

How to Cite:

Khandhan, C. R., Sowndharya, P., & Visalini, N. D. (2022). A machine learning method for heart disease prediction using convolutional neural network. *International Journal of Health Sciences*, 6(S8), 488–497. <https://doi.org/10.53730/ijhs.v6nS8.9727>

A machine learning method for heart disease prediction using convolutional neural network

Mr. C. Rukumani Khandhan

Assistant Professor, Computer Science and Engineering, K.S.Rangasamy College of Technology, Tiruchengode-637 215, Namakkal District, TamilNadu, India

Corresponding author email: rukumanikhandhan.c@gmail.com

P. Sowndharya

Students, Computer Science and Engineering, K.S.Rangasamy College of Technology, Tiruchengode-637 215, Namakkal District, TamilNadu, India

Email: sowndharyapanneer08@gmail.com

N. D. Visalini

Students, Computer Science and Engineering, K.S.Rangasamy College of Technology, Tiruchengode-637 215, Namakkal District, TamilNadu, India

Email: visalinideepa30@gmail.com

Abstract---Heart disorder is one of the complicated sicknesses and globally many human beings suffered from this disorder. On time and green identity of coronary heart disorder a key function in fitness care especially withinside the area of cardiology. The utility of disorder prediction the usage of system gaining knowledge of withinside the scientific analysis area is growing successively. This may be contributed mainly to the development withinside the type and pinpointing structures utilized in disorder identity and reputation structures utilized in disorder analysis that's capable of offer records that aids health workers in early identity of deadly sicknesses and therefore, elevating the survival price of sufferers importantly. Applying distinctive styles of algorithms, every with its personal benefit on 3 separate databases of disorder (Heart) to be had in UCI repository for disorder prognosis. The results regarding the identification of diseases using machine learning algorithm has strengthen the concept of the applying of machine learning in early detection of diseases, so that the disease can be diagnosed in the early stage itself and then it can be treated as earlier. So that the survival prices of the sufferers may be increased. A guide vector system and synthetic neural network, educated with dataset of spectra and algorithms, were carried out for prediction of disorder. Coronary infection forecast using data mining is possibly the maximum exciting and trying out task. The loss of situation be counted specialists and

excessive wrongly analyzed instances has required the want to foster a brief and effective discovery framework. As according to beyond framework the becoming a member of of medical desire assist with PC primarily based totally affected person file can lessen medical mistakes, may be made extra genuine and sooner or later enhance affected person security. The framework facilitates in forecast of coronary infection with the aid of using thinking about risky issue associated with coronary infection. Here machine applies Here framework applies calculation on verifiable records/data of affected person and it offers highlights like Age, Sex, Smoking, Overweight, Alcohol Intake, Bad Cholesterol, Blood Pressure and Heart Rate to make forecast of coronary infection with better precision.

Keywords---DL, CNN, MLP, heart disease.

Introduction

Heart is one of the most vast and crucial organs in the human body, it requires special attention. Because the majority of diseases are linked to the heart, it is necessary to predict heart diseases, which necessitates a comparative study in this field. Today, most patients die because their diseases are detected at an advanced stage due to instrument inaccuracy, so there is a need to learn about more efficient algorithms for disease prediction. Calculating the accuracy of four distinct machine learning algorithms and determine which one is the best based on the results. Traditional disease risk models often use a machine learning and supervised learning method that uses training data with labels to train the models. Patients are classified as high-risk or low-risk in groups test sets. However, these models only use low-level algorithms. Existing systems can predict disease using one or two machine learning algorithms. Although existing methods may forecast diseases, their accuracy is modest. It is unable to predict disease severity. Due to a shortage of professionals and a significant number of incorrectly diagnosed cases, a quick and efficient detection method is required. This work proposes a convolutional neural network approach for machine learning that can accurately predict cardiac disease. This work provides an effective methodology that uses a large number of datasets as input to predict heart disease in a short amount of time and with high accuracy.

