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OPTIMIZATION HEART DISEASE PREDICATION USING MACHINE LEARNING

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Abstract - A chronic illness that affects millions of people globally is heart failure. In order to predict early heart failure health status and take the necessary activities to address this widespread problem, an effective machine learning-based approach is required. Exercise is becoming recognized as an effective adjunct therapy for controlling heart failure, even if medicine remains the main course of treatment. In this work, we developed an approach to enhance heart failure detection based on patient health parameter data involving machine learning. Our work helps improve heart failure detection at its early stages to save patients' lives. We employed nine machine learning based algorithms for comparison and proposed a novel Principal Component Heart Failure (PCHF) feature engineering technique to select the most prominent features to enhance performance. We optimized the proposed PCHF mechanism by creating a new feature set as an innovation to achieve the highest accuracy scores. The newly created dataset is based on the eight best-fit features. We conducted extensive experiments to assess the efficiency of several algorithms.

Key Words: prominent, Principal Component Heart Failure, PCHF mechanism, efficiency.

1.INTRODUCTION

Heart failure is a condition in which the heart is unable to pump enough blood to meet the body's needs. Cardiovascular diseases have emerged as a significant global health concern, substantially impacting public health worldwide. Heart failure is a common and serious condition affecting millions worldwide. According to a recent state, heart failure disorders cause to happen around 26 million population. The causes of heart failure can be divided into two categories. First related to the heart's structure, such as a previous heart attack. Second related to the heart's function, such as high blood pressure. Symptoms of heart failure can include shortness of breath, fatigue, and swelling in the legs and ankles. Treatment options for heart failure include medications, lifestyle changes, and in some cases, surgery. Research has shown that early detection and management of heart failure can improve quality of life and prolong survival. The current study focuses on developing a machine learning model for managing heart failure to improve patient health. Machine learning is highly involved in medical diagnoses and the healthcare industry. Machine learning has many applications in the medical field, including drug discovery, medical imaging diagnosis, outbreak prediction, and heart failure prediction.

2. LITERATURE SURVEY

"Effectively Predicting the Presence of Coronary Heart Disease Using Machine Learning Classifiers"

URL: https://pubmed.ncbi.nlm.nih.gov/36236325/

ABSTRACT: Coronary heart disease is one of the major causes of deaths around the globe. Predicating a heart disease is one of the most challenging tasks in the field of clinical data analysis. Machine learning (ML) is useful in diagnostic assistance in terms of decision making and prediction based on the data produced by healthcare sector globally. We have also perceived ML techniques employed in the medical field of disease prediction. In this regard, numerous research studies have been shown on heart disease prediction using an ML classifier. In this paper, we used eleven ML classifiers to identify key features, which improved the predictability of heart disease. To introduce the prediction model, various feature combinations and wellknown classification algorithms were used. We achieved 95% accuracy with gradient boosted trees and multilayer perceptron in the heart disease prediction model. The Random Forest gives a better performance level in heart disease prediction, with an accuracy level of 96%..

"A Method for Improving Prediction of Human Heart Disease Using Machine Learning Algorithms"

URL: https://www.researchgate.net/publication/359125883

ABSTRACT: A great diversity comes in the field of medical sciences because of computing capabilities and improvements in techniques, especially in the identification of human heart diseases. Nowadays, it is one of the world's most dangerous human heart diseases and has very serious 6 effects the human life. In this regard, machine learning algorithms are efficient and reliable sources to detect and categorize persons suffering from heart disease and those who are healthy. According to the recommended study, we identified and predicted human heart disease using a variety of machine learning algorithms and used the heart disease dataset to evaluate its performance using different metrics for evaluation, such as sensitivity, specificity, F-measure, and classification accuracy. For this purpose, we used nine classifiers of machine learning to the final dataset before and after the hyperparameter tuning of the machine learning classifiers, such as AB, LR, ET, MNB, CART, SVM, LDA, RF, and XGB. Furthermore, we check their accuracy on the standard heart disease dataset by performing certain preprocessing, standardization of dataset, and hyperparameter tuning.

