

Prediction of Heart Disease Symptoms using Convolutional Neural network

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Abstract— Heart disease is a common effect on people from ancient time. There are different types of heart disease types they approach patients with effective blood pressures to overcome this the best approach is to use medical image processing techniques the one best approach is to use convolutional neural networks that model will analyze and classify the pixel datasets. The dataset is used for the study of various lifestyle-related features of an individual that can be age and sex also blood pressure. The convolutional neural network model uses the best dataset to demonstrate that model is reached the high accuracy level or not. For detection we need a best analyzing tool to process the medical images and to produce a accurate high efficient results.

Keywords— Trained model, CNN-based model, flatten, stride, deep learning, classifiers, pixel data structure.

Introduction

Heart disease was lead to causing deaths in Globally by past analysis and diagnosis. By the treatment all can signify for improving the patients' health by using the medical data which was increasing by the technology which was used in now a days and there is also a lot of interest in developing the new automation systems which can accurately predict the heart diseases without any fault convolutional neural network is a type of neural network which is used to predict the medical images and also analyze its symptoms the convolutional neural network model is trained model with medical images of patients without any heart disease and try to predict the features and will define a difference between trained model and non-trained model. If once the model is trained, then the model goes on predicting its features then ultimately improves patients health. development.

Introducing Heart Disease: The heart disease is defined as the affecting the blood vessels for the reason of the high pressure in the human body. Heart disease also defined as the affect of the Blood vessels by range of Symptoms like heart muscle disease, heart valve disease. The most type of common disease is coronary heart disease. In the United States the coronary heart disease is most popular disease. The heart attack can cause the Blood pressure, If the blood pressure is decreased then it is considered as Heart attack Disease. Now-a-days heart disease is most leading Disease in the United States. The heart disease is more preliminary cause in the united American states.

TYPES OF HEART DISEASE

Heart Failure: The Heart Failure occurs when the heart muscle cannot pump the Blood. This occurs when there is vulnerability in muscles of a heart. The heart failure can cause at any spot of time for a heart patient also they can predict that when it can occur. This impact can be on the buildup fluid can impact the Blood Pressure and breathing problem and swellings on legs and hands.

Valve Disease: The missing of leaflets on the heart is known as valve disease. The most commonly effected valve in the heart is aortic valve. In which the valve Disease will be containing only two leaflets in it so, the

Resultant will be the valve Disease.

Inherited Heart conditions: An inherited heart disease is defined as the disease which was passed through the parent's genes. Inherited cardiac disease is a rare disease it is a combination of all heart diseases. This heart disease is identified as the most common rare disease in the world where the genes is passed from the

parent to child level. The inherited cardiac disease has types of heart diseases which is originated from the Inherited level.

Heart Attacks: Heart attack is defined as the when blood supply to the heart is completely blocked. When the blood vessels stop its functionality in the blood flow then it is considered as Heart Attacks. Heart Attacks is a part of Type of Heart Attack which is based on the blood flow of a vessels and based on the pumping of blood flow of vessels.

Aortic Disease: The Aortic disease is defined as the valve disease where the functionality of left chamber and main aorta does not work properly. The aortic valve helps the blood flow is to flow in the correct direction. The Aortic Blood pressure is caused due to connective tissue disorders. Such, that can be syndrome Aortic Disease is commonly a Aortic disease. The Aortic disease is combinedly combination of all diseases, this can result many vulnerable heart diseases. The disease will result in decrease of immunity and blood pressure of blood vessels.

Congenital Heart conditions: The Congenital heart conditions are defined as the blood flows. This can affect the structure of baby's heart this can vary mild in hole of a heart. The most common heart defect is ventricular septal defect. This is a very rare heart disease cause in the type of heart diseases.

Literature Reviews

Aniruddha Datta done research on efficient convolutional neural network for disease related to the coronary for prediction of heart disease in November 30 2020 published externally with article number 113408. The state was published in the state which support of support vector machine. For a prediction of a dataset for exhibiting a CNN neural network. This research is done in the 77 percent of absence of negative accuracy.

