Dissimilar Technologies for the Prognosis of Cardiovascular Diseases: A Review

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***Abstract*−Because of the rise in death tally due to cardiovascular diseases, there is a requirement of a system in position for precisely forecasting cardiovascular disease. Many models were proposed by several investigators to predict cardiovascular diseases by employing dissimilar technologies such as ANN, ML, DM,GA etc. This paper reviewed the work done by most of the investigators through different approaches for the prognosis of cardiovascular disease. A particular assessment has been supported in the work.**

Keywords: Heart Disease Prognosis, Cardiovascular Disease, Deep Learning(DL), Artificial Neural Networks (ANN), Fuzzy Logic(FL), Data Mining(DM), Genetic Algorithm(GA)

I. Introduction

Cardiovascular disease beingthe crucial affair in person existence is related to Cardiologist disease[1]. Heart diseases or cardiovascular diseases (CVD) have come out as one of the most prime source of death globally. In India, cardiovascular disease is the foremost root of morbidity and temporality. Therefore, achievableand precise prediction of cardiovascular disease is of great significance [2]. Meditative science is developing excellentlyfor a better standardofhealth maintenance. These technologydevelopments coverthe proceduretoerror-free diagnosis and forecast of diseases. Machine learning provides many rapid and authentic results to attainexcessiveperfectionfor prognosis heart diseases.In addition to Machine Learning, ANN (Artificial Neural Networks), DL (Deep Learning), FL(Fuzzy Logic), Data Mining (DM), Genetic Algorithm(GA) are also used for predicting heart diseases[3].

Thedissimilar soft computing techniques are comparedto predict whether a patient suffers from cardiovascular disease or a patient does not suffers from cardiovascular disease found on a blend of threat elements (attributes) relating ill health is the primary objective of this paper.

II. Techniques Analysed Basis

A. Machine Learning

It is an abstraction that a workstationplan of action canfollow and modifyup to datefactsdevoid of person interference.

Different types:

1. *Supervised Machine Learning:* On familiar input and output data, a model (replica) is being instructed such that future outputs can be predicted in supervised learning.
2. *Unsupervised Machine Learning:* Here unseen patterns or inherent formations arefound in input data.
3. *Reinforcement Machine Learning(RL):*RL shares out the capability of studying the consortium between stimuli, actions, and the occurrence of pleasant events, called rewards, or unpleasant events called punishments.

B. Deep Learning

Deep learning assists to educate computers to carry outall that happens of course to human beings: graspat instance and examinations.

C. Artificial Neural Networks (ANN)

ANN deals with algorithms motivated by the composition and responsibility of the brain.

D. Data mining

Data Mining is termed as a procedure to remove usual data out of a huge deposit of some fresh data.

E. Fuzzy Logic

FuzzyLogic (FL) is deliberated to model logical reasoningwith indefinite and non-specific statements.

F. Genetic Algorithms

Genetic algorithm reflects the process of natural selection where the fittest individuals are selected for reproduction to produce offspring of the next generation.

III. Literature Review

Theanalysis has been given in this section. Table I giveswriting paperquickexplanation and Table II givesthe professionalattribute assumed in the writing paper discussed.