3.PROBLEM STATAMENT

Heart disease diagnosis using machine learning approaches often faces challenges in extracting meaningful information from raw medical data. Inaccurate or irrelevant features can lead to suboptimal predictive models, affecting diagnostic accuracy. Existing research lacks a comprehensive analysis of feature engineering techniques tailored to heart disease prediction. Addressing this gap is crucial to enhance model performance and facilitate reliable clinical decisions. Therefore, this study aims to investigate and develop effective feature engineering methods to improve the accuracy and reliability of heart disease prediction models.

4.OBJECTIVE

The objective of this study is to identify and propose effective feature engineering techniques for enhancing the accuracy and robustness of heart disease prediction models using machine learning. By systematically analyzing various feature engineering methods, this research aims to optimize the representation of input data, thereby improving the performance of predictive models in diagnosing heart disease. The study aims to contribute valuable insights to the field of medical diagnostics and advance the effectiveness of machine learning-based healthcare applications.

5. SYSTEM REQUIREMENT SPECIFICATION

5.1 FUNCTIONAL REQUIREMENTS

1.Data Collection
2.Data Preprocessing
3.Training and Testing
4.Modiling
5.Predicting

5.2 NON - FUNCTIONAL REQUIREMENTS

- Usability requirement
- Serviceability requirement
- Manageability requirement
- Recoverability requirement
- Security requirement
- Data Integrity requirement
- Capacity requirement
- Availability requirement
- Scalability requirement
- Interoperability requirement
- Reliability requirement
- Maintainability requirement
- Regulatory requirement
- Environmental requirement

6. SOFTWARE REQUIREMENTS

PYTHON LANGUAGE: Python is an interpreted, object-oriented, high-level programming language with dynamic semantics. Its high-level built in data structures, combined with dynamic typing and dynamic binding, make it very attractive for Rapid Application Development, as well as for use as a scripting or glue language to connect existing components together. Python's simple, easy to learn syntax emphasizes readability and therefore reduces the cost of program maintenance. Python supports modules and packages, which encourages program modularity and code reuse. The Python interpreter and the extensive standard library are available in source or binary form without charge for all major platforms, and can be freely distributed. Often, programmers fall in love with Python because of the increased productivity it provides. Since there is no compilation step, the edit-test-debug cycle is incredibly fast. Debugging Python programs is easy: a bug or bad input will never cause a segmentation fault.

Features in Python: There are many features in Python, some of which are discussed below as follows:

1. Free and Open-Source

Language is freely available at the official website and you can download it from the given download link below click on the Download Python keyword. Download Python Since it is open-source, this means that source code is also available to the public. So you can download it, use it as well as share it.

2. Easy to code

Python is a high-level programming language. Python is very easy to learn the language as compared to other languages like C, C#, Javascript, Java, etc. It is very easy to code in the Python language and anybody can learn Python basics in a few hours or days. It is also a developer-friendly language.

3. Easy to Read

As you will see, learning Python is quite simple. As was already established, Python’s syntax is really straightforward. The code block is defined by the indentations rather than by semicolons or brackets.

4. Object-Oriented Language

One of the key features of Python is Object-Oriented programming. Python supports object- oriented language and concepts of classes, object encapsulation, etc.

5. GUI Programming Support

Graphical User interfaces can be made using a module such as PyQt5, PyQt4, wxPython, or Tk in python. PyQt5 is the most popular option for creating graphical apps with Python.

6. High-Level Language

Python is a high-level language. When we write programs in Python, we do not need to remember the system architecture, nor do we need to manage the memory.

