin for "heart"), is the generic term for cardiac problems. Our talk centers on the two most prevalent types of heart illness, heart attack and heart failure, despite the fact that there are other forms as well. The purpose of this article is to provide you with information regarding heart
attacks and heart failure, including causes, symptoms, and treatment options. We have also included a discussion of preventative measures you may take to lessen the likelihood that you will develop heart disease or to lessen the consequences of heart disease that already exists, as both of these conditions are

somewhat preventable.

LITRATURE REVIEWS:

HEART DISEASE PREDICTION USING MACHINE LEARNING

Predicting heart disease is one of the trickiest things to do in the medical industry these days. Heart disease claims the lives of about one person per minute in the contemporary era. Processing vast amounts of data in the healthcare industry requires the use of data science. Since predicting cardiac illness is a difficult undertaking, it is necessary to automate the process in order to minimize risks and notifypatients well in advance. The UCI machine learning repository's dataset on heart disease is used in this work. The suggested study uses several data mining approaches, including Naive Bayes, Decision Tree, Logistic Regression, and Random Forest, to forecast the likelihood of heart disease and classify the risk level of the patient. In order to conduct a comparison analysis, the performance of many machine learning algorithms is examined in this work. The trial results verify that Random Forest algorithm has achieved the highest accuracy of 90.16% compared to other ML algorithmsimplemented.

Advantage:

Deep learning techniques, with their ability to capture intricate patterns and temporal relationships, may lead to a significant improvement in prediction accuracy. Deep learning excels at learning hierarchical representations of data,allowing it to automatically extract complex features from the heart sound data.

Disadvantages:

- Deep learning models, especially complex ones, often require largeamounts of labeled data for training.
- Training and running deep learning models can be computationally intensive,requiring substantial resources.

ECG-BASED ON THE MACHINELEARNING ALGORITHMS USED FOR HEARTBEAT CLASSFICATION

This study introduces a novel algorithm for enhanced analysis of Electrocardiogram (ECG) signals, leveraging two-event related moving- averages (TERMA) and fractional-Fourier- transform (FrFT) techniques. The TERMA algorithm identifies specific areas of interest to pinpoint desired peaks, while the FrFT rotates ECG signals in the time-frequency plane to reveal the locations of various peaks. The proposed algorithm demonstrates superior performance compared to existing methods. To automate heart disease classification, a machine- learning model is trained using estimated peaks, durations between different peaks, and other ECG signal features. Notably, the study utilizes the Shaoxing People’s Hospital (SPH) database, encompassing over 10,000 patients, for training, offering a more realistic dataset compared to the commonly used MIT-BIH database with only 48 patients. The uniqueness of this research lies in its cross-database training and testing approach, yielding promising results for the proposed machine-learning model.

Advantage:

- The algorithm's performance surpasses that of state-of-the-art methods, indicating its effectiveness
- in extracting relevant information from ECG signals. This can lead to more accurate and reliable diagnosticinsights.
- The study's use of a cross-database training and testing strategy, involving datasets from different sources, adds a unique dimension to the research.

Disadvantage:

- The combined use of TERMA and FrFT introduces a level of algorithmic complexity.
- The complexity of the algorithm might reduce its interpretability. Understandinghow the algorithm arrives at specific conclusions or peak identifications couldbe challenging.

HEART DISEASE PREDICTION USINGMACHINE LEARNING

This study addresses the imperative need for accurate diagnosis of cardiovascular diseases using machine learning techniques applied to electronic health data. The research explores four classification methods—Multilayer Perceptron (MLP), Support Vector Machine (SVM), Random Forest (RF), and Naïve Bayes (NB)—to construct predictive models based on significant health factors. Prior to model building, essential steps of data preprocessing and feature selection were undertaken. The evaluation of models incorporated key metrics such as accuracy, precision, recall, and F1-score.Notably, the Support Vector Machine (SVM) model outperformed the others, achieving a high accuracy of 91.67%. This underscores the potential of machine learning algorithms in providing effective predictive tools for diagnosing cardiovascular diseases based on electronic health data.

Advantage:

- Machine learning algorithms offer a proactive approach to identifying and diagnosing cardiovascular diseases, which can be life-threatening.
- The utilization of electronic health data allows for a comprehensive analysis of major health factors.

Disadvantage:

- The necessity for data preprocessing and feature selection, while essential formodel development, can introduce complexity to the workflow.
- The black-box nature of some machine learning models, especially complex ones like SVM, can limit their interpretability.