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Table I: Quick Explanation

S. No	Year	Ref. No	Description
1.	2020	[1]	Topredictheart disease, Deep Neural Network was employed using Talos optimization.
2.	2020	[5]	MAPO algorithm was proposed with other machine learning algorithms to predict heart disease.
3.	2020	[6]	For the prognosis of heart diseases, Classification algorithms were used and dissimilar perfections were acquired.
4.	2020	[7]	The Partial Least Square Method was used in Structural Equation Modelling for the analysis of data.
5.	2019	[8]	The machine learning algorithm neural networks had proved to be the most accurate and reliable and hence used in the proposed system.
6.	2019	[9]	An expert system was introduced with better performance having accuracies in the range of 57.85–91.83%.
7.	2019	[4]	Models of machine learning were developed out of which logistic regression carry outleading 0.87% accuracy.
8.	2019	[11]	For the diagnosis of heart disease, a Decision tree and artificial neural network was employed.
9.	2019	[2]	Different machine learning algorithms were compared based on Framingham Heart Study dataset.
10.	2019	[13]	Naive Bayes and Random Forest Classifier algorithms have shown better accuracy rates when compared with Support Vector Machine.
11.	2019	[14]	Artificial Neural Networks attains a higher accuracy of 95%.
12.	2019	[27]	The author proposed algorithms like KNN, NBayes and SVMto analyze the heart disease. From the experimental results,Naïve Bayesprovides 86.6%precise results.
13.	2018	[15]	For the prognosis of heart disease, a hybrid model was put forward. Random forest classifier and simple k-means algorithm machine learning techniques were pre-owned.
14.	2018	[16]	The author proposed a hybrid algorithm based on machine learning. Random Forest classifier and a simple k-means algorithm were used.
15.	2018	[17]	Accuracy 98.30% is achieved with Support Vector Machine (SVM) algorithm.
16.	2018	[18]	For the conduction of the lineage management of the deep learning model, two algorithms Tracking-Ancestors algorithm and Find-Specified-Ancestor algorithm was designed.
17.	2017	[19]	The Decision tree model and Naïve Bayes classifier had predicted the heart disease with an accuracy of 91% and 87% respectively.
18.	2017	[20]	An accuracy of 78% is achieved on the diagnosis of a hybrid OFBAT-RBFL heart disease system.
19.	2017	[21]	Different algorithms were proposed to predict heart disease accurately.
20.	2017	[22]	Decision Tree, Naïve Bayes, Multilayer Perceptron, K-Nearest Neighbor and Support Vector Machine (SVM) wereused to predict the heart disease.
21.	2016	[23]	The logistic regression is employed with an accuracy of 85%.
22.	2016	[24]	In the paper, a hybrid ANN and Fuzzy_AHP were used to predict heart failure.
23.	2016	[25]	To analyze the risk of CardioVascular Diseases, a deep learning approach was employed.
24.	2016	[26]	Average K-nearest neighbour algorithm was proposed in this paper.
25.	2016	[28]	ANN, K-nearest neighbor classification, decision trees, Naive Bayes classifiers and support vector machine (SVM)were pre-ownedforof prognosisheartdisease, out of which ANNandSVMwerebest.
26.	2016	[29]	REMI algorithm using STULONG and UCI data bases was used to predict the risk of coronary artery atherosclerosis using ML.
27.	2015	[30]	Adecision tree and fuzzy logic model were used with achieved accuracy 69.51% to predict Coronary Heart Disease.
28.	2015	[31]	Feed forward Back Propagation learning algorithm was used to test the model with accuracy for heart disease to 88%.
29.	2015	[32]	Fuzzy K-NN approach is used to diagnose heart disease.
30.	2014	[33]	Neural Network and Genetic Algorithm was pre-owned to diagnose the heart disease. Genetic neural approach predicted the heart disease up to 98% accuracy.
31.	2014	[3]	ANN algorithms were applied to the dataset with 13 attributes. MLP gives more accurate and efficient results.
32.	2013	[34]	ANN & LR have been used for preparing predictive models.
33.	2013	[35]	For the prediction of heart disease, Probabilistic Neural Network (PNN) was used with an accuracy 92.10%.
34.	2013	[36]	Decision trees, SVM and logistic regression were analyzed to diagnose cardiovascular disease.
35.	2013	[37]	Genetic algorithm and Neural network techniques in MATLAB provides precise results of 89%.
36.	2012	[38]	Associative classification algorithm employs genetic approach techniques to diagnose the patient disease. Precision attained 88.9%.

