

Heart Failure Prediction Model Using Machine Learning

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ABSTRACT

This research focuses on studying the condition of heart failure, which is highly significant due to its common occurrence and the large number of patients worldwide. It is also a major cause of significant mortality in Thailand, with a rising trend each year. The objective is to investigate factors influencing the occurrence of heart failure, analyzing the problem to implement measures that can reduce the risk. Three models, namely Artificial Neural Network, Naïve Bayes, and Random Forest, were employed to compare their effectiveness. The goal is to select the most suitable model, providing insights into the predictive performance of each model in anticipating heart failure. The analysis results reveal that the Artificial Neural Network model is the most suitable, achieving an accuracy rate of up to 85.87%.

INTRODUCTION

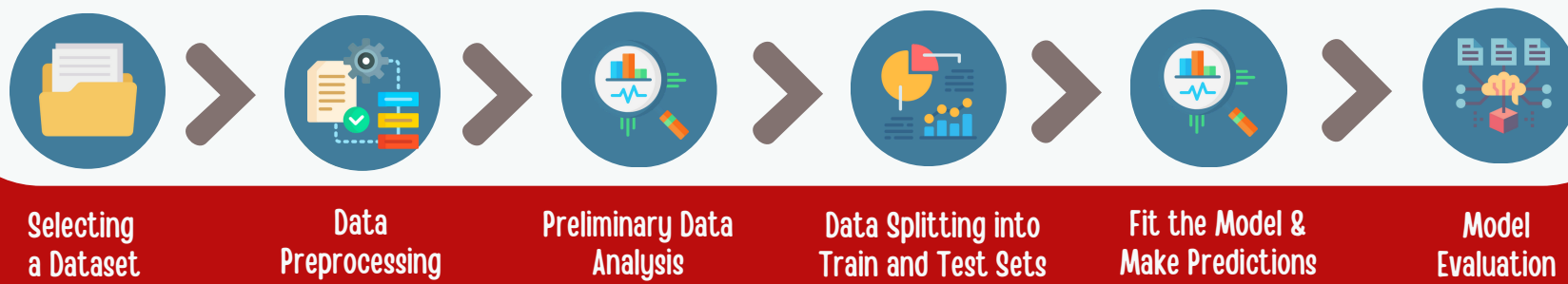
When discussing Heart Failure, people in many countries around the world, including Thailand, are currently facing this condition. Heart Failure is a serious disease that significantly impacts individuals' quality of life and health, and it can be life-threatening if not promptly treated. This disease has multiple causes.

In this study, the researcher used the models Artificial Neural Network, Naïve Bayes, and Random Forest to compare and find the most suitable and accurate model for predicting Heart Failure occurrence. These models play a crucial role in developing and enhancing efficiency. By utilizing various related data and factors, they help identify trends in Heart Failure occurrence, ultimately increasing the chances of providing timely and effective heart health care as per established standards.

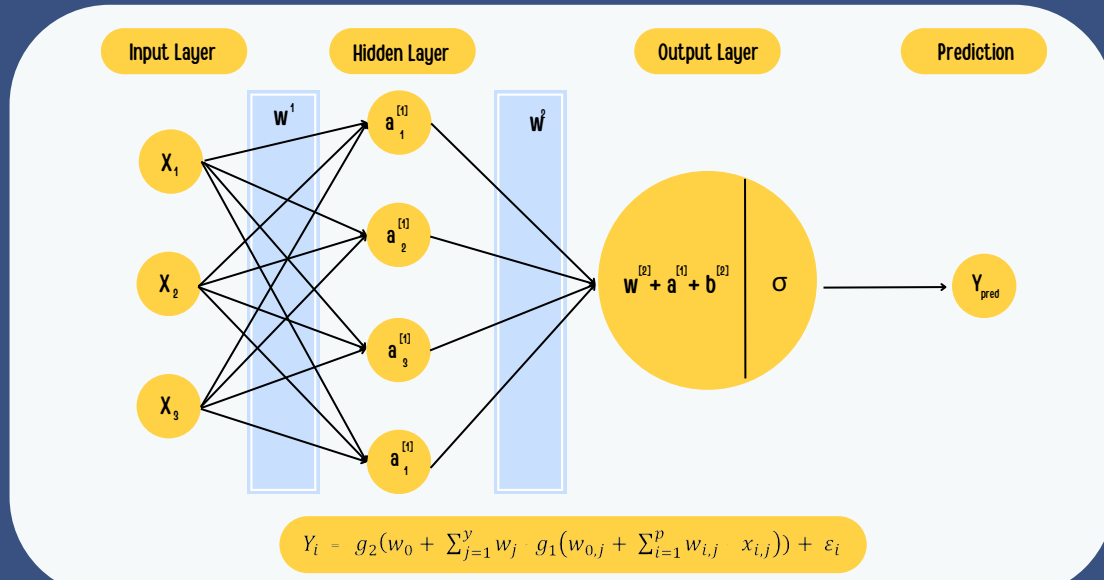
OBJECTIVES

- To study the relationships among various factors that tend to lead to heart failure
- To study and compare prediction models for predicting the occurrence of heart failure based on various factors, three models will be examined: Artificial Neural Network (ANN), Naïve Bayes, and Random Forest
- To analyze and select the most accurate and appropriate model to study the relationships among various factors that tend to lead to heart failure