Objectives

- i. To determine how many participants in the dataset have heart disease and what type of heart illness they have
- ii. Using a convolutional neural network technique, deliver a better outcome in detecting heart problems in less time
- iii. To achieve a high level of accuracy in detecting cardiac disease in a dataset
- iv. To address the demand for a quick and efficient detection system due to a shortage of specialists and a significant number of incorrectly diagnosed cases

Literature Review

In literature the researchers have proposed different machine learning-based diagnosis strategies to diagnose HD. Machine Learning (ML) provides a vast range of possible implementations in medicine and can be of tremendous benefit, according to Aleksei Dudchenko, Matthias Ganzinge, and others. Nonetheless, cardiovascular diseases account for nearly a third of all fatalities worldwide. Is machine learning used in cardiology, and what progress has been made so far? To address this question, present a systematic review aimed at finding studies in which machine learning algorithms were used in the field of cardiology, as well as an overview based on the current literature of state-of-the-art ML algorithms used in cardiology [2]. Amin Ul Haq, Jianping Li et al., has proposed that detection of coronary heart disorder (HD) through the usage of fashions of system getting to know (ML) could be very powerful in early tiers. Cleveland coronary heart disorder dataset changed into for assessment of the gadget[4]. Jalaluddin Khan and Salah Ud Din et al., has proposed that powerful detection of breast most cancers is specially crucial for recuperation and remedy withinside the preliminary phases[5]. Reddi Sivaranjani, Vankamamidi et al., has proposed that coronary heart sickness prediction is a burning issue, no matter age, paintings pressure, stress, and meals habits, which could disturb the coronary heart functionality. [9]. Gamal G. N. Geweid et al., has proposed that currently, Heart failure sickness is taken into consideration a multifaceted scientific sickness affecting tens of thousands and thousands of humans worldwide. [7]. L. Zhu, J. Shen, L. Xie et.al has proposed that moreover, lots of them fail to make the most complicated and high-order semantic correlations that inherently exist amongst images [19]. S. Raschka et.al has proposed an appropriate use of version evaluation, version choice, and set of rules choice strategies is important in instructional system gaining knowledge of studies in addition to in lots of business settings[13]. Amin Ul Haq , , Jian Ping Li et al., has proposed that giant interest has been paid to the correct detection of diabetes[3]. A. U. Haq, J. Li, M. H. Memon et.al has proposed the correct analysis of Parkinson sickness specially in its preliminary levels is extraordinarily complicated and time consuming[15]. Shah Nazir , Sara Shahzad et.al has proposed software program additives are vital elements of a machine which play a essential position withinside the universal feature of a machine[12]. J. Li and H. Liu et.al has proposed characteristic choice, as a kind of measurement discount technique, has been validated to be powerful and green in coping with excessive dimensional records[18]. Shah Nazir , Ijaz Ahad , et al., has proposed that the affected person of Parkinson's ailment (PD) is going through a vital neurological sickness problem[11]. Jianping li, Salah ud din et al., has proposed that coronary heart ailment is one of the complicated illnesses and globally many human beings suffered from this ailment. The capabilities choice algorithms are used for capabilities choice to growth the class accuracy and decrease the execution time of class machine[1]. Senthilkumar Mohan, Chandrasegar Thirumala et al., has proposed that coronary heart ailment is one of the maximum enormous reasons of mortality withinside the international today[6]. Mordecai Folarin Raj, Sana Ullah Et Al., has proposed that analysis of coronary heart illnesses via bill primarily based totally strategies in addition to normal clinical primarily based totally techniques aren't reliable[10]. A. U. Haq, J. Li, M. H. Memon et.al has proposed Heart disorder is one of the maximum important human illnesses in the international and influences human lifestyles

very badly[16]. Xiao Liu, Xiaoli Wang et.al has proposed coronary heart disorder is one of the maximum not unusualplace illnesses in the international[20]. A.Jović , K. Brkić et.al has proposed function choice (FS) techniques may be utilized in facts pre-processing to obtain green facts reduction[17]. R. Alzubi, N. Ramzan, et.al has proposed system studying strategies have the capacity to revolutionize clinical prognosis[14]. Jalaluddin khan, Muhammad Hammad Memon et al., has proposed that correct and green reputation of Parkinson's disorder is one of the distinguished troubles in the area of healthcare. Specifically, a hybrid function choice set of rules has been designed via way of means of integrating the Relief and ant-colony optimization algorithms to pick out applicable capabilities for schooling the version [8]

