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Arrythmia Disease Prediction using Deep Learning Techniques

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Abstract: *The major goal of this study is to put into practise a straightforward algorithm to identify the illness arrhythmia. Any issue with a person's heartbeat's pace or rhythm is referred to as arrhythmia, which is a sickness. The heart cannot adequately pump blood when it is not beating appropriately. The danger that the organs may shut down or suffer damage is very great when this occurs, making it impossible for the lungs, brain, and all other organs to function properly. Arrhythmias are frequently thought to be unimportant and untreated. The doctor once stated that if someone develops an arrhythmia, they should determine whether it is abnormal or only interferes with the heart's normal function. The results of the ECG report are typically examined by the doctors to determine the heartbeat rate. Maximum accuracy in identifying the disease is possible with deep learning. The model is created as the source data are used to train it and build the model. These data are used by the model to train itself, and it uses the previously learned data to forecast the occurrence of the disease. As a result, the disease's presence is established, and the model is supplied with data from the reports. Hence, by doing so, the likelihood of diagnosing errors and the amount of time needed to analyse the report are both significantly decreased.*

Keywords: Arrythmia Detection, Deep Learning

I. INTRODUCTION

A type of heart condition called arrhythmia is brought on by a person's irregular heartbeat. When a heart rate estimate is outside of the normal range, side effects can be identified. Early detection of this illness may significantly lower the risk of mortality. Deep learning algorithms are utilised to identify the disease. Deep learning makes it possible for computers to "self-learn" from training data over time and advance without explicit programming. In essence, deep learning models and algorithms gain knowledge through experience.

II. LITERATURE SURVEY

[1]Rahul Katarya & et.al: Healthcare professionals have long had a difficult and important task: predicting and detecting cardiac disease. To treat cardiac disorders, hospitals and other institutions provide pricey therapies and procedures. So, being able to detect cardiac disease in its early stages will help individuals all over the world take the required precautions before it becomes severe. The consumption of alcohol, tobacco, and a lack of exercise are the main causes of heart disease, which has become a serious issue in recent years. Machine learning has proven successful over time at making judgements and predictions from the vast amount of data generated by the healthcare sector. Artificial neural networks (ANN), decision trees (DT), random forests (RF), support vector machines (SVM), naive Bayes (NB), and the k-nearest neighbour method are a few of the supervised machine learning approaches employed in this prediction of heart disease. Also, a summary of these algorithms' performances is provided.

[2]Senthilkumar Mohan & et. al: One of the leading causes of death in the modern world is heart disease. Clinical data analysis faces a significant problem when predicting cardiovascular disease. With the use of machine learning (ML), it has been demonstrated that it is possible to make predictions and judgements from the vast amount of data generated by the healthcare sector. Additionally, we have observed the employment of ML approaches in recent advancements across several IoT domains (IoT).Only a few research have looked into using ML to predict cardiac disease. In this study, we suggest a unique approach to improve the precision of cardiovascular disease prediction by

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identifying key features using machine learning techniques. Several feature combinations and many well-known categorization strategies are used to introduce the prediction model. With the use of a computer programme, we were able to create a model of the human brain that could be used to forecast the brain's activity (HRFLM).

[3] Rifki Wijaya& et.al: In this paper, they discussed about the development of heart prediction using machine learning (in this case the Artificial Neural Network or ANN). According to Miss Chaitrali's paper, 13 factors can predict heart disease. By examining the model heart rate data, it is possible to predict a person's heart illness one year in advance. Data collection tools include a smart chair, smart mouse, smart mirror, and smart phone. Data on heart rates were gathered online and stored on a server. With this method, learning is carried out over a year to collect adequate data for predictions. A person's awareness of heart disease can be raised if it can be predicted that they will develop the disease within a year. The approach is also anticipated to decrease the number of heart disease patients and heart disease-related mortality.

[4] SeyedaminPouriyeh & et. al: This study compares and contrasts the efficacy of several data mining categorization systems for heart disease prediction using ensemble machine learning techniques. The major database for training and testing the built system was the Cleveland data set for cardiac disorders, which has 303 occurrences. To enhance the amount of data, which would have otherwise been constrained, 10-Fold Cross-Validation has been used. There have been used a variety of classifiers, including Decision Tree (DT), Naive Bayes (NB), Multilayer Perceptron (MLP), K-Nearest Neighbor (K-NN), Single Conjunctive Rule Learner (SCRL), Radial Basis Function (RBF), and Support Vector Machine (SVM). The dataset has also been subjected to the ensemble prediction of classifiers, bagging, boosting, and stacking. The results of the studies show that the boosting technique-based SVM approach works better than the other methods listed above.