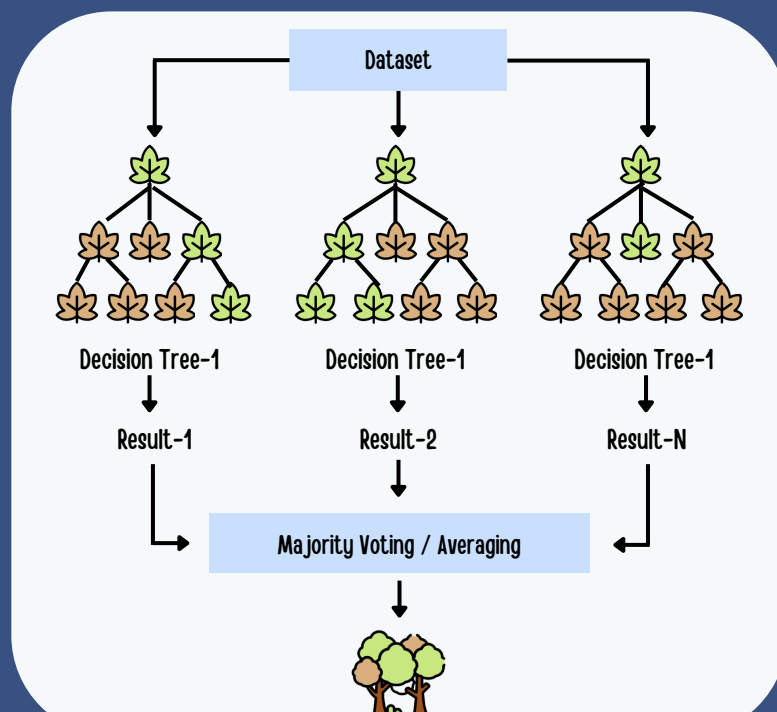
METHODOLOGY



ARTIFICIAL NEURAL NETWORK



RANDOM FOREST



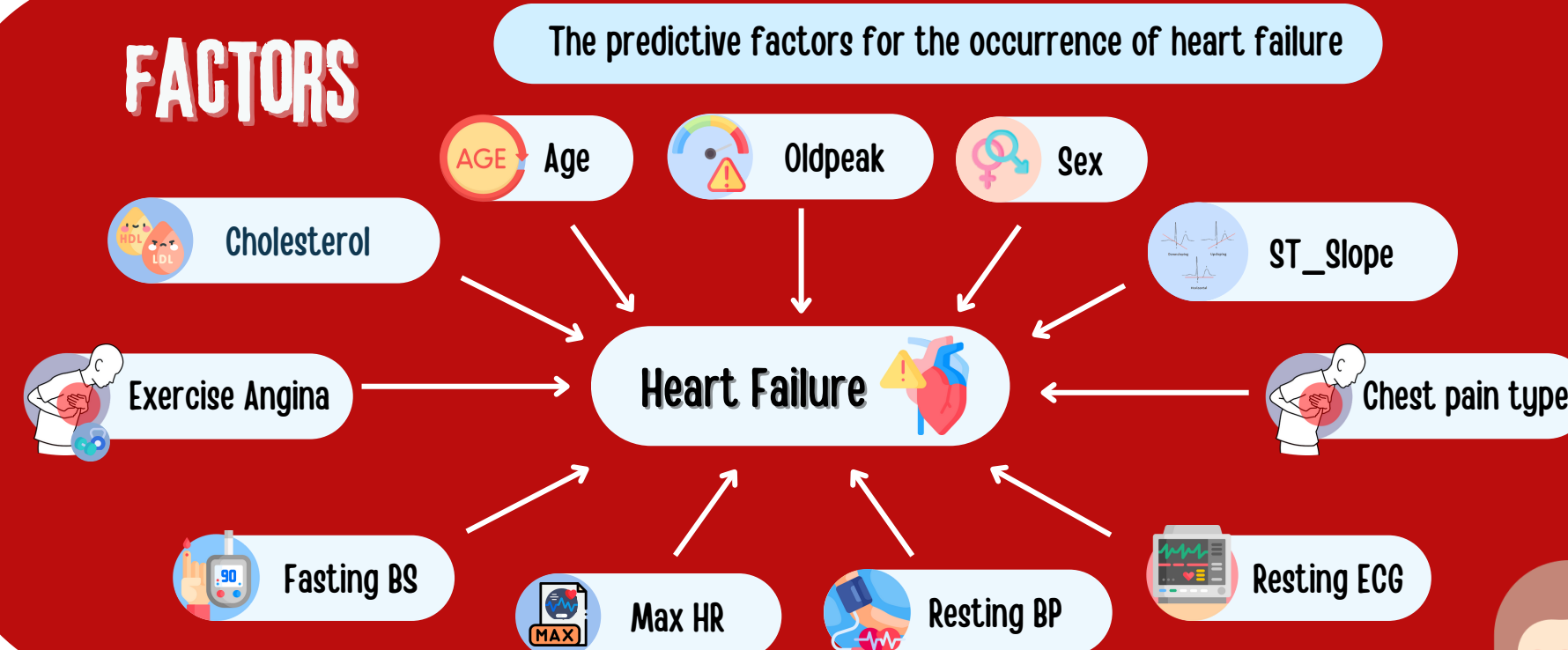
NAÏVE BAYES

$$P(c|x) = \frac{P(x|c)P(c)}{P(x)}$$