Existing System

In existing system the Prediction using traditional disease risk model usually involves a machine learning and supervised learning algorithm which uses training data with the labels for the training of the models. Patients are classified as high-risk or low-risk in groups test sets. However, these models only use low-level algorithms. Machine learning algorithms such as Support vector machine, Logistic regression, Artificial neural network, K-nearest neighbour, Naive bays, and Decision tree can be used to predict disease. It is unable to predict disease severity. Existing systems can anticipate diseases, but they aren't always correct, and they demand a lot of storage space. Existing medical systems, such as hospital administration and decision-making systems, concentrate on gathering and processing all medical data. All patient records are loaded, and all considerations are taken into account. Misdiagnosis has been underutilised and misunderstood by existing methods. A crucial characteristic that connects and addresses all of these difficulties. The key is to mine the misdiagnosis attribute because the users' initial diagnosis would have already covered all of the underlying variables such as the patient's medical history and various other factors, allowing the user to focus on either missed variables such as hidden symptoms, prevailing conditions, complications, and so on, or heart diseases that are similar to the one already diagnosed.

Disadvantages

- i. It necessitates a lot of storage space.
- ii. A complex decision tree is generated if the dataset type is numeric.
- iii. SVM was designed to solve the binary class problem, and it can also handle the multiclass problem by splitting it down into two classes: one versus one and one against all
- iv. The training of the dataset is very difficult and very complicated to implement by the algorithm to the system
- v. Less accuracy

Proposed Methodology

In the proposed work client will search for the coronary infection determination (coronary infection and remedy associated records) through giving dataset. These manifestations are pre processed to make the in addition cycle easier to find out

the symptoms boundary which assists with spotting the coronary infection swiftly through using CNN algorithm . The manifestations which trap word is coordinated with the placed away medical information records set to understand the severa coronary heart Diseases diagnosed with that worth. Different coronary heart Diseases is recognized, it'll make the instance coordinating on the subject of the severa coronary heart Diseases and moreover find out the chance of coronary heart Diseases. Then, at that point, the coronary infection will make a differential evaluation to find out the coronary infection exactness.

Implementation

Data visualization and pre-processing

The lacking characteristics are supplanted with becoming characteristics. Certain characteristic values are used to pick out the category output. Henceforth it's far removed and the end result feature characterizes the goal or ward variable on this way diminishing the listing of abilities traits. The algorithmic techniques carried out for encompass importance exam and characterization are extravagantly brought withinside the accompanying sections. The dataset has been pre processed for talented use with the aid of using the classifier procedures, for example, erase of lacking characteristics, everyday scalar, or Min and Max Scalar.

Risk prediction

The algorithm are grouped utilizing Multi-Layer Perceptron's(MLP), Convolutional Neural Network (CNN), Long Short-Term Memory (LSTM) ,Gated intermittent units (GRU), Bidirectional Long Short-Term, Memory(BiLSTM), Bidirectional Gated repetitive units(BiGRU) using each one of the provisions of CAD information. The end result of the idea fashions may be used to choose the maximum fitting/encouraged procedure. An exam of displayed that the usage of a coronary heart ailment estimate in getting greater aware about the outcomes, to have a greater uplifting mindset closer to powerful identification.

Classification algorithms

Planned profound getting to know calculations are focused round a profound multi-aspect translation of framework and plan guideline. Further, the realization layout is applied to pick out if sufferers have coronary contamination depending on the instruction version. The exhibition has been accredited for accuracy, the blunder likelihood, particularity, affectability, accuracy. To request intercourse (goal class) the usage of hair period as characteristic limit, installing a version the usage of any collecting computations to create a few recreation plan of cutoff situations that may be used to isolate the male and girl genders the usage of hair period because the making plans incorporate. In intercourse portrayal case the cutoff situation should the maximum best hair period regard. Then, at that point, the records are bunched utilising Multi-Layer Perceptron's(MLP), Convolutional Neural Network (CNN), Long Short-Term Memory (LSTM), Gated intermittent units (GRU), Bidirectional Long Short-Term Memory(BiLSTM), Bidirectional Gated repetitive units(BiGRU) utilising each one of the factors of CAD information. Further, a far off affected person checking (RPM) degree is proposed, that is

satisfactorily proficient to display the affected person commonly with assist To acquire information approximately the sufferers' well-being barriers like heartbeat, ECG and pulse and ship an emergency cautioning to the parent with their real situation and entire medicinal subtleties. Here the Feature willpower is needed for profound getting to know assist in mild of the truth that sometimes non-relevant provisions have an effect on the profound getting to know characterization productivity. The desire of factors expands the accuracy of characterization and diminishes the version time. The DL calculations had been applied for deciding on highlights, and a multi-aspect perceptron calculation has been used for parallel order issues.

