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Advances in AI for Predicting Surgical Complications: Improving Patient Outcomes through Data Analysis

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ABSTRACT: The use of AI to predict complications during surgery is an emerging field in healthcare. By analysing vast amounts of data from electronic medical records, surgical videos, and patient information, AI models can learn to identify patterns and predict potential complications before they occur. AI models can be used to predict a variety of surgical complications, including blood loss, infections, and postoperative complications such as pneumonia or sepsis. These predictions can help surgeons prepare for potential complications and take preventive measures to minimise risk. The model analysed data from electronic medical records and predicted with 80% accuracy which patients would experience postoperative complications, such as kidney failure or prolonged hospital stays. The model was able to predict with 87% accuracy which patients would develop infections, allowing surgeons to take preventive measures such as administering antibiotics before surgery. Overall, the use of AI to predict surgical complications has the potential to improve patient outcomes and reduce healthcare costs by allowing surgeons to take preventive measures and avoid complications before they occur. However, it is important to note that AI models should be used in conjunction with clinical judgement and not relied on as the sole source of decision-making. This paper is aimed to reduce death due to lack of practical knowledge of doctors, nurses and time delay. Implementing this in Indian hospitals, especially in the rural areas, can bring down the mortality rates due to medical negligence by nearly 50 percent. Surgical complications pose significant challenges for surgeons, patients, and health care systems as they may result in patient distress, suboptimal outcomes, and higher health care costs. Artificial intelligence and machine learning driven predictions have shown promising potential in influencing real-time decisions and improving surgical outcomes by facilitating screening, diagnosis, risk assessment, preoperative planning, and shared decision-making.

KEYWORDS: ML model, Predictive model, Surgical Complication, AI in Healthcare.

I. INTRODUCTION

Making errors is part of normal human behaviour. However when errors have significant consequences or occur in high risk industries they become of paramount importance. Healthcare industry being the most important and one of the high risk industry it is very important to make sure there is no mishap due to human negligence and lack of medical skill and knowledge. Surgery is a complex and delicate process. Every year, about 5.2 million people die due to human errors in India. Procedure that requires careful planning, precise execution, and constant monitoring. Despite advancements in surgical techniques and technologies, complications can still occur, leading to adverse outcomes for patients. Predicting and preventing these complications is crucial for improving patient safety and reducing healthcare costs. Every year, about 5.2 million people die due to human errors in India. Around 70% of deaths that occur due to medical negligence can be attributed to human errors. Nearly 5,000,000 deaths occur in India annually due to medical errors triggered by lack of practical knowledge among the doctors and nurses to handle patients when brought to the hospital. In recent years, there has been growing interest in the use of artificial intelligence (AI) to predict complications during surgery. Machine learning algorithms can analyse vast amounts of data from various sources, including patient characteristics, surgical procedures, and real-time physiological data, to identify factors that increase the risk of complications. The development of AI models that accurately predict surgical complications could enable surgeons to take proactive measures to prevent adverse outcomes. For example, by identifying patients who are at high risk of developing postoperative infections, surgeons can prescribe antibiotics before the procedure or take extra precautions to prevent



