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Predicting Patient Outcomes Using Machine Learning

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Abstract
Surgical quality was historically measured based on objective endpoints like mortality, readmission to the hospital, and rates of postoperative complication. To produce predictions, the Random Forest approach mixes several decision trees that have been trained using bootstrapped samples. The average prediction of every tree is the end result. These results can assist medical practitioners in making patient-centered choices and offering patients undergoing breast reconstruction individualized treatment. 1553 women who had mastectomy and breast reconstruction participated in a follow-up study to assess the machine learning models in more detail. Two years later, 45.2% of patients were happy with the way their breasts looked, compared to 27.2% who weren't. Following training, testing, and validation using the new data, the models demonstrated enhanced performance. Additionally, the authors contrasted their machine learning technique with NHS's hip prediction tool, which uses a linear regression model.
Keywords: *AI, ML, DL, surgery*

INTRODUCTION

Whether it is in the healthcare sector or in any other field, technological advancements have a speedy influence on every possible way of life. Although the decision-making process through data analysis, artificial intelligence had already proved promising results in the field of healthcare [1]. Within a comparatively short period, COVID-19 had affected more than 100 countries. Individuals on all the continents are vulnerable to its long-term impacts. The development of a coronavirus detection management system is necessary. Detection of diseases using different Technologies like ai may be one of the solutions to control the present chaos. In combating the huge challenges brought by the COVID-19 pandemic, research is centered on the diagnosis and management of the disease [9]. The constraints and deficiencies of diagnostic and predictive methods in the context of the present global health crisis are the primary issue with the thesis. Traditional diagnostic tools are required, but they have proven to be limited when applied to COVID-19. Excessive falsepositive and false-negative test results, delayed diagnosis, and the inability to predict patient disease progression are some of these limitations. These restrictions add further burden to already stretched healthcare systems and hinder timely and precise patient care. Another issue is the lack of tailored and adaptable COVID-19 predictive models [3]. The virus's fast evolution and differing impacts on diverse populations require a more personalized model of disease outcome and patient risk levels prediction. The uniform approach to the management and treatment of patients arises from the failure of existing models to provide a response to these special elements of the disease. Sophisticated machine learning in the thesis tries to close the gaps and difficulties [2]. Develop models that make the diagnosis of COVID-19 faster and more accurate and facilitate the prediction of more complex and distinctive patient outcomes and disease courses [13]. By optimizing patient management and resource utilization, this approach ought to enhance the efficiency and efficacy of pandemic healthcare responses. Problem statement therefore launches research undertaking to utilize machine learning to revolutionize COVID-19 diagnostic and predictive paradigms to reduce the burden on the healthcare system and improve patient care worldwide[4].

MATERIALS AND METHODS

In the current scenario, data are fragmented as Reports, Forms, and Statistics and so on. They are used as inputs to the various kinds of techniques [5]. Since the technology has been booming in the current era, a lot of techniques have been emerged and they are going on further developing nullifying the issues

occurring in the every field. The technology has become extremely supportive for identifying the weaknesses in the particular region and it is a big help for correcting the issues within a short period of time. The emerging technology is proving to be very important mainly in the health care industry. This has worked extremely well in case of developing the result in the real situation. Despite that, various studies and researches have been conducted in different fields, and in particular, the medical field has extended the utilization of technology to reach the data officially, and approximating the outcome which can be displayed worldwide [10].Machine learning (ML) is one of the disciplines of AI wherein statistical techniques are utilized to impart computers with the capacity to "learn" and improve automatically with time and even with no guidance by humans [6]. Algorithms capable of learning from and forecasting data and datasets [7] based on varied training procedures are the interest of machine learning research and development. Machine learning models are more flexible than statistical models when it comes to gathering high-order relationships between the data, which may result in better predictions. This is one of the benefits of using machine learning models instead of statistical models[11].