7. RESULTS

Fig- 1

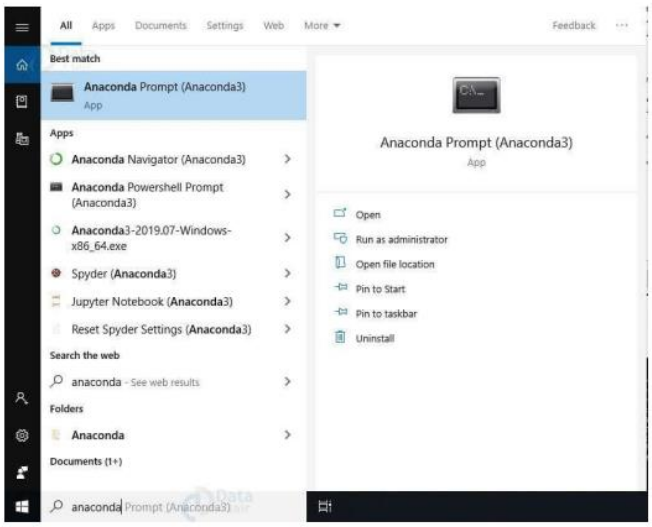

Fig- 2

8. CODING

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Coding

9. CONCLUSIONS

Predicting heart failure using machine learning methods is proposed in this study. The dataset based on 1025 patient records is used to build the applied models. A novel PCHF feature engineering technique is proposed, which selects the eight most prominent features to enhance performance. The logistic regression, random forest, support vector machine, decision tree, extreme gradient boosting, naive base, k-nearest neighbors, multilayer perceptron, and gradient boosting are the applied machine learning techniques in comparison. The proposed DT method achieved 100% accuracy with 0.005 runtime computations. The cross-validation technique based on 10-fold data is applied to each learning model to validate the performance. Our proposed method outperformed the state-of-the-art studies and is generalized for detecting heart failure.

REFERENCES

[1] M. Gjoreski, M. Simjanoska, A. Gradišek, A. Peterlin, M. Gams, and G. Poglajen, ‘‘Chronic heart failure detection from heart sounds using a stack of machine-learning classifiers,’’ in Proc. Int. Conf. Intell. Environments (IE), Aug. 2017, pp. 14–19.
[2] G. Savarese and L. H. Lund, ‘‘Global public health burden of heart failure,’’ Cardiac Failure Rev., vol. 3, no. 1, p. 7, 2017.
[3] E. J. Benjamin et al., ‘‘Heart disease and stroke statistics—2019 update: A report from the American heart association,’’ Circulation, vol. 139, no. 10, pp. e56–e528, 2019.
[4] A. Qayyum, J. Qadir, M. Bilal, and A. Al-Fuqaha, ‘‘Secure and robust machine learning for healthcare: A survey,’’ IEEE Rev. Biomed. Eng., vol. 14, pp. 156–180, 2021.
[5] C. A. U. Hassan, J. Iqbal, R. Irfan, S. Hussain, A. D. Algarni, S. S. H. Bukhari, N. Alturki, and S. S. Ullah, ‘‘Effectively predicting the presence of coronary heart disease using machine learning classifiers,’’ Sensors, vol. 22, no. 19, p. 7227, Sep. 2022.
[6] R. Katarya and S. K. Meena, ‘‘Machine learning techniques for heart disease prediction: A comparative study and analysis,’’ Health Technol., vol. 11, no. 1, pp. 87–97, Jan. 2021.
[7] P. Rani, R. Kumar, N. M. O. S. Ahmed, and A. Jain, ‘‘A decision support system for heart disease prediction based upon machine learning,’’ J. Reliable Intell. Environments, vol. 7, no. 3, pp. 263–275, Sep. 2021.
[8] N. S. Mansur Huang, Z. Ibrahim, and N. Mat Diah, ‘‘Machine learning techniques for early heart failure prediction,’’ Malaysian J. Comput. (MJoC), vol. 6, no. 2, pp. 872–884, 2021.
[9] T. Amarbayasgalan, V. Pham, N. Theera-Umpon, Y. Piao, and K. H. Ryu, ‘‘An efficient prediction method for coronary heart disease risk based on two deep neural networks trained on well-ordered training datasets,’’ IEEE Access, vol. 9, pp. 135210–135223, 2021.
[10] R. Bharti, A. Khamparia, M. Shabaz, G. Dhiman, S. Pande, and P. Singh, ‘‘Prediction of heart disease using a combination of machine learning and deep learning,’’ Comput. Intell. Neurosci., vol. 2021, pp. 1–11, Jul. 2021.