DETECTION OF CARDIOVASCULAR DISEASES IN ECG IMAGES USING MACHINE LEARNING AND DEEP LEARNING METHODS

This study introduces a novel lightweight Convolutional Neural Network (CNN) architecture that significantly enhances the accuracy of cardiovascular disease classification to 98.23%, surpassing existing state-of-the-art methods. The model operates efficiently on a single CPU, addressing computational power limitations. Notably, when employed as a feature extraction tool for traditional machine learning algorithms, the proposed method remarkably improves classification accuracy, achieving an impressive 99.79% with the Naïve Bayes algorithm. This breakthrough suggests the method's potential integration into the Internet of Things (IoT) ecosystem in healthcare. The high accuracy and resource efficiency make it a promising tool for early detection of cardiovascular diseases, emphasizing the broader impact of artificial intelligence in improving healthcare outcomes and encouragingfurther exploration of innovative methods by AI researchers in the field.

Advantage:

- The proposed lightweight Convolutional Neural Network (CNN) architecture demonstrates a remarkable accuracy rate of 98.23% in classifying cardiovascular diseases.
- The lightweight nature of the CNN architecture allows it to achieve the impressive accuracy rate while being performable on a single CPU.

Disadvantage:

- Convolutional Neural Networks, especially lightweight architectures,might lack interpretability.
- The effectiveness of the CNN architecture relies heavily on the quality and representativeness of the ECG imagedataset.

PREDICTION OF HEART DISEASE USING DIFFERENT MACHINE LEARNING ALGORITHMSAND THEIR PERFORMANCE ASSESSMENT.

This paper underscores the paramount importance of disease diagnosis in healthcare, emphasizing the potential of machine learning classification techniques to enhance precision and timeliness in this critical activity. Focusing on the challenging task of diagnosing heart disease, the study presents a comprehensive survey of various machine learning methods employed for this purpose. Utilizing two datasets, namely the UCI-heart-disease dataset and another from Kaggle, both comprising 14 patient information features, the research evaluates the performance of Support Vector Machine (SVM), K-nearest neighbors (KNN), Decision Tree, and Tensor Flow (TF). Notably, the study attains a peak accuracy of 96.42% withthe KNN method. The comparison of results across different techniques and datasets reveals insights into their respective effectiveness. Moreover, the study highlights that a more extensive dataset contributes to higher accuracy, emphasizing the potential of machine learning in advancing heart disease diagnosis for both healthcare professionals and patients, ultimately saving crucial time in the diagnostic process.

Advantage:

- The study highlights the advantage of using a more extensive dataset,demonstrating that a larger and diverse dataset contributes to higher accuracy in disease diagnosis.
- The paper presents a comprehensive comparison of different machine learning techniques and datasets, offering insights into the strengths and weaknesses of each approach.

Disadvantage:

- The accuracy and reliability of machine learning models are highly dependent on the quality and representativeness of the input data.
- The use of patient data for machine learning in healthcare raises ethical and privacy concerns.

HEART DISEASE PREDICTION USING MACHINE LEARNING TECHNIQUES

Heart disease, sometimes called cardiovascular disease, is the leading cause of mortality globally during the last several decades. It encompasses a variety of disorders that affect the heart. It links a number of heart disease risk factors and emphasizes the urgency of finding timely, accurate, and reasonable ways to diagnose the condition early on and begin treating it. One popular method for handling massive amounts of data in the healthcare industry is data mining. Researchers analyze vast amounts of intricate medical data using a variety of data mining and machine learning approaches, assisting medical personnel in the prediction of cardiac disease. This study outlinesseveral characteristics associated with heartdisease and proposes a model based on supervised learning techniques, such as random forest, decision trees, K-nearest neighbor, and Naïve Bayes.It utilizes the most recent dataset from the Cleveland database of the UCI heart disease patient repository.It utilizes the most recent dataset from the Cleveland database of the UCI heart disease patient repository. There are 76 characteristics and 303 occurrences in the collection. Just 14 of these 76 qualities are takeninto account during testing, which is crucial to proving the effectiveness of various algorithms. The purpose of this study work is to estimate thepatients' risk of

acquiring heart disease. The findings show that K-nearest neighbor yields thegreatest accuracy score.

Advantage:

- The research focuses on the importance of early diagnosis in heart disease, emphasizing the need for accurate and reliable approaches.
- Data mining is a valuable technique for processing enormous datasets in thehealthcare domain.