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37.	2012	[39]	A HDPS (Heart Disease Prediction System) was proposed using multilayer perceptron neural network.
38.	2012	[40]	To diagnose heart disease, Genetic algorithm and multilayer perceptron neural network were employed. Genetic algorithm achieved an accuracy of 94.17%.
39.	2012	[46]	To classify heart disease, a fuzzy based expert system with particle swarm optimization (PSO) had been progressed in order 93.27% correct classification was achieved.
40.	2012	[47]	In this paper, Decision Support System had been progressed to investigate the data with an accuracy 94.17%.
41.	2011	[41]	To diagnose the heart disease, ANN techniques were applied. The accuracy came out to be 80%.
42.	2010	[42]	Genetic algorithm was employed to diagnose the heart ailments.
43.	2010	[43]	Naive Bayes algorithm, Decision list algorithm and k-nn algorithm were used for the prediction of heart disease.

TABLE II: TECHNOLOGY USED

S No.	Year	Technology Used	References
1.	2020	Deep Learning/Data Mining	[1]/[6]
		Machine Learning	[5],[6],[7]
2.	2019	Machine Learning	[8],[9],[4],[11],[2],[13],[14]
		Data Mining	[27]
3.	2018	MachineLearning/Data Mining	[16],[17]/[17]
		Fuzzy-Neural Network/DL	[15]/[18]
4.	2017	Machine Learning	[20]
		Rule-Based fuzzy-Logic Model	[19],[21],[22],[20]
5.	2016	Deep Learning/Data Mining	[25]/[28],[26]
		Fuzzy-ANN	[24]
6.	2015	Fuzzy/ANN	[16]/[22]
		Fuzzy-ANN	[21]
		Data Mining/ANN	[36]/[34],[35],[33],[3],[23]
		Genetic Algorithm	[37],[10],[33]
9.	2012	Genetic Algorithm/Fuzzy	[38], [40], [12]/[46]
10.	2011	ANN	[41]
12.	2010	Genetic Algorithm/Data Mining	[42]/[43]

IV. ANALYSIS

Based on the prediction of cardiovascular disease, work on comparative analysis has been done on publishing in the middle of years 2010 and 2021.

Fig.1 shows the share of dissimilar technologies employed for the prediction of cardiovascular disease.Machine learning has been used by many researchers(nearly 38%) followed byan artificial neural network.

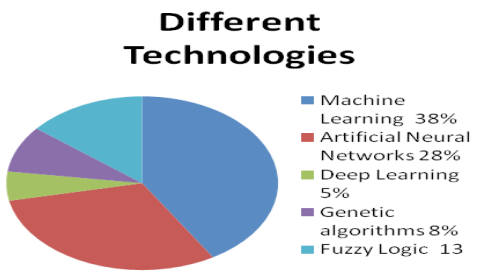

Fig. 1: Share of Dissimilar Technologies Employed for Cardiovascular Disease

Fig. 2 shows publishing is done in the middle of 2010 and 2021 in spread of 2 years. The graph appears that ample analyses pre-owned for this study were printed in the middle of 2010and 2021. Therefore, the study implies the current labour at an end for the prognosis of cardiovascular disease.

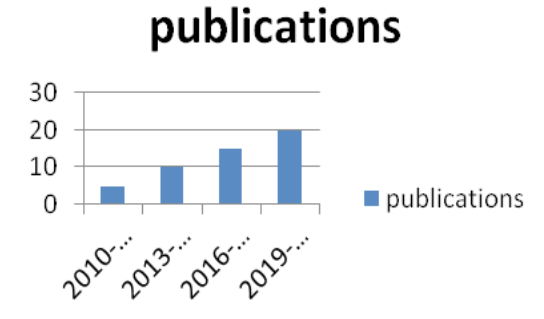

Fig. 2: Publishing at an End in the Middle of 2010 and 2021 in Spread of 2 years

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Fig. 3 exhibit the comparing accuracies attained by employing dissimilar advancements for cardiovascular disease prognosis. Machine Learning and Artificial Neural Networks permit finest outcomes with 98.3% [17] and 8.58% [23] precision .