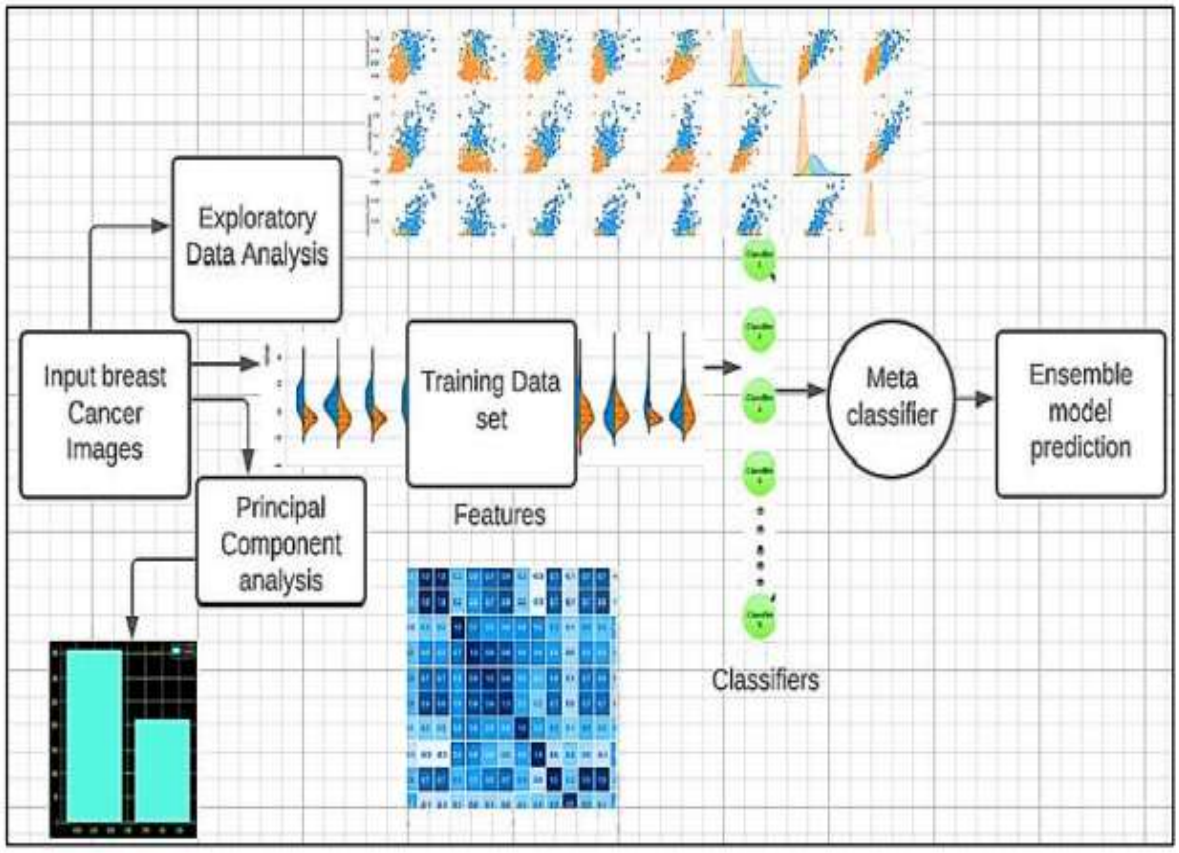


Figure 1: Proposed framework

In recent years, the developments in high-throughput technologies have resulted in an explosion in medical data availability, which in turn has raised our awareness of how effectively they could be utilized to enhance human life. The assessment of a vast amount of data can assist us in characterizing clinical conditions [12]. Feature selection is also referred as attribute selection or variable selection that has been employed for extracting the new variable from the original data that enable the machine learning to perform. Feature selection algorithm has been employed for discarding the data such as noisy data, redundant data, and irrelevant data and at the same time it improves the performance of the classification. The primary goal of the feature selection method is to acquire the minimum feature subset from the problem to achieve accuracy in the representation of the original feature[8]. The heart disease prediction process is depending on the attributes selection phase. During heart disease prediction feature selection, the attributes of results obtained during analysis are depend upon the patient quality groups and the attributes which were previously selected. The feature selection method in machine learning is mainly

categorized into supervised and unsupervised methods, particle swarm optimization methods, Ant-colony optimization methods, Grey-wolf optimization methods and so on.

RESULT AND DISCUSSION

Clinical variables, patient-reported health data (PGHD) from VivoFit, and patient-reported outcomes (PROs) from the MD Anderson Symptom Inventory (MDASI) were utilized to train the machine learning algorithm.