Ensemble classification

EDCNN has been proposed for the early expectation of coronary infection and willpower. The UCI save dataset has been used for the willpower reason, and CNN classifier and multi-side perceptron (MLP), Gated intermittent units (GRU), Bidirectional Long Short-Term Memory (BiLSTM), Bidirectional Gated repetitive units (BiGRU) module has been applied to set up important ECG pulses for spotlight extraction. The CNN capacities as an detail extractor block due to the beat characterization issue. The final enactments getting from the final convolution layer are applied as contributions to an organization. A cluster standardization layer and an enactment work comply with the essential convolutional layer utilising a numerical convolutional process. Using the making plans dataset to similarly broaden restrict situations that would be used to pick every goal elegance. At the factor while the cutoff situations are settled, the accompanying undertaking is to count on the intention elegance. In batching, the contemplation is not to count on the goal elegance as all collectively, it is moreover endeavoring to gather the close to type of factors via way of means of thinking about the maximum glad condition, each one of the matters in a similar social event must be equal and need to no unmistakable get-collectively matters to now no longer be relative Experiment outcomes display the superiority of the proposed method as to forecast precision of Ensemble characterization record with the provisions selected via way of means of outfit, multiple scientific records want to use this model. The precision may be moreover elevated with extra records occasions

Algorithm

Convolutional neural network

A convolutional neural organization (CNN, or ConvNet) is a category of profound neural organizations, maximum usually implemented to dissecting visible symbolism. They have packages in photograph and video acknowledgment, recommender frameworks, photograph characterization, Image division, medical photograph investigation, ordinary language dealing with, cerebrum PC interfaces, and economic time series. The "absolutely connectedness" of those companies makes them willing to overfitting statistics. Normal strategies of regularization contain including a few kind of length estimation of masses to the misfortune work. CNNs undertake an change approach closer to regularization: they take advantage of the innovative instance in statistics and gather greater

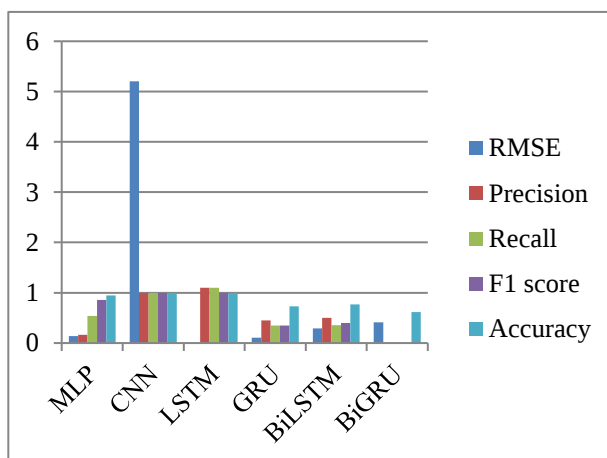
difficult examples making use of greater modest and much less complicated examples. Subsequently, on the scale of connectedness and intricacy, CNNs are at the decrease outrageous. Convolutional networks had been enlivened via way of means of herbal cycles in that the provision layout among neurons takes after the affiliation of the creature visible cortex. Individual cortical neurons react to upgrades simply in a restricted place of the field of vision referred to as the open field. The open fields of diverse neurons to a few diploma cross-over with the give up purpose that they cowl the complete field of vision. CNNs make use of reasonably minimum pre-dealing with contrasted with different photograph characterization calculations. This means that the company learns the channels that during traditional calculations had been hand-designed. It is simple to extract signatures from man or woman facts instances, as their systems simply gather the signs and symptoms that sufficient to scaling samples. Can without difficulty expect the coronary heart Disease stage and severity without difficulty the use of variety stage of queries. It is feasible coronary heart Diseases ranked in step with the range of signs and symptoms matched withinside the database. The CNN features as a characteristic extractor block because of the beat type problem. The very last activations acquiring from the final convolution layer are used as inputs in a network.