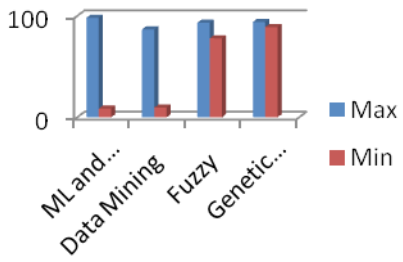

Fig. 3 Accuracy Comparison Achieved by Using Dissimilar Technologies for Cardiovascular Disease Prediction

Data mining providesthe highest precision 86.6%[27] with classification associative rules and the lowest precision 9.6%[26] with Decision Tree algorithm. For fuzzy, highest precision93.27%[46] had been attained by PSO based fuzzy expert system and lowest precision 78% [20] had been attained by rule based fuzzy logic. For genetic algorithm, highest precision 94.17% [12] had been attained by a GA-ANN model while lowest precision was 89% [37].

V. Conclusion

Human society is facing an acute well-being issue as far as Cardiovascular Disease is concerned. Machine Learning (ML) and Neural Networks (NN) with their increasing applications have emerged as up-and-coming techniques in the primary care sector. It has culminated through analysis that Machine Learning (ML) and Artificial Neural Networks (ANN) give precise and authentic outcomes to diagnose cardiovascular disease. The replica implementation results to provide customer help and a trouble-free adviserfavor to patients with rapid and correct recognition of cardiovascular disease.

References

[01] Sumit Sharma, Mahesh Parmar:“Heart Diseases Prediction using Deep Learning Neural Network Model”, IJITEE, (2020)

[02] H.Jayasree, D. S. S. K. R. T. Naren, K. Sai Sankeerth, T. Kumidini:”Heart Disease prediction System”,JASC, (2019)

[03] Juan Jose Beunza, Enrique Puertas, Ester Garcia Ovejero, Gema Villalba, Emilia Condes, Gergana Koleva, Cristian Hurtado, Manuel F. Landecho.: “Comparison of machine learning algorithms for clinical event prediction (risk of coronary heart disease)”, Journal OfBiomedical Informatics, vol. 97, 2019

[04] R. Kannan and V. Vasanthi: “Machine Learning Algorithms with ROC Curve for Predicting and Diagnosing the Heart Disease”, Soft Computing and Medical Bioinformatics,(2019)

[05] Prerna Sharma, Krishna Choudhary, Kshitij Gupta, Rahul Chawla, Deepak Gupta, ArunSharma : “Artificial Plant Optimization Algorithm to detect Heart Rate & Presence of Heart Disease using Machine Learning”, Artificial Intelligence In Medicine,(2019)

[06] Lamido Yahaya, Nathaniel David Oye, Etemi Joshua Garba:”A Comprehensive Review on Heart Disease Prediction Using Data Mining and Machine Learning Techniques”,American Journal of Artificial Intelligence,(2020)

[07] Lewlyn L. R. Rodrigues, Dasharathraj K Shetty, Nithesh Naik, Chetana Balakrishna Maddodi, Anuradha Rao, Ajith Kumar Shetty, Rama Bhat & B. M.Zeeshan Hameed : ” Machine learning in coronary heart disease prediction: Structural equation modeling approach ”, Biomedical Engineering, (2020)

[08] Aditi Gavhane, Gouthami Kokkula, Gouthami Kokkula, Kailas Devadkar:”Prediction of Heart Disease Using Machine Learning” ,ICECA (2018)

[09] Liaqat Ali, Awais Niamat, JavedAli Khan, Noorbakhsh Amiri Gololarz, Xiong Xingzhong:”An Expert System Based on Optimized Stacked Support Vector Machines for Effective Diagnosis of Heart Disease”,(2019)

[10] Syed UmarAmin, KavitaAgarwal,DrRizwan Beg. “Genetic Neural Network Based Data Mining in Prediction of Heart Disease Using Risk Factors”, ICT, (2013).