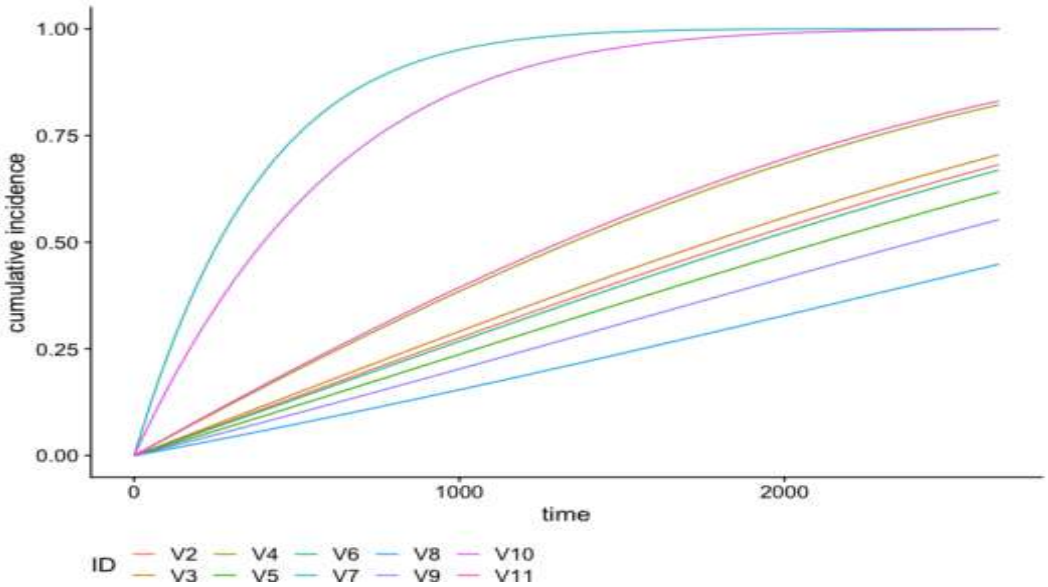


Figure 2: Cumulative Incidence Plot

Using PROs and PGHD, it could predict post-operative challenges with great accuracy, as shown by a robust area under the curve (AUC). From the machine learning models, changes in physical activity, whether a major increase or decrease, could increase the likelihood of issues after surgery[14].

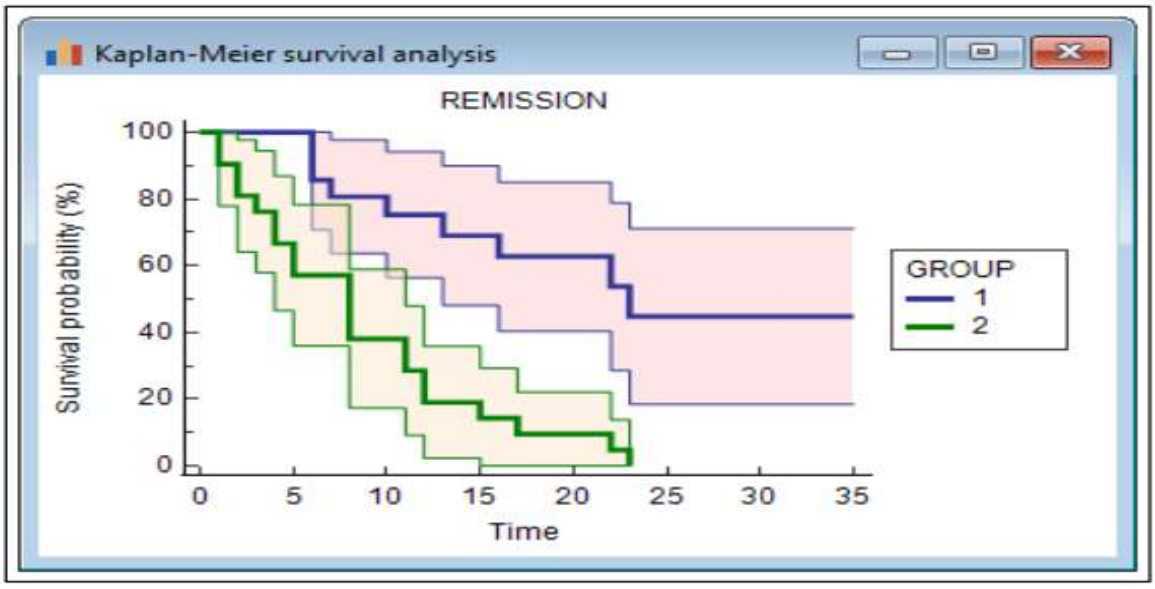


Figure 3: Kaplan Meier Survival Curves

By identifying patients who are more or less likely to have problems following oncologic surgery, these findings, which are based on Patient-Reported Outcomes (PROs), can improve monitoring and risk stratification.