Result

Man-made intelligence approach referred to as the danger estimate path of motion for peril elements for cardiovascular affliction. It tries to paintings at the insightful accuracy of cardiopathy hazard with an alleged outfit approach. Subsidiary path of motion offers excessive accuracy and excessive versatility, even withinside the remedy of unstructured facts, regarded in another way in relation to conventional request. The perceptive restrict has been tried and reachability of the cardiovascular mathematical version in Heart Failure sufferers to paintings at the shot at making the mathematic components to apprehend the possibility of coronary illness occasions.. The Cleveland Heart Disease Data determined withinside the UCI AI keep carries 14 additives surveyed on 303 humans who've coronary disorder. People have been collected into 5 stages of coronary disorder. The facts approximately the pollutants popularity is withinside the Heart Disease goal academic grouping. Three statistics outlines with 303 observations at the going with 14 elements. The credit of Cleveland academic collection are age, sex, cp - chest torture. Type (standard angina, atypical angina, non-angina torment, asymptomatic), trestbps laying circulatory pressure on assertion, cholserum cholesterol, fbs fasting glucose, relaxation ecg resting ECG end result, thalch maximum critical heartbeat refined, antique peak - ST wretchedness brought on thru making ready recognized with relaxation, tendency of the top exercise ST Segment, ca - quantity of fluoroscopy protected vessels, thal reversible deformity and class (injured/healthy). After consolidate reducing improve visiting seven hazard elements: cp, thalch, exang, antique zenith, slant, ca, thal. By loading the dataset as an enter, then via way of means of thinking about the 14 elements, the end result suggests that many of the given enter facts how lots of them having what sort of coronary heart disease. The take a look at effects display regarded in another way on the subject of normal structures attracts near, for instance, Multi-Layer Perceptron's (MLP), Convolutional Neural Network (CNN), Long Short-Term Memory (LSTM), Gated repetitive units (GRU), Bidirectional Long Short-

Term Memory(BiLSTM), Bidirectional Gated intermittent units(BiGRU) taking into consideration the evaluation the organized insightful shape can beneficially select the danger stage of coronary disease sufficiently.

Algorithm	RMSE	Precision	Recall	F1 score	Accuracy
MLP	0.1510	0.1722	0.5522	0.8656	0.9555
CNN	5.2066	1.0	1.0	1.0	1.0
LSTM	0.0	1.1	1.1	1.0	1.0
GRU	0.1143	0.452	0.349	0.3493	0.729
BiLSTM	0.299	0.501	0.3518	0.4012	0.769
BiGRU	0.4125	0.0	0.0	0.0	0.616



Conclusion

In our human body, coronary heart is a extensive organ. In the occasion that the blood motion to the frame is lacking, the organs of the frame which are cerebrum and coronary heart cease operating and dying occurs in couple of moments. The maximum riding purpose for loss of life universally from latest years is referred to as coronary infection. In this way, it's far a extensive concept to count on Heart illness at a starting segment to avoid human dying. The importance of facts mining in scientific location is recounted and steps are taken to use relevant techniques withinside the Disease Prediction. The boundary on which coronary infection location of some and steps are taken to use extensive method withinside the Disease Prediction. Coronary infection is reliant is extremely powerless and variation. Subsequent to conducting chronicled information approximately the affected person, coronary infection may be anticipated. Here, the proposed method predicts the coronary infection depending on the chronicled scientific facts of affected person the usage of CNN with excessive degree of accuracy and much less time consumption. We might be getting the Proposed CNN set of rules because the exceptional output result.

Future Work

Further more the obtaining of the better result and the better accuracy for the CNN classifier to get the full highly accurate result than the previous result. A Convolutional neural organization is altogether more slow because of an activity, for example, maxpool. Assuming the cnn has a few layers, the preparation cycle takes a tone of time if the PC doesn't comprise of a decent GPU. Updating these techniques through the related ideas and other upgraded cnn strategy can be worked on later on work.

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