[11] Juan-Jose Beunzaa, Enrique Puertasa, Ester García-Ovejeroa,Gema Villalbaa, Emilia Condesa, Gergana Kolevaa, Cristian Hurtadoa, Manuel F. Landechoa:” Comparison of machine learning algorithms for clinical event prediction (risk of coronary heart disease) ”, Journal of Biomedical Informatics,(2019)

[12] Bhuvaneswari Amma N.G.,.”Cardiovascular Disease Prediction System using Genetic Algorithm and Neural Network”, IEEE, 2012

[13] Frantisek Babic, Jaroslav Olejar, Zuzana Vantova, Jan Paralic.:”Predictive and descriptive analysis for heart disease diagnosis”, IEEE, 2017

[14] Priyan Malarvizhi Kumar, S. Lokesh, R. Varatharajan, C. Gokulnath, P. Parthasarathy:” Cloud and IoT based disease prediction and diagnosis system for healthcare using Fuzzy neural classifier”, Future Generation Computer Systems,(2018)

[15] Sanchayita Dhar, Krishna Roy, Tanusree Dey, Pritha Datta, Ankur Biswas:” A Hybrid Machine Learning Approach for Prediction of Heart Diseases”, International Conference on Computing Communication and Automation, (2018)

[16] Nikhil Kumar Mutyala, K.V.s Koushik:” Prediction of Heart Diseases Using Data Mining and Machine Learning Algorithms and Tools”, IJSRCSEIT, (2018)

[17] Sneha Borkar, M. N. Annadate.: “Supervised Machine Learning Algorithm for Detection of Cardiac Disorders”, IEEE, 2018

[18] Yang Peilli, Yin Xuezhen, Ye Jian, Yang Lingfeng, Zhao

Hui, Liang Jimin.: "Deep learning model management for coronary heart disease early warning research", IEEE, 2018

[19] Santhana Krishnan.J, Geetha.S:" Prediction of Heart Disease Using Machine Learning Algorithms", (2017)

[20] G. Thippa Reddy, Neelu Khare: "An Efficient System for Heart Disease Prediction using Hybrid OFBAT with Rule-Based Fuzzy Logic Model", Journal of Circuits, Systems, and Computers, (2017)

[21] Himanshu Sharma, M A Rizvi: "Prediction of Heart Disease using Machine Learning Algorithms: A Survey", International Journal on Recent and Innovation Trends in Computing and Communication,(2017)

[22] Seyedamin Pouriyeh, Sara Vahid, Giovanna Sanninoy, Giuseppe De Pietroy, Hamid Arabnia, Juan Gutierrez:" A Comprehensive Investigation and Comparison of Machine Learning Techniques in the Domain of Heart Disease", ISCC (2017)

[23] Jayshril S. Sonawane, D.R. Patil.: "Prediction of Heart Disease Using Multilayer Perceptron Neural Network", ICICES, 2014

[24] Oluwarotimi Williams Samuel, Grace Mojisola Asogbona, Arun Kumar Sangaiahc, Peng Fanga, and Guanglin Lia.: "An Integrated Decision Support System Based on ANN and Fuzzy_AHP for Heart Failure Risk Prediction", SIAT, CAS, (2016)

[25] Han C. W. Hsiao, Sean H. F. Chen, Jeffrey J. P.: "Deep Learning for Risk Analysis of Specific Cardiovascular Diseases Using Environmental Data and Outpatient Records", IEEE, 2016

[26] C. Kalaiselvi.: "Diagnosing of heart diseases using average k-nearest neighbor algorithm of data mining", IEEE, 2016

[27] Dr. S .Anitha and Dr. S. Sridevi.:"Heart Disease Prediction using Data Mining Techniques", Journal of Analysis and Computation (JAC), (2019)