Zenghui wang published research on the improved sparse autoencoder based on heart disease for prediction of disease of heart the method Which he was introduced uses an unsupervised machine learning algorithms. The wang used an autoencoder to specify a unsupervised machine learning Technique. The Artificial neural network classifier is used for the improving a efficient model for neural networks. It is published on volume 8 in 2020.

Atiqur Rahman was published a Diagnostic system for Heart disease prediction based on configured deep neural network. He used different support systems based on the previous studies. They focus both on features of elimination. He examined the different features from the efficient model. For Search strategy for good performance of the datasets. He used different features for removing a overfitting and underfitting problem for evaluating the features of the

convolutional neural network model for the usage of activation functions.

Mohammad ayub introduced an iot framework for prediction of a disease using classifier he relevantly used the Long short term memory for reduction of irrelevant features generated in the model of convolutional neural networks technique was used with the technology with a minimum cost of dataset.

Akalya Devi published a research on Analysis of neural networks prediction on heart disease using the data sets. She analyzed that health is major reason for the prediction of heart diseases. Extracting a data from the hospital data. Her main objective is to analyze different medical data. The objective of her paper is to minimize the clinical tests of a research content of health industry.

Rahat Hossain done a research study on the Artery heart disease for the coronary Artery heart disease for a computational intelligence Techniques. He analyzed that there are various prediction of techniques mechanism for the support vector machine. The resultant that was obtained was as of machine learning arbitrary constants. The highest accuracy found was 98 percent most focuses on the art of heart disease prediction.

Leandro done a research work on the approach for the congestive heart failure which was associated with the high prevalence that has recent health cares. The Heart disease prediction provided methods that pressures on the Convolutional neural network. By presenting a accurately a neural network model they compromised with detection of accuracy mechanism.

Amr Tobla from a king Saud university published a new article on 2019 globally the heart disease where the diagnosis treatment was improved. He proved that the Deep learning methods will learn new feature techniques the deep learning deals with the new features associated with a developed models that was initially developed.

Young Zhi Huang done a research article on applying an neural network to filter a prediction model. He supposed to explain that the insufficient blood supply to heart for count less a cardiac functionality which kills the heart simulation from the blood to the cardiac auscultation. The main objective of the Huang is to implement that how heart sounds are regenerated from the heart origin during the heart effect.

Zhen Liu elaborated a content in the predicting a heart disease for the risk heart failure related to the sequential data modelling. Where the heart patient

records are used to predict the records of the hospitals and also refers to the vitamin, heart insufficient failures. Heart failure and also insufficiency is used to predict a heart disease. Our own idea analyzes the keymetrics.

Rajendra Acharya initially started automated detection of coronary artery disease of Ecg segments with convolutional neural networks. He analyzed that the due to the coronary disease the resultant will be decrease level of blood pressure. He used a automated system because of automated system we used the abnormal conditions and because of the accurate conditions with the percent accuracy of 95 percnet.

Syed Ahmed done a research on the mutually informed neural networks which optimizes the generalization for capability of Decision support. He analyzed. The model they evaluated for the dataset collection. He observed various symptoms related to the heart disease. They usedfor a detection of a heart disease.

Magesh kumar published a research paper on the effective prediction of heart disease using a swarm algorithm. The main impact for the high morality rates considered the major functions to schedule a work for prediction consideration of major data minimization techniques used in the data learning techniques. The clinical dataset relevant of data features for minimum highest prediction of image dataset.

Keith Chan published an efficient approach based on the information to predict disease associations using Deeplearning on emerging the evidence which indicates which plays a circum role for identification a biological diagnosis for biological experiments for gathering the semantic information that gather for biological experimentation, with the 80 percent of sensitive data under the semantic analysis using the gaussian interaction.