Disadvantage:

- The use of a specific dataset, such as the Cleveland database, may limit the generalizability of the findings to diversepopulations.
- Achieving high accuracy with a specific algorithm, like K-nearest neighbor, raises the risk of overfitting to the training data.

HEART DISEASE PREDICTION USING ARTIFICIAL INTELLIGENCE ENSEMBLE NETWORK

Heart disease has climbed its way to the top of the list of the primary causes of death all over the world. In the past, individuals also referred to heart disease as cardiovascular disease when talking about it. In India, heart disease and stroke together account for one out of every four deaths. These conditions are the leading causes of mortality in the country. It is extremely beneficial to apply machine learning to the process of making decisions and forecasts based on the vast amounts of data generated by the healthcare industry.

This is because machine learning can analyse patterns in the data to make more accurate predictions. According to the information that was provided by the WHO, cardiovascular disease is the primary cause of around 24 percent of deaths in India that are attributed to non-communicable illnesses. Coronary artery disease (CVD) is the primary cause of these fatalities. Furthermore, in industrialized nations like the United States of America and other wealthy nations, coronary heart disease is the leading cause of mortality. Around 17 million people each year lose their lives to cardiovascular disease, making it the leading cause of death on a global scale; the incidence of cardiovascular disease mortality is greatest inAsia.

Advantage:

- The automation of disease diagnosis through machine learning can save valuable time for both healthcare professionals and patients.
- The study highlights the advantage of using a more extensive dataset,demonstrating that a larger and diverse dataset contributes to higher accuracy in disease diagnosis.

Disadvantage:

- The use of patient data for machine learning in healthcare raises ethical and privacy concerns.
- The accuracy and reliability of machine learning models are highly dependent on the quality and representativeness of the input data.

A. Analysis Table:

S.no	apertitle	Techniques	dressedissue
1	Heart Disease Prediction using Machine Learning	Random Forest algorithm	Training andrunning deep learning models can be computationally intensive, requiring substantial resources.

2	ECG-based machine- learning algorithmsfor heartbeat classificati on	The TERMA algorithm	The combined use of TERMA and FrFTintroduces a level of algorithmiccomplexity.
3	Heart Disease Prediction Using Machine Learning	MultilayerPerceptron(MLP), Support Vector Machine (SVM)	The necessityfor data preprocessing and featureselection, while essentialfor model development, can introduce complexity tothe workflow.
4	Detection of cardiovascular diseases inecg images using machine learning and deep learning methods	CNN	Convolutional Neural Networks, especially lightweight architectures, might lack interpretability .
5	Predictionof Heart Disease Using	Tensor Flow (TF),Decision Tree, and	The accuracy and reliability of machine learning
	Different Machine Learning Algorithms And Their Performance Assessme nt.	K-nearestneighbors(KNN).	models arehighly dependent onthe quality and representativeness of the input data.
6	Heart Disease Prediction using Machine Learning Techniques	Naïve Bayes, decisiontree	The use of aspecific dataset, such as the Cleveland database, maylimit the generalizabilit y of the findings todiverse populations
7	Heart Disease Prediction Using Artificial Intelligence EnsembleNetwork	CNN	The use ofpatient data for machine learning in healthcare raises ethical and privacyconcerns.

CONCLUSION:

The paper discussed various algorithms and processes in the context of heart disease diagnosis, emphasizing the importance of accurate predictions for timely interventions. Through the analysis, it has been concluded that deep learning algorithms are likely to be more efficient in audio processing for this specific application.

Deep learning, a subset of machine learning, has demonstrated remarkable capabilities in handling

complex patterns and relationships within data. In the context of audio processing for heart disease diagnosis, deep learning algorithms can excel in capturing nuanced features present in heart sounds or related audio signals. The intricate patterns in these signals, which may be challenging for traditional algorithms to discern, can be effectively identified and analyzed by deep learning models. Moreover, deep learning algorithms, particularly neural networks, have the ability to automatically learn hierarchical representations from the raw audio data. This feature extraction capability is crucial in tasks where the relevant information might be distributed across various layers of the data. The conclusion drawn from the paper suggests that, given the complexity of audio data related to heart diseases, employing deep learning algorithms in the analysis process can lead to enhanced accuracy and reliability in diagnostic predictions. This is based on the understanding that deep learning models are adept at handling intricate and multi- dimensional data, making them well-suited for tasks involving audio processing and pattern recognition in healthcare applications.

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