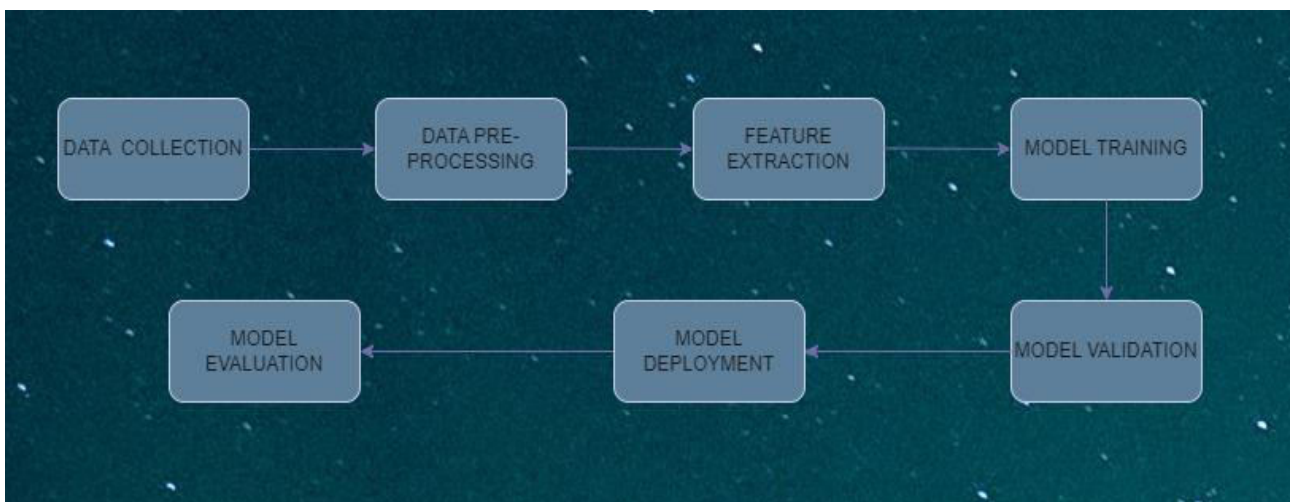
contamination during surgery. This paper aims to provide an overview of the current state of research on the use of AI to predict surgical complications. We will review the different types of data sources used in these models, the machine learning algorithms employed, and the potential benefits and challenges associated with their use. By synthesising existing research, we hope to contribute to the growing body of knowledge on the application of AI in surgery and provide insights for future research in this area.

II. RELATED WORKS

1. Artificial Intelligence and Machine Learning in Prediction of Surgical Complications: Current State, Applications, and Implications.^[1] In this paper they have used an AI predictive model to predict post-surgical complications.
2. Artificial intelligence in spine care: current applications and future utility.^[2]
Hornung AL, Hornung CM, Mallow GM, Barajas JN, Rush A 3rd, Sayari AJ, Galbusera F, Wilke HJ, Colman M, Phillips FM, An HS, Samartzis D.
3. Predicting Patient-Reported Outcomes Following Surgery Using Machine Learning^[3].
Hassan AM, Biaggi-Ondina A, Rajesh A, Asaad M, Nelson JA, Coert JH, Mehrara BJ, Butler CE.

III. METHODOLOGY

Relevant medical history data from the patient's electronic health record (EHR), such as previous medical conditions, surgical history is collected. The collected data is pre-processed to remove irrelevant or missing data and standardise the data format. A machine learning algorithm is developed to predict the surgical complications using the features. This step involves an SVM algorithm to train the model defining the model architecture and train the model. Then the performance of the model is evaluated by using an independent test dataset assessing its accuracy, mean squared error value and other relevant metrics. Then the model is deployed in a website for real-time predictions.