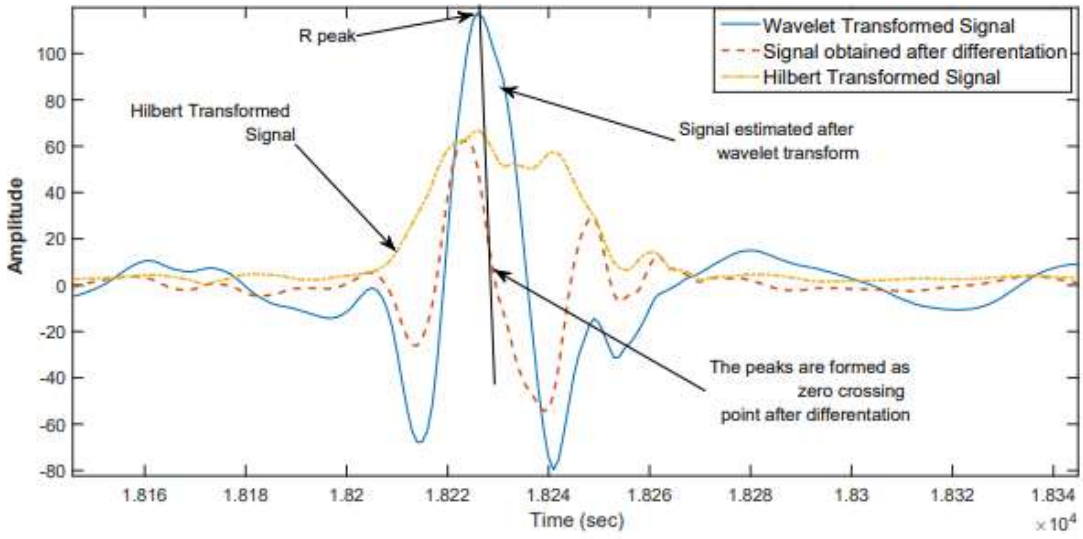
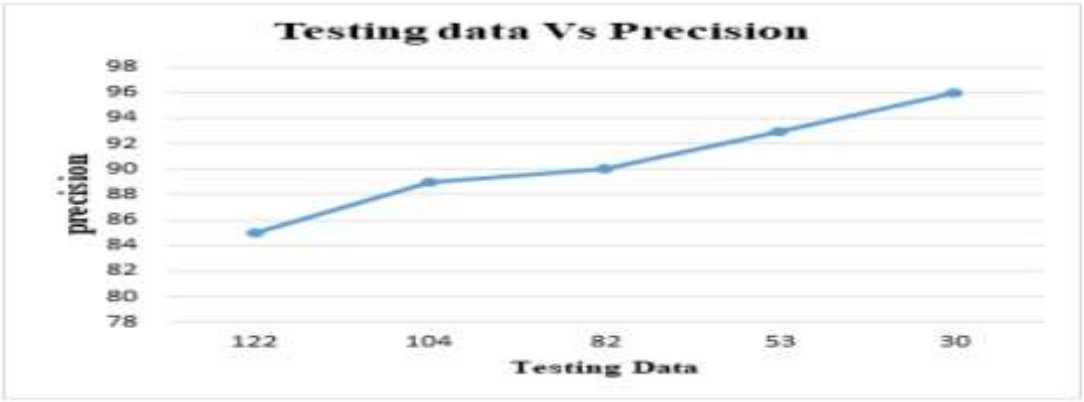
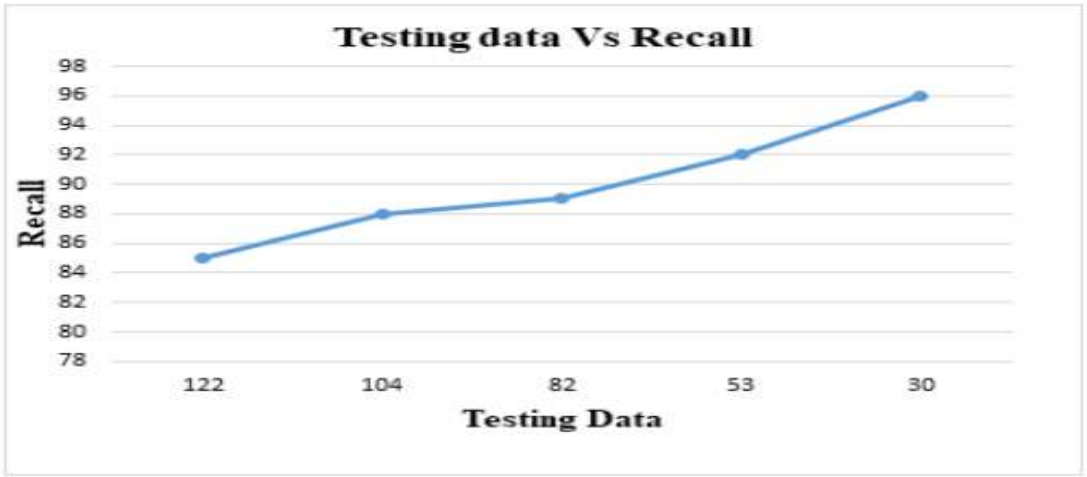