Mehedi Zaman implemented a research mechanism on the heart failure related to the stacked ensemble machine algorithm having a major hazard issue of the time. He analyzed that the converting to massive techniques of deep learning. He used the majorly oversample synthetic techniques. Through out the investigation the algorithms used was kmeans and fuzzy algorithm set. The oversampling technique was more designed that possiblyused to failure impact.

Amir Hajjam firstly developed a model for feature selection and principle component analysis related to the heart diseases the main aim of the heart cardiac disease is reduce the dimensionality reduction. The developed dataset contains 90 percent of Hungarian methods which would require the computation of the raw data. The

computation of the raw data will consist of the valuable predictable data.

Avinashvardarajan analyzed cardiovascular risk factors from retinal fundus photographs using Deeplearning. He discovered medical conditions. He had analyzed that there are number of patterns and regulations in prediction of the heart disease. And had visualized that there are somany cardiovascular risk factors associated with the heart.

Basit Raza who was from comsats university has analyzed and studied on the optimally configured and improved Belief network approach for the heart disease prediction which will use the genetic algorithm. He used for predicting a feature to process a feature in the heart disease he used multifactor system performance. He also analyzed some metrics that involved to execute the ReLufunctions.

Ming Cheng visualized the content in hypertension mechanism on the patients based on the health records received from patients from the biomedical community in the disease multiple disease prediction. He analyzed different evaluation metrics involved in the processing of the target disease the autoencoder networks are fully captured in the large number of the raw data.

David Mendes assisted himself for predicting a new version of mechanism for detection of Heart disease. He analyzed that the many administrative used the AI algorithms to implement and discover new mechanisms for predicting and protecting the heart disease. The objective of this to test apps in Artificial Intelligence field for nonlocked algorithms which are used for prediction of various mechanisms.

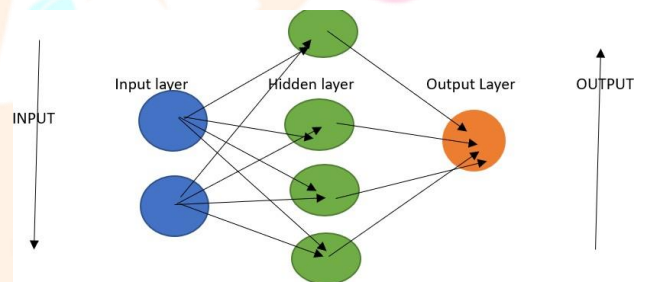
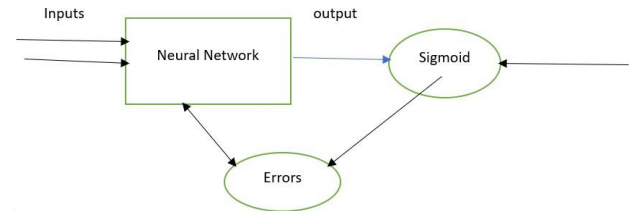
Balasubramanian a researcher conducted a research study on the development of big data predictive Analysis using machine learning prediction technique. He able to identified that there are more classification techniques forresearch on the heart prediction techniques Analysis. There are some parameters Associated related to the Convolutional neural networks. He conducted some experiments for predicting the patients health disease.

Takeshi konuma conducted a research study on methodology for predicting and analyzing the dataset for prediction of Heart disease. He observed that the retrospective study included 1031 cardiac characterizations on heart disease. In the resultant they included all type of data sets for disease prediction heart disease. so, Takeshi konuma who was a researcher predicted various chest radiographs for evaluating the metrics in evaluation of metrics involved in confusion matrix.