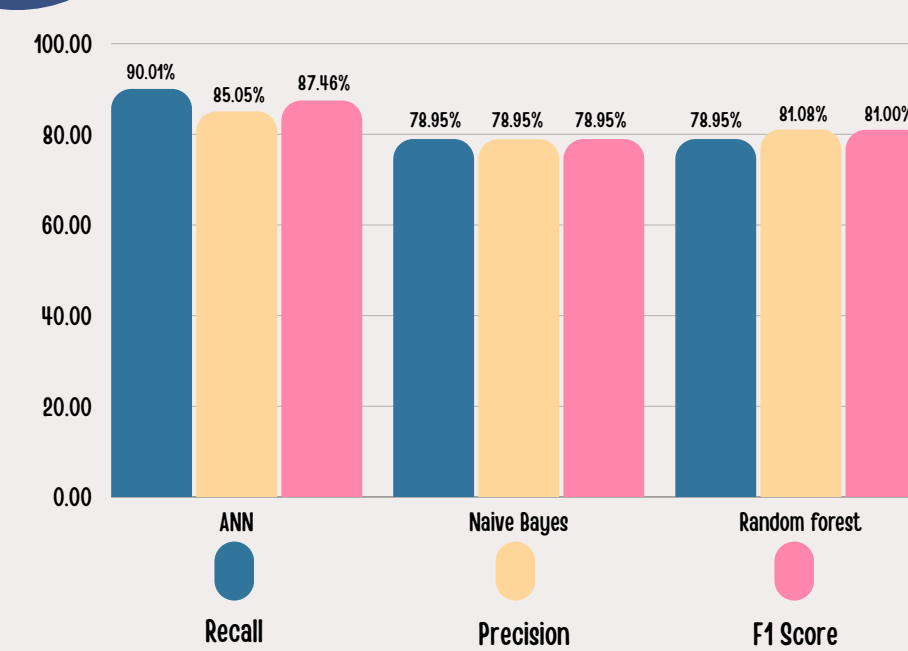
$$P(c_0|x) = \frac{P(x|c_0)P(c_0)}{P(x)}$$

$$P(c_1|x) = \frac{P(x|c_1)P(c_1)}{P(x)}$$

FACTORS

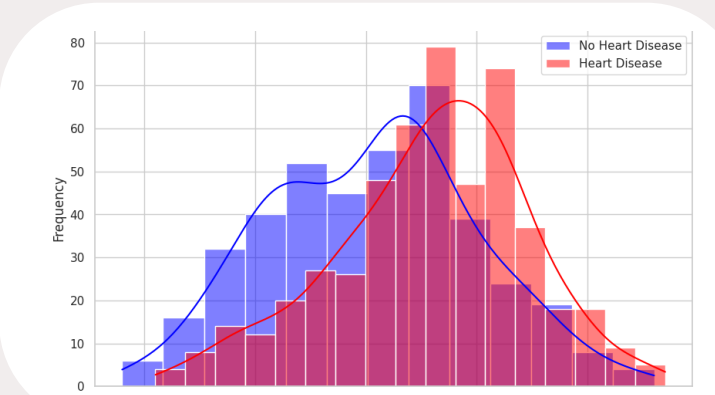
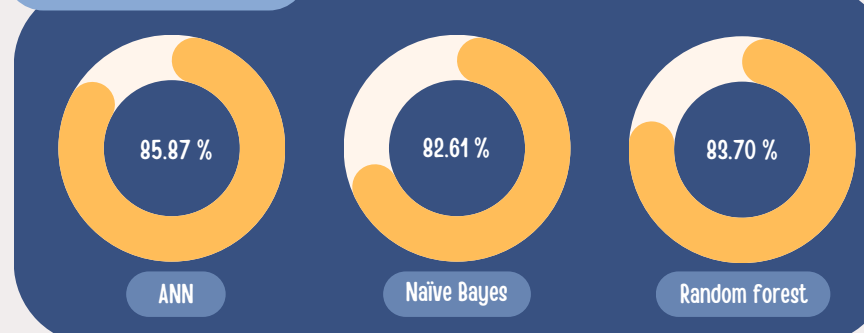