[5] Mihir J. Gaikwad & et.al: The biggest cause of patient mortality is heart disease, which has been a major public health problem in recent years. The main causes include excessive alcohol consumption, smoking, and a sedentary lifestyle. Heart disease is renowned in medicine for being challenging to predict, find, and diagnose. Hospitals and other institutions administer pricey medications and procedures to treat cardiac ailments. Heart disease is becoming more prevalent, according to a recent WHO study. As a result, 17.9 million individuals pass away in 2019. As the population increases, diagnosis gets more challenging. People all throughout the world will therefore benefit from early detection of cardiac disease because it will enable them to receive necessary treatment before it worsens. Machine learning has proven successful at making judgements and predictions from a large set of data provided by the healthcare industry, thanks to recent technological advancements. Support Vector Machines (SVMs), Gradient Boosting Classifier (GB), Decision Tree (DT), Random Forest (RF), and Logistic Regression (LR) on the "UCI Machine learning repository for Statlog (Heart) Data Set" are some of the supervised machine learning techniques used in this paper to predict heart disease. Additionally, the findings of these algorithms are discussed, and a proposal is made to employ the algorithm with the highest accuracy for predicting Heart Disease on a web application. Medical professionals will utilise this programme as a decision assistance system in their clinics and individuals at home.

III. EXISTING SYSTEM

The already pre-existing standards for identification of the irregular heartbeat has a significant drawback – human errors. As the name quite suggests it is said to be creeping in at times, we don't expect it. As there may possibility for a human who tends to make error unintentionally, i.e., human errors cannot be eliminated at all times. Even with systems that detect the heartbeat it does so with variable and inconsistent accuracy thereby, contradicting the very purpose it is created for. The existing system which has been trained using several algorithms has only produced a system with way less accuracy and the system fails to give the predicted value to the user. Thus, usage of such systems results in inconsistent predictions and also provides the result with a variable accuracy which tends to deceive the sole purpose of the system. Generally, a machine system is preferred only to overcome such human errors while the existing systems just tries to reduce the error percentage rather than eradicating the prediction error at most possible. The existing system fails to provide the predicted outcome for the given data which makes the prediction unreliable. Which is considered as a major drawback of the model. The model must provide results with the accuracy for its trustworthiness.

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IV. PROPOSED SYSTEM

The sole purpose of the proposed system is to address the significant problems in already existing systems which is said to induce inconsistency and chaos i.e., human errors, and to do it in a way that the system reaches maximum accuracy while doing so. The build model will be selected upon satisfying various accuracy measures. Datasets of various persons heartbeat who previously suffered from irregular heartbeat and normal persons heartbeat are being obtained to train and test the model to predict the model with maximum accuracy. The use of machine learning algorithms makes the model to provide more precise predictions on a long run as the model still learns from the predictions. Instead of the traditional ways of providing an unreliable output, the system aims to provide the user with a predicted value which generally ranges from values (0 to 1) i.e., the probability, of the person not suffering from Arrythmia and person suffering from Arrythmia creating a model that produces results with maximum accuracy and trustworthiness.