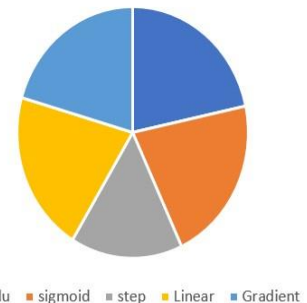
Literature

Author, year	methodology	Prediction(Accuracy)
Aniruddha Dutta,2020	Expert systems	100 %
Zenghui wang,2020	autoencoder	98%
Rahman,2019	Statistical model	85%
Khan,2020	MDCCN classifier	91%
Rajamhona,2018	Neural networks	78%
Islam Ayon,2022	Prediction	100%
Mihaela Porumb,2020	Network approach	96%
Zafer,2019	Classification	88%
Jimmy,2019	Ensemble methods	92%
C.che,2018	Data modelling	96%
Rajendra Acharya,2017	Neural network	87%
Bukhari,2020	Generalization	92%
Mageshkumar,2022	Deep Learning	81%
Keith Chan,2020	Associations	98%
Ishaq,2020	Prediction	99%
Anna Karen,2017	Feature selection	89%
Poplin ,2018	Risk factors	97%
Ali,2020	Deep learning	100%
Liang,2018	Neural networks	87%
C. Yao,2016	Neural model	99%
Venkatesh,2019	Analytics model	98%
Toba,2019	Systematic flow	97%

Flow of execution: The execution for a neural network will work on the efficient sigmoid function and on the function activation all inputs are provided to the efficient image processing model then the model can give the accurate output.



Prediction of Activation Functions in Convolutional NeuralNetwork



Proposed Methodology: The methodology that used in Detection heart disease is convolutional neural network it uses the combination of the components that are pooling and padding techniques. The main proposed methodology that was used for developing a mechanism for detection of heart disease.

Evaluation Metrics Involved in Heart disease detection:

Confusion matrix: The confusion matrix is field of machine learning that there will be classification mechanism and also known as confusion matrix. It is a table for a specific layout of visualization techniques. The confusion matrix comes under the supervised learning technique.

Metrics Involved In the matrix:

- a) Condition positive
- b) Condition negative
- c) True positive
- d) True Negative
- e) False positive
- f) False Negative

The conditional positive deals with the real positive cases in the data also negative condition deals with the negative conditions in the cases of the data. True positive the condition may indicate the presence of condition related to the characteristic. True negative indicates the absence of the characteristic of the data. False positive includes that the wrongly indication of the particular condition of the data that the presence of attribute. False Negative will be indicating the particular condition related to in the absence of the attribute.

Convolutional neural Network: convolutional neural network mechanism where the algorithm works in a superior way. The image processing and speech processing takes place. They will have three input layers. They are three defined layers:

- A) Convolutional layers
- B) Pooling layers
- C) Fully connected layers

A) Convolutional layers are the first layer of a convolutional neural network where the additional layers of a greater portions of image. As the image data processing starts then the input of the dimensions of kernel will be in the feature map and activation map.

B) Pooling layers are the part of neural networks where the number of dimensionality layers will be reduced in the part of convolutional layers and the aggregation function to the values will be as of maximum pooling and average pooling.

The maximum pooling is a pooling technique in neural networks where the maximum value will be carried out of the approach in the terms of pixels.

Average pooling is a type of pooling technique where the output of pooling will be calculated within the presence of neural networks. The average pooling uses a average value technique where it calculates the value as of smallest or biggest in the pixel data.

C) Fully connected layer the fully connected layer is a type of layer the convolutional neural network The fully connected layer will describes it self and the pixel of input of image is not directly associated with the output of layer. Each node in the output layer directly connects to the previous layer.

Types of Convolutional neural networks:

Fukushima the founder of convolutional neural network in 1980 with the help of back propagation mechanism. More famously yann lecun successfully applied back propagation for the handwritten zip code. Some of the Architectures includes:

- A) Alex net
- B) google net
- C) res net

Convolutional Neural networks in Computer vision: In the vision of the computer convolutional neural networks plays a major role. It works on the based on the provided inputs and generate the accurate image processing data set. The convolutional neural networks possibly works on visualized inputs.

- Marketing
- Healthcare Sector
- Retail sector
- Automotive

Future Scope: The future scope of the prediction of heart disease using convolutional neural network is prediction of images using neural networks. In future we and our team will be elaborating more content in deriving a new mechanism for the prediction of disease using enhanced and developed neural networks. On the basis of this we can be able to detect the prediction of heart diseases easily.