IV. EXPERIMENTAL RESULTS

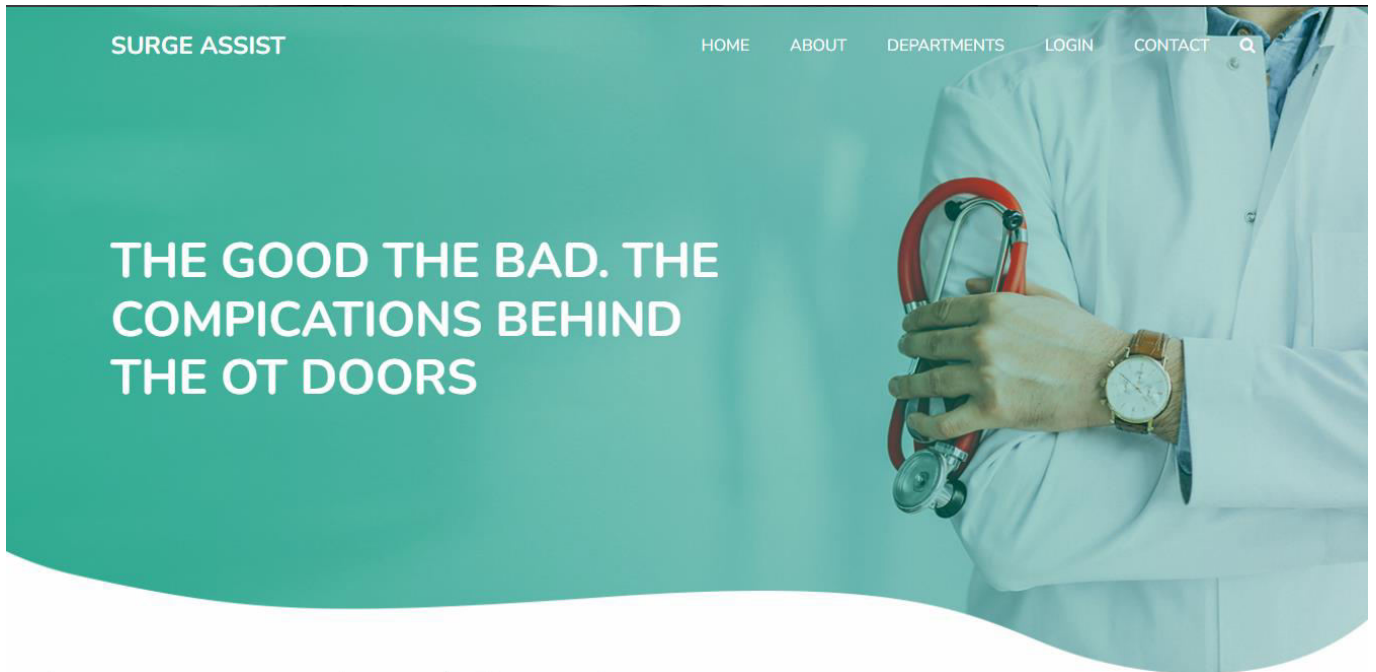


Fig.1

Login

Email address

Password

LOGIN IN

Fig.2

Figure 1 shows the home page for Surge Assist webpage. Figure 2 is the login page for authenticated users.



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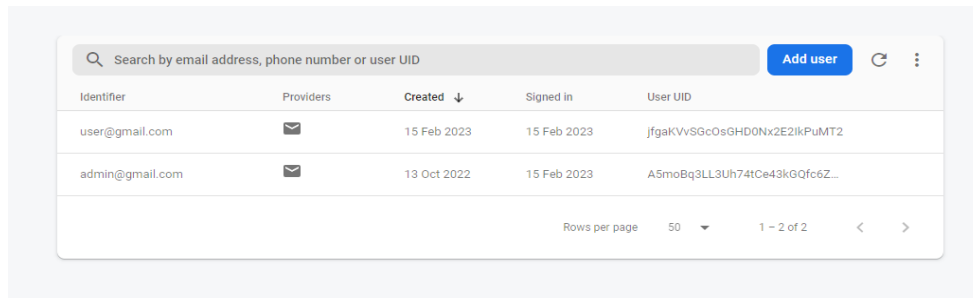


Fig.3

Figure 3 shows the firebase authentication for hospital staffs.