V. SYSTEM ARCHITECTURE DESIGN

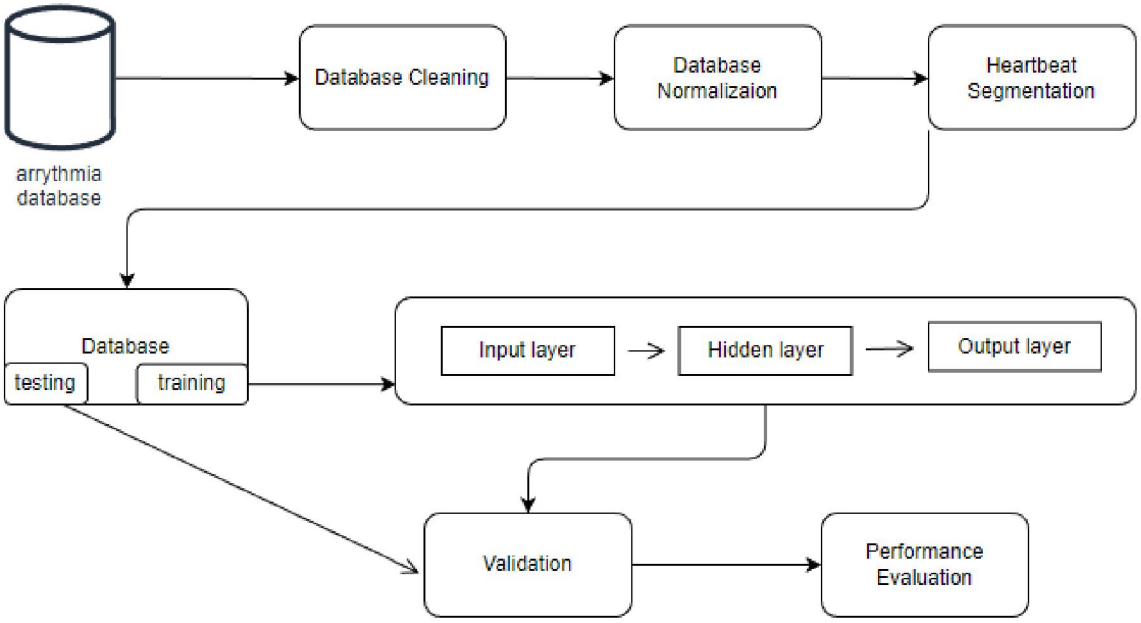

Figure 1: Architecture Diagram

VI. IMPLEMENTATION

6.1 Data Collection

One of the most crucial steps in creating a machine learning model is data collection. We gather the particular dataset in accordance with the demands from the internet. Also, the dataset includes some undesired data. So, we must first pre-process the data to create the ideal data set for the algorithm.

	age	sex	height	weight	qrs_duration	p-r_interval	q-t_interval	t_interval	p_interval	qrs	...	KY	KZ	LA	LB	LC	LD	LE	LF	LG	diagnosis
0	75	0	190	80	91	193	371	174	121	-16	...	0.0	9.0	-0.9	0.0	0	0.9	2.9	23.3	49.4	8
1	56	1	165	64	81	174	401	149	39	25	...	0.0	8.5	0.0	0.0	0	0.2	2.1	20.4	38.8	6
2	54	0	172	95	138	163	386	185	102	96	...	0.0	9.5	-2.4	0.0	0	0.3	3.4	12.3	49.0	10
3	55	0	175	94	100	202	380	179	143	28	...	0.0	12.2	-2.2	0.0	0	0.4	2.6	34.6	61.6	1
4	75	0	190	80	88	181	360	177	103	-16	...	0.0	13.1	-3.6	0.0	0	-0.1	3.9	25.4	62.8	7
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
447	53	1	160	70	80	199	382	154	117	-37	...	0.0	4.3	-5.0	0.0	0	0.7	0.6	-4.4	-0.5	1
448	37	0	190	85	100	137	361	201	73	86	...	0.0	15.6	-1.6	0.0	0	0.4	2.4	38.0	62.4	10
449	36	0	166	68	108	176	365	194	116	-85	...	0.0	16.3	-28.6	0.0	0	1.5	1.0	-44.2	-33.2	2
450	32	1	155	55	93	106	386	218	63	54	...	-0.4	12.0	-0.7	0.0	0	0.5	2.4	25.0	46.6	1

Figure 2: Dataset used

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6.2 Data Preprocessing

We need to gather the required dataset for model training when using ML algorithms for prediction or analysis. Pre-processing can be done in a variety of ways. Pre-processing data can be carried out by:

- Data cleaning
- Data transformation
- Data selection.

We have two options: build our own code or use external libraries. A module for keras and tensorflow augmentation is available. With keras, we can preprocess data for images, texts, and sequences. It must be imported using the import keyword before we can use it.

- **Data cleaning:** Fill in missing numbers, smooth noisy data, locate or get rid of outliers, and deal with inconsistencies when cleaning data. By deleting the complete row of the missing data row, we will attempt to remove the missing data from the dataset.
- **Data transformation:** Can involve smoothing, aggregation, generalisation, and other processes that enhance the data's quality. We shall try to transform the data from distinct form to a general form.
- **Data selection:** Consists of a few techniques or features that let us choose the pertinent data for our system. Now, we'll choose the information that will be most helpful in making our prediction. That doesn't imply that other data should be deleted from the dataset since they are useless.

VII. CONCLUSION

In every field of work, human error is an unavoidable one across world. So in order considering that in mind, the above model was proposed to provide a solution to overcome human errors in the identification of the irregular heart beat and to provide a suitable treatment based on the condition of the report found. At the end of the project, it is believed that it'll fulfill its proposed purpose and also provide solution with maximum accuracy which can be later on used in medical fields. The use of learning algorithms helps the model to provide accurate solutions and also the utilization of the maximum potential of the existing algorithms helps in training the model to provide and suggest the precise solution that could be obtained.

VIII. FUTURE WORKS

An effective approach for pre-processing datasets before they are examined by Deep Learning algorithms was created in this model. Since we only have a little amount of data to train the model with, we might try to give it multiple sets of data, and we might also use real-time medical data to train the model effectively. In order to interact with the model effectively and to make it more usable, we may also create a graphical user interface. The goals and outcomes of this research can also be applied to the field of neural networks, where there has been a great deal of similar work.

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