[28] S.Prabhavathi, D.M.Chitra, "Analysis and Prediction of Various Heart Diseases using DNFS Techniques", International Journal of Innovations in Scientific and Engineering Research, vol.2, 1, January 2016, pp.1-7

[29] Soodeh Nikan, Femida Gwadry-Sridhar, Michael Bauer.: "Machine Learning Application to Predict the Risk of Coronary Artery Atherosclerosis", IEEE, 2016

[30] Jaekwon Kim, Jongsik Lee, Youngho Lee.: "Data-Mining-Based Coronary Heart Disease Risk Prediction Model Using Fuzzy Logic and Decision Tree", Health Inform Research, July 2015

[31] Noura Ajam,"Heart Disease Diagnoses using Artificial Neural Network", The International Insitute of Science, Technology and Education, vol.5, No.4, 2015, pp.7-11.

[32] V. Krishnaiah, G. Narsimh, N. Subhash Chandra:" Heart Disease Prediction System Using Data Mining Technique by Fuzzy K-NN Approach", Advances in Intelligent Systems and Computing,(2015)

[33] Nilakshi P. Waghulde, Nilima P. Patil:" Genetic Neural Approach for Heart Disease Prediction", International Journal of Advanced Computer Research,(2014)

[34] Zi-Hui Tang, Juanmei Liu, Fangfang Zeng, Zhongtao Li, Xiaoling Yu, Linuo Zho.: "Comparison of Prediction Model for Cardiovascular Autonomic Dysfunction Using Artificial Neural Network and Logistic Regression Analysis", PLOS ONE, vol. 8, no. 8, 2013

[35] Indira S. Fal Dessai.: "Intelligent Heart Disease Prediction System Using Probabilistic Neural Network", IJACTE, vol. 2, issue. 3, 2013

[36] Mythili T, Dev Mukherji, Nikita Padalia, and Abhiram Naidu.: "A Heart Disease Prediction Model using SVM-Decision Trees-Logistic Regression (SDL)", International Journal of Computer Applications, vol. 68, no. 16, 2013

[37] M.Akhil jabbar, Dr.Priti Chandrab, Dr.B.L Deekshatuluc.: "Heart Disease Prediction System using Associative Classification and Genetic Algorithm", ICECIT, (2012)

[38] C. Beulah Christalin Latha, S. Carolin Jeeva.: "Improving the accuracy of prediction of heart disease risk based on ensemble classification techniques", Informatics in Medicine Unlocked, vol.16, 2019

[39] M.Akhil jabbar, Dr.Priti Chandrab, Dr.B.L Deekshatuluc.: "Heart Disease Prediction System using Associative Classification and Genetic Algorithm", ICECIT, (2012)

[40] Bhuvaneswari Amma N.G.: "Cardiovascular Disease Prediction System using Genetic Algorithm and Neural Network", IEEE, 2012

[41] AH Chen, SY Huang, PS Hong, CH Cheng, EJ Lin.: "HDPS: Heart Disease Prediction System", IEEE, 2011

[42] Anbarasi Masilamani, N Ch Sriman Narayana Iyenger:" Enhanced Prediction of Heart Disease with Feature Subset Selection using Genetic Algorithm", International Journal of Engineering Science and Technology,(2010)

[43] Asha Rajkumar, G.Sophia Reena:" Diagnosis Of Heart Disease Using Datamining Algorithm", Global Journal of Computer Science and Technology,(2010)

[44] Soodeh Nikan, Femida Gwadry-Sridhar, Michael Bauer.: "Machine Learning Application to Predict the Risk of Coronary Artery Atherosclerosis", IEEE, 2016

[45] S. Muthukaruppan, M.J. Er.: "A hybrid particle swarm optimization based fuzzy expert system for the diagnosis of Coronary artery disease", www.elsevier.com/locate/eswa, 2012

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