Conclusion: The overall research work in predicting a heart disease using convolutional neural network has become for me a major advantage in gaining knowledge in the field of Artificial intelligence. So, that we analyzed that the convolutional neural network plays a major role in the terms of operating, implementing, discovering a role in neural networks. The major aspect of the implementation of convolutional neural network is implementation of activation functions through the neural network such as relu, sigmoid. I hope that this paper will give complete reference about the disease prediction using neural networks.

References:

- 1) Aniruddha Dutta, Tamal Batabyal, Meheli Basu, Scott T. Acton, An efficient convolutional neural network for coronary heart disease prediction, Expert Systems with Applications, Volume 159, 2020, 113408, ISSN 0957-4174, <https://doi.org/10.1016/j.eswa.2020.113408>.
- 2) Ibomoiye Domor Mienye, Yanxia Sun, Zenghui Wang, Improved sparse autoencoder based artificial neural network approach for prediction of heart disease, Informatics in Medicine Unlocked, Volume 18, 2020, 100307, ISSN 2352-9148, <https://doi.org/10.1016/j.i.mu.2020.100307>.
- 3) L. Ali, A. Rahman, A. Khan, M. Zhou, A. Javeed and J. A. Khan, "An Automated Diagnostic System for Heart Disease Prediction Based on χ^2 Statistical Model and Optimally Configured Deep Neural Network," in IEEE Access, vol. 7, pp. 34938-34945, 2019, doi: 10.1109/ACCESS.2019.2904800.
- 4) M. A. Khan, "An IoT Framework for Heart Disease Prediction Based on MDCNN Classifier," in IEEE Access, vol. 8, pp. 34717-34727, 2020, doi: 10.1109/ACCESS.2020.2974687.
- 5) S. P. Rajamhoana, C. A. Devi, K. Umamaheswari, R. Kiruba, K. Karunya and R. Deepika, "Analysis of Neural Networks Based Heart Disease Prediction System," 2018 11th International Conference on Human System Interaction (HSI), Gdansk, Poland, 2018, pp. 233-239, doi: 10.1109/HSI.2018.8431153.
- 6) Safial Islam Ayon, Md. Milon Islam & Md. Rahat Hossain (2022) Coronary Artery Heart Disease Prediction: A Comparative Study of Computational Intelligence Techniques, IETE Journal of Research, 68:4, 2488-2507, DOI: 10.1080/03772063.2020.1713916
- 7) Mihaela Porumb, Ernesto Iadanza, Sebastiano Massaro, Leandro Pecchia, A convolutional neural network approach to detect congestive heart failure, Biomedical Signal Processing and Control, Volume 55, 2020, 101597, ISSN 1746-8094, <https://doi.org/10.1016/j.bspc.2019.101597>.
- 8) Zafer Al-Makhadmeh, Amr Tolba, Utilizing IoT wearable medical device for heart disease prediction using higher order Boltzmann model: A classification approach, Measurement, Volume 147, 2019, 106815, ISSN 0263-2241, <https://doi.org/10.1016/j.measurement.2019.07.043>.
- 9) Jimmy Ming-Tai Wu, Meng-Hsiun Tsai, Yong Zhi Huang, SK Hafizul Islam, Mohammad Mehedi Hassan, Abdulhameed Alelaiwi, Giancarlo Fortino, Applying an ensemble convolutional neural network with Savitzky-Golay filter to construct a phonocardiogram prediction model, Applied Soft Computing, Volume 78, 2019, Pages 2940, ISSN 1568-4946, <https://doi.org/10.1016/j.asoc.2019.01.019>.
- 10) B. Jin, C. Che, Z. Liu, S. Zhang, X. Yin and X. Wei, "Predicting the Risk of Heart Failure With EHR Sequential Data Modeling," in IEEE Access, vol. 6, pp. 9256-9261, 2018, doi: 10.1109/ACCESS.2017.2789324.
- 11) U. Rajendra Acharya, Hamido Fujita, Oh Shu Lih, Muhammad Adam, Jen Hong Tan, Chua Kuang Chua, Automated detection of coronary artery disease using different durations of ECG segments with convolutional neural network, Knowledge-Based Systems, Volume 132, 2017, Pages 6271, ISSN 0950-7051, <https://doi.org/10.1016/j.knsys.2017.06.003>.
- 12) L. Ali, S.A.C. Bukhari, An Approach Based on Mutually Informed Neural Networks to Optimize the Generalization Capabilities of Decision Support Systems Developed for Heart Failure Prediction, IRBM, Volume 42, Issue 5, 2021, Pages 345-352, ISSN 1959-0318, <https://doi.org/10.1016/j.irbm.2020.04.003>.
- 13) Jaishri Wankhede, Palaniappan Sambandam & Magesh Kumar (2022) Effective prediction of heart disease using hybrid ensemble deep learning and tunicate swarm algorithm, Journal of Biomolecular Structure and Dynamics, 40:23, 133341-13345, DOI: 10.1080/07391102.2021.1987328

