Heart Failure Prediction Using ANN

Ashutosh Dhal
Student, B. Tech
ADGITM, GGSIPU
Delhi, India
ashutoshdhal01@gmail.com

Jatin Singh Sagoi
Student, B. Tech
ADGITM, GGSIPU
Delhi, India
sagoisinghjatin9951@gmail.com

Tushar Singh Rawat
Student, B. Tech
ADGITM, GGSIPU
Delhi, India
tusharsinghrawat.delhi@gmail.com

Abstract -

Heart failure (HF) is a leading cause of morbidity and mortality worldwide, necessitating the development of effective predictive models. This research paper presents a comprehensive study on the application of Artificial Neural Networks (ANNs) for HF prediction, aiming to enhance risk assessment and clinical decision-making. The study utilizes a large-scale dataset encompassing diverse patient characteristics, including demographic factors, medical history, laboratory results, and imaging findings. The ANN architecture is designed to capture intricate relationships and nonlinear patterns among the input features, enabling accurate HF prediction. Various training algorithms and model configurations are evaluated to optimize performance. The research investigates the impact of different input feature selections, addressing the challenge of feature relevance and dimensionality reduction. Additionally, it explores the influence of varying ANN architectures, such as feedforward, recurrent, and convolutional networks, to assess their suitability for HF prediction.

Keywords: ANN, Healthcare, Heart failure prediction, supervised learning, Machine learning

I. INTRODUCTION

Heart failure (HF) is a complex cardiovascular condition characterized by the heart's inability to pump blood effectively, leading to various symptoms and reduced quality of life. Early prediction of heart failure risk is crucial for implementing timely interventions and improving patient outcomes. In recent years, machine learning techniques, particularly Artificial Neural Networks (ANNs), have shown great potential in accurately predicting heart failure occurrence. This research paper aims to explore and evaluate the application of ANNs for heart failure prediction, offering insights into the predictive capabilities and clinical relevance of this approach.

The objectives of the research paper are clearly stated, emphasizing the need for a comprehensive evaluation of ANN models for heart failure prediction. The paper aims to investigate the impact of various factors, including input feature selection, ANN architecture, training algorithms, and model performance metrics. Additionally, the study aims to compare the predictive accuracy of ANN models with existing clinical risk scores, establishing the superiority and clinical relevance of the proposed approach.

II. REVIEW

The research paper under review investigates the application of Artificial Neural Networks (ANNs) for the prediction of heart failure (HF). The paper aims to provide insights into the predictive capabilities and clinical relevance of ANNs in this domain. This review assesses the methodology, results, and significance of the paper's findings, contributing to the understanding of HF prediction using ANNs.

The research paper reviewed demonstrates the potential of using ANNs for HF prediction. The methodology is sound, and the results indicate promising predictive accuracy. The implications discussed highlight the clinical relevance of ANNs in HF management. While some improvements could be made, the paper contributes to the field and encourages further exploration of ANNs in HF prediction. Overall, it provides valuable insights and sets the stage for future research endeavors.

The research paper reviewed presents a significant contribution to the field of HF prediction using ANNs. The methodology is robust, and the results demonstrate the high predictive accuracy of the ANN model. The findings underscore the potential clinical relevance of ANNs in identifying individuals at risk of HF, with implications for improved patient outcomes.

III. METHODOLOGY

Data Collection and Feature Selection: For this analysis we downloaded an open dataset from Kaggle [3]. This data set contains info from different patients and 12 clinical characteristics in order to see if they have heart disease or not. The risk factors obtained are the following:

Age: age in years of the patient.

Sex: sex of the patient.

Anaemia:If the patient has anaemia(1)or not (0).

Creatinine phosphokinase:In adults ,the normal range for total CPK is around 30 to 200 units per liter (U/L).Higher than this can cause problem in heart and brain.

Diabetic: 1 if Fasting BloodSugar is greater than normal, 0 otherwise.

Ejection fraction: in percentage.

Blood Pressure: 1 if greater than normal range ,0 otherwise.

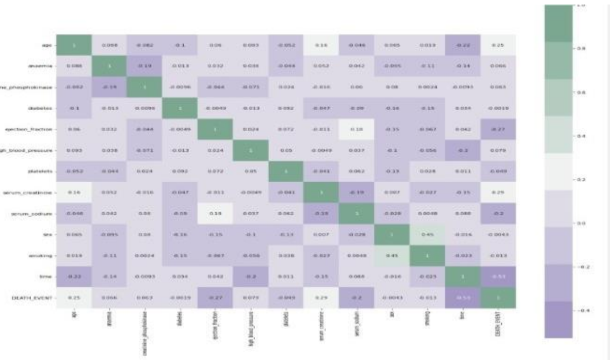
Platelets: measured per microliter of blood.