Figure 4: Amplitude plot

The CNN is employed to automatically generate the features and it is coupled with the classifiers. The benefit of employing this CNN as feature extractor is that, it is utilized as the simplest way to transform the input volume to the output volume through differential function. The drawback of employing this method is that it doesn't encode the object's position and orientation into their predictions. Further, the deep network will require more time in training process. Comparative analysis of prediction is carried out, based on some parameters of the proposed and the current methods.



(a)



(c)

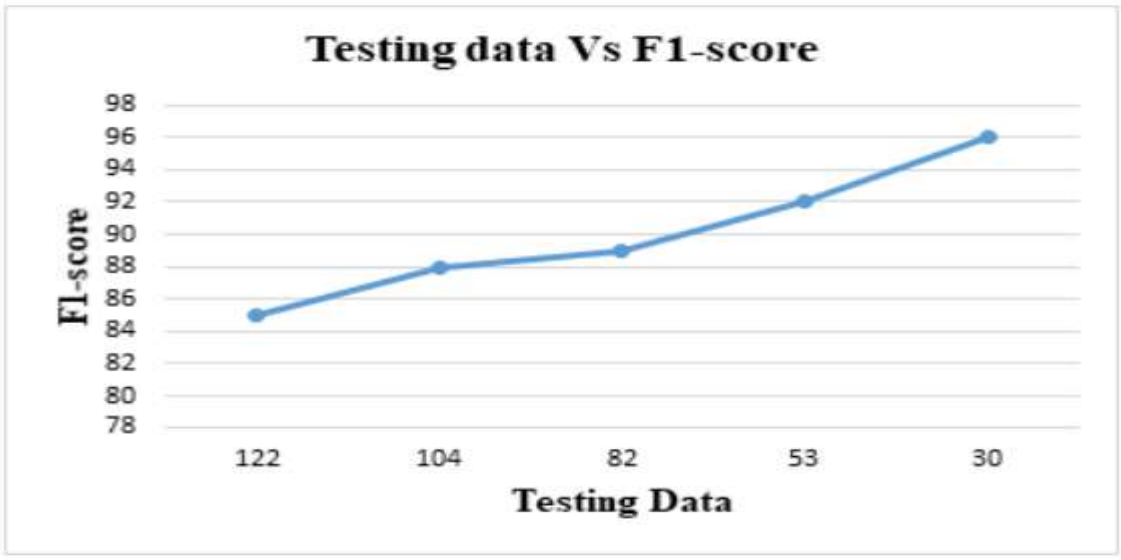


Figure 5: performance evaluation

The classification algorithm is the most common algorithm in the machine learning field. Typically, the machine learning methods are divided into three methods based on their learning style, unsupervised learning, supervised learning and reinforcement learning. The classification algorithm is the method of learning when the machine learns the method for assigning the labels to each data class[15].

CONCLUSION

The recent upsurge in machine learning has transformed data management in data science and how we generate better results with very useful applications towards further improvement of the prediction of adverse events and better patient care. Healthcare systems grapple with exactly identifying sepsis in disease development at early stages. Statistical and computational approaches have been applied widely for data analysis such as linear models or univariate techniques in the healthcare industry has argued a range of statistical concepts required and utilized in healthcare studies. However, with the ease in these approaches, the amount and nature of information gained as well as the application of results or outcomes in the healthcare industry are limited. The overall idea of healthcare analytics is that a person would be able to carry out less expensive methods to achieve better healthcare outcomes and lower healthcare service costs. Healthcare quality comprises the quality of patient satisfaction once a patient has received medical care.

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