- 14) Lei Wang, Zhu-Hong You, Yu-An Huang, De-Shuang Huang, Keith C Chan, An efficient approach based on multi-sources information to predict circRNA–disease associations using deep convolutional neural network, *Bioinformatics*, Volume 36, Issue 13, July 2020, Pages 4038–4046, <https://doi.org/10.1093/bioinformatics/btz825>.
- 15) A. Ishaq et al., "Improving the Prediction of Heart Failure Patients' Survival Using SMOTE and Effective Data Mining Techniques," in *IEEE Access*, vol. 9, pp. 39707-39716, 2021, doi: 10.1109/ACCESS.2021.3064084.
- 16) Anna Karen Gárate-Escamila, Amir Hajjam El Hassani, Emmanuel Andrès, Classification models for heart disease prediction using feature selection and PCA, *Informatics in Medicine Unlocked*, Volume 19, 2020, 100330, ISSN 23529148, <https://doi.org/10.1016/j.i mu.2020.100330>.
- 17) Poplin, R., Varadarajan, A.V., Blumer, K. et al. Prediction of cardiovascular risk factors from retinal fundus photographs via deep learning. *Nat Biomed Eng* 2, 158–164 (2018). <https://doi.org/10.1038/s41551-018-0195-0>
- 18) S. A. Ali et al., "An Optimally Configured and Improved Deep Belief Network (OCI-DBN) Approach for Heart Disease Prediction Based on Ruzzo–Tomba and Stacked Genetic Algorithm," in *IEEE Access*, vol. 8, pp. 65947-65958, 2020, doi: 10.1109/ACCESS.2020.2985646.
- 19) Ren, Y., Fei, H., Liang, X. et al. A hybrid neural network model for predicting kidney disease in hypertension patients based on electronic health records. *BMC Med Inform Decis Mak* 19 (Suppl 2), 51 (2019). <https://doi.org/10.1186/s12911-019-0765-4>
- 20) C. Yao et al., "A Convolutional Neural Network Model for Online Medical Guidance," in *IEEE Access*, vol. 4, pp. 40944103, 2016, doi: 10.1109/ACCESS.2016.2594839.
- 21) Venkatesh, R., Balasubramanian, C. & Kaliappan, M. Development of Big Data Predictive Analytics Model for Disease Prediction using Machine learning Technique. *J Med Syst* 43, 272 (2019). <https://doi.org/10.1007/s10916-019-1398-y>
- 22) Toba S, Mitani Y, Yodoya N, et al. Prediction of Pulmonary to Systemic Flow Ratio in Patients With Congenital Heart Disease Using Deep Learning–Based Analysis of Chest Radiographs. *JAMA Cardiol*. 2020;5(4):449–457. doi:10.1001/jamacardio.2019.5620