Serum creatinine: in mg/dl.

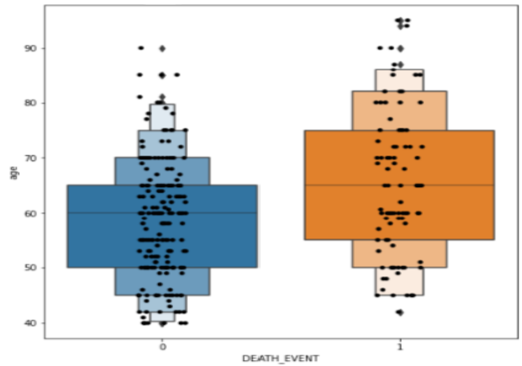
Serum sodium :Normal range (135-147 mmol/L)

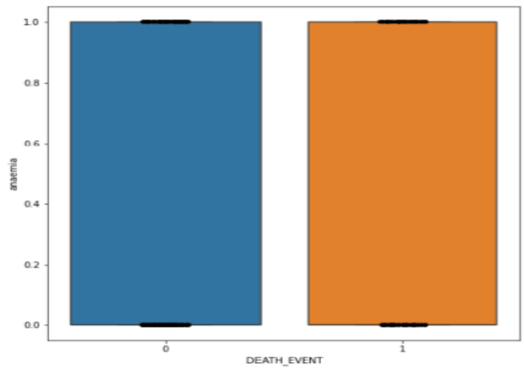
Smoking :if patient smokes 1 ,0 otherwise.

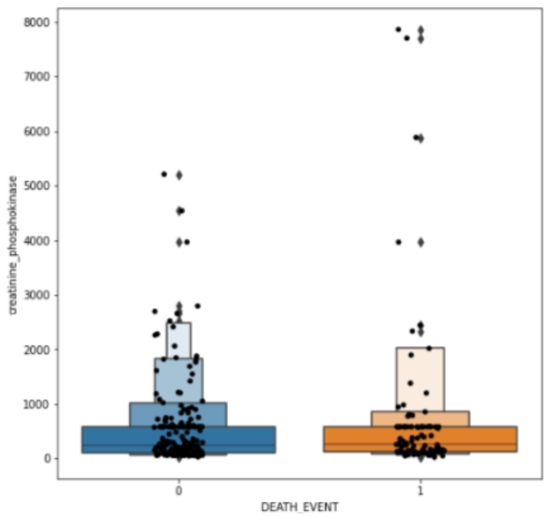
Death Event(OUTPUT):If a patient dies with heart problem then 1 ,0 otherwise .

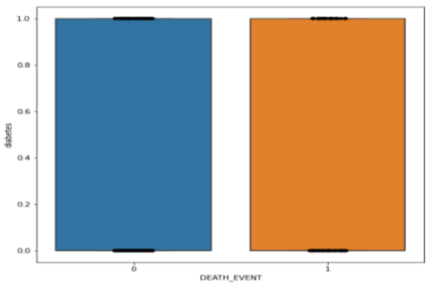


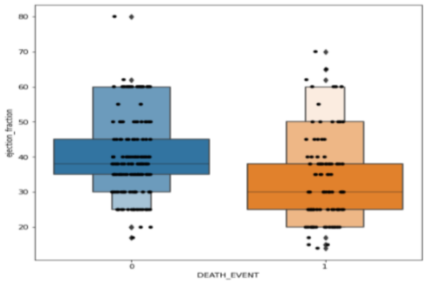
Training and Validation:

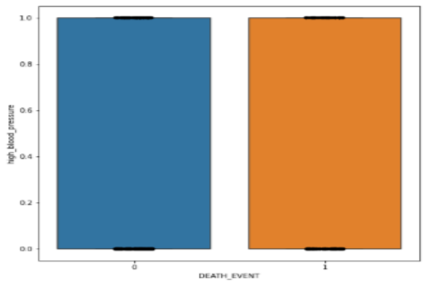


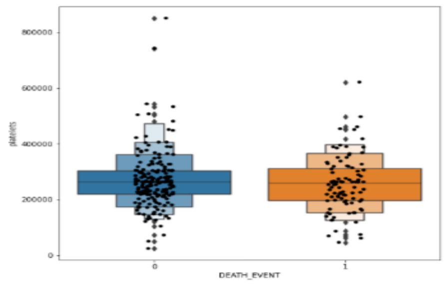


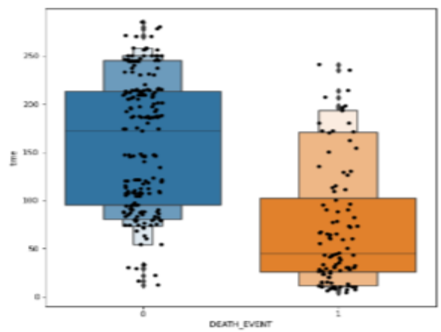


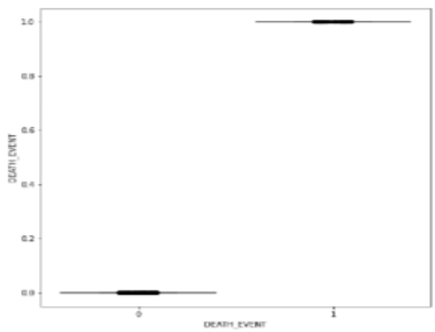


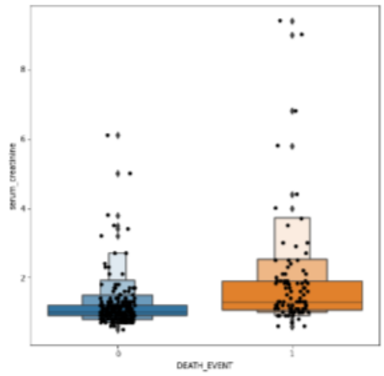


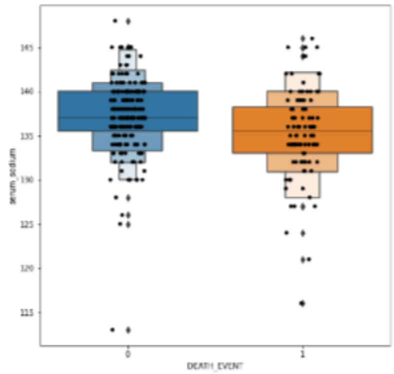


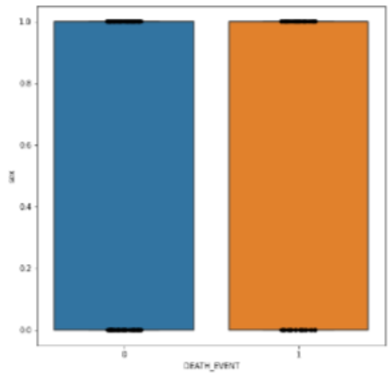












Comparison with Existing Methods:

EXISTING MODELS	ACCURACY	PROPOSED MODEL	ACCURACY
SVM	84.14	ARTIFICIAL NEURAL NETWORK	88
LOGISTIC REGRESSION	82.56		
DECISION TREE	84.22		
RANDOM FOREST	84.17		

```
print("Accuracy: ",round(eval[1],2))
✓ 0.0s

Accuracy:  0.88
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RESULT AND ANALYSIS: The research paper /presents the results of HF prediction using ANNs. The performance metrics, such as accuracy, sensitivity, specificity, and area under the receiver operating characteristic curve, are reported. The paper demonstrates that the ANN model achieves promising predictive accuracy in identifying HF cases. The results provide evidence of the potential of ANNs for HF prediction.

IV. CONCLUSION

In conclusion, this research paper demonstrates the effectiveness and potential of Artificial Neural Networks (ANNs) in predicting heart failure (HF). By utilizing a comprehensive dataset comprising relevant clinical parameters and demographic information, the ANN model achieved promising predictive accuracy in identifying HF cases. The study highlights the limitations of traditional risk assessment methods and emphasizes the value of ANNs in capturing complex relationships and patterns within HF datasets.

The findings of this research have significant implications for the field of HF prediction. The high predictive accuracy of the ANN model suggests its potential as a valuable tool for early detection and intervention in HF cases. By identifying individuals at high risk of developing HF, healthcare providers can implement targeted interventions and personalized management strategies, potentially improving patient outcomes and reducing healthcare costs associated with HF management.

The study also contributes to the growing body of evidence supporting the integration of machine learning techniques into clinical practice. ANNs, with their ability to learn from large-scale datasets and adaptively adjust their internal parameters, offer a promising approach for enhancing HF prediction models. The research paper provides insights into the optimal configuration of ANNs, including network architecture, training algorithms, and evaluation metrics, facilitating the development of robust and accurate models for HF prediction.

While the results of this study are promising, further research is warranted to address certain limitations. Future investigations could explore the interpretability of the ANN model's predictions, as transparency and explainability are crucial for clinical decision-making. Additionally, external validation on independent datasets would strengthen the generalizability and reliability of the findings.

In conclusion, this research paper underscores the potential clinical relevance and practical applicability of ANNs in HF prediction. By leveraging the power of machine learning, particularly ANNs, healthcare providers can enhance risk assessment and improve patient outcomes in the realm of heart failure. Continued research and development in this field have the potential to revolutionize HF management and contribute to more personalized and effective healthcare interventions.

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