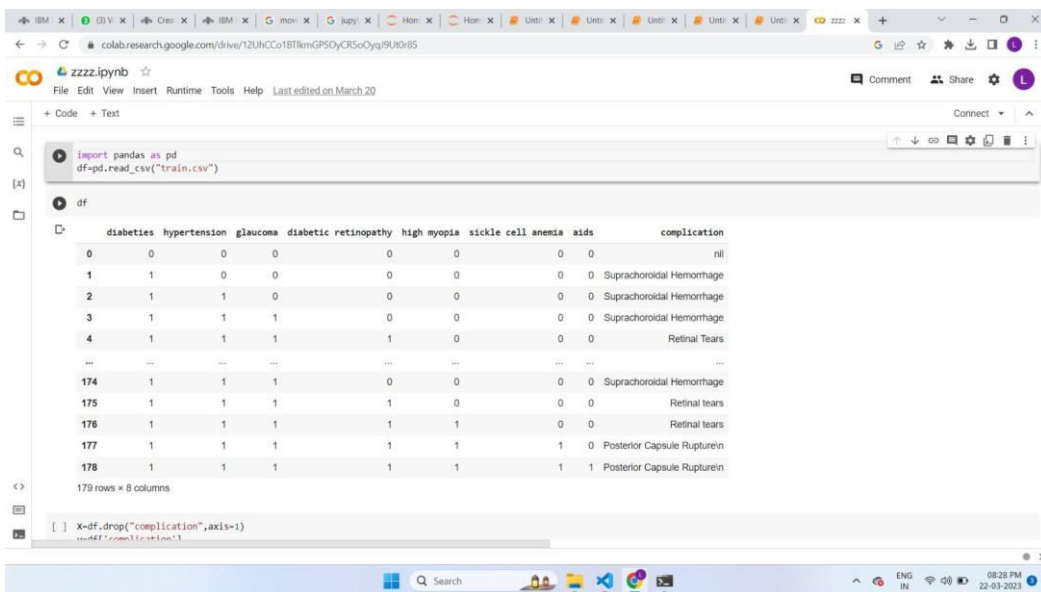


Fig.4

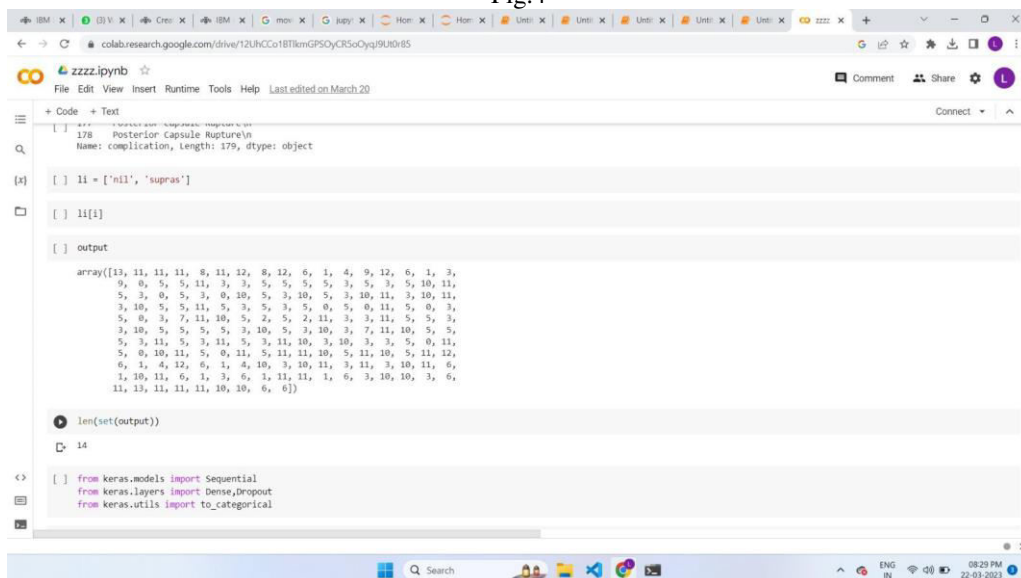


Fig.5

Figure 4,5 shows training the dataset using SVM algorithm



V. CONCLUSION

We have used machine algorithms to predict complications to help reduce death due to lack of practical knowledge of doctors, nurses and time delay. Implementing this in Indian hospitals, especially in the rural areas, can bring down the mortality rates due to medical negligence by nearly 50 per cent.

REFERENCES

- [1] Artificial Intelligence and Machine Learning in Prediction of Surgical Complications: Current State, Applications, and Implications Abbas M. Hassan, MD, Aashish Rajesh, MBBS and Charles E. Butler, MD.
- [2] Artificial intelligence in spine care: current applications and future utility: Alexander L. Hornung, Christopher M. Hornung, G. Michael Mallow
- [3] Predicting Patient-Reported Outcomes Following Surgery Using Machine Learning
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