RESULT

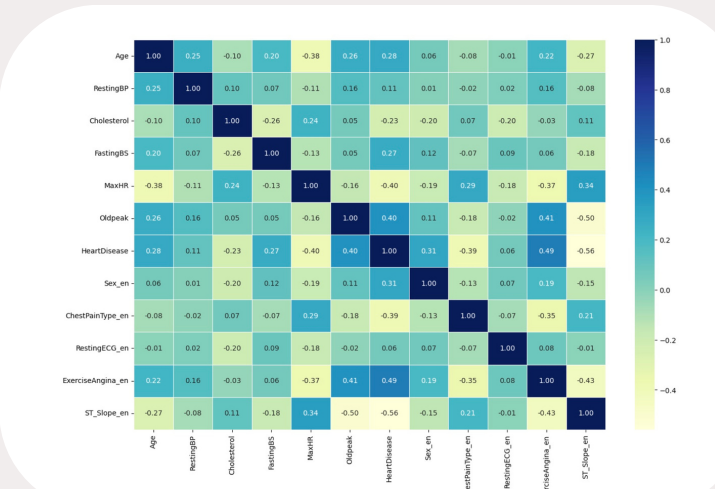


The graph illustrates the performance metrics of Recall, Precision, and F1-Score for each model

ACCURACY



The majority of the people with Heart Disease are in the age range of 55 to 77 years old

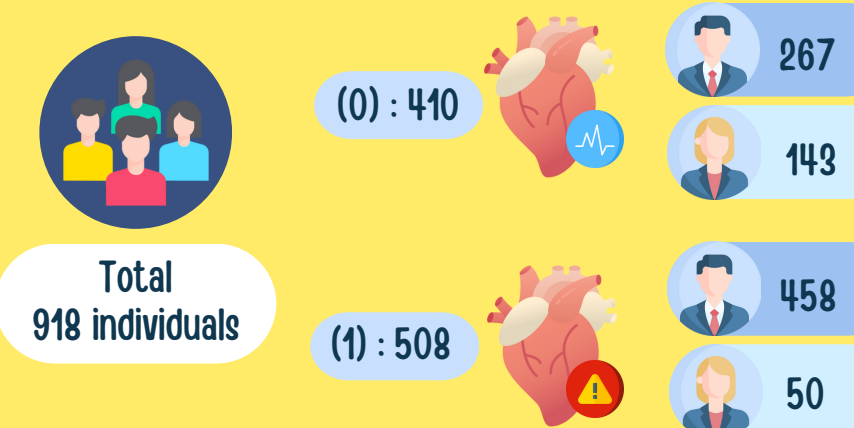


The correlation matrix illustrates the relationships between heart disease and 11 variables

CONCLUSION

Actual	Confusion Matrix		No	Yes
	No	67 (TN)	16 (FP)	
	Yes	10 (FN)	91 (TP)	
	Predicted			
	<div>90.01 %</div> <div>Recall</div>	<div>85.87 %</div> <div>Accuracy</div>	<div>85.05 %</div> <div>Precision</div>	
ANN				

From the dataset, variables can be defined as follows :
"C" is the class of prediction
• 0 : Heart disease • 1 : Normal



From the study, it was shown that the ANN model was the most appropriate model for predicting the occurrence of heart failure. This model has performance metrics with a Recall of 90.01%, Accuracy of 85.87%, and Precision of 85.05%.

DISCUSSION & APPLICATION

Comparing and finding the most suitable model for accurately predicting the occurrence of heart failure by examining the relationships between influencing factors is crucial. This process can be extended to various other applications, aiding in the generation of data to improve healthcare plans and reduce risk in high-risk groups effectively.



References

- Frank, Liang. (2020). Evaluating the Performance of Machine Learning Models. Retrieved September 14, 2023, from <https://citly.me/vKWL5>
Fedesoriano. (2021). Heart Failure Prediction Dataset. Retrieved September 7, 2023, from <https://www.kaggle.com/datasets/fedesoriano/heart-failure-prediction>
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