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Automated Detection of Heart Attacks: A CNN-Based Approach

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Abstract: ***Seventeen million people die because of the world's cardiovascular diseases annually that make up to 32% of the global population. One fourth (25%) of global deaths and 17 million each year, representing almost a third (32%), are attributable to cardiovascular disease or the world heart attack syndrome. In addition, cardiovascular disease kills an amazing 32% of overall deaths on the globe per quarter of percentage to be exact. In the short term, heart disease's mortality rate could decline by predicting it. It has demonstrated that convolutional neural network is the best approach when implementing deep learning, generating training and test accuracy of 94.2%. Deep learning algorithm comprises of artificial neuronal network that uses a supervised machine learning method for the data set prediction. The EGC can also be used to detect cardio diseases. Deep learning will turn out being the most preferred approach because of its high precision and predictive power which also translates to good sensitivity and specificity. Deep learning techniques give better results than others, for example, CNN with auto-encoders.***

Keywords: Blob Storage, Azure, CNN, Database Warehouse, Medical Imaging.

I. INTRODUCTION

In today's data-driven world, we are constantly inundated with information from a multitude of sources. While data can provide valuable insights and inform decision-making, it is essential to recognize that not all data should be accepted unquestioningly. The problem lies in the assumption that data, by its nature, is inherently accurate, unbiased, and representative of the truth. This is not always the case, and there are several critical reasons why we should exercise caution and scrutiny when dealing with data. We should consider how the data was collected and what social and economic parameters are hidden in that data. Data can be incomplete, with gaps or missing values. Relying on incomplete data can result in skewed understanding of the situation. For example, if a physician does not take the patient seriously, they will be less likely to order a diagnostic test to obtain data and rather being diagnosed with heart attack, a condition may be classified as indigestion or anxiety so that the patient is sent home. Also, some of the cardiovascular-related fatalities may have happened because it was harder to access medical care during the height of the pandemic. There are instances where heart attacks may not be detected early, particularly if the symptoms are atypical or mild, leading to delayed diagnosis or misinterpretation of symptoms. heart disease is a common cause of mortality and recognition of the ECG signs is important.

II. PROPOSED MODEL

By paying attention to data, we can improve algorithms and retrain them on variables that are prone to bias. Using markers to chronic diseases and objective metrics of health AI can predict which patients need treatment and need intervention. Algorithms can cut down un-needed tests and recommend testing for individuals who have historically been undertested. Such as people of lower income. Homogenous data might affect the outcomes; hence algorithms should be retrained. Algorithms trained on such population and specific kinds of patients and their needs will be very useful and would solve this huge problem. To solve this problem, we are proposing a model. The model described in the paper has six stages. Firstly, a diverse and comprehensive dataset of patients and records, including demographics, medical history, lifestyle factors and symptoms is collected. This also includes data from patients who have experienced heart attack and those who haven't. Then the data collected is cleaned by handling missing values, outliers, and noise. Then the processed data is stored and synchronized which is hosted with help of cloud service provider. This processed and synchronized data helps identification of relevant features or attributes that may contribute to early detection. It includes various statistical lab tests, blood tests, ECG, X-rays and important techniques or domain expertise to select the most informative variables. After that, model selection stage chooses an appropriate algorithm for classification of task. Considering using AI models for extraction for medical imaging data such as Chest X-rays, tests like echocardiography and cardiac MRI, blood tests, ECGs are part of our dataset.

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In our model, we will be using CNNs are used to analyse ECG signals and medical images, such as coronary angiograms, for signs of heart attack. Then the model evaluation stage is crucial for ensuring that the AI model is safe, effective, and reliable for early detection of heart attacks in real-world healthcare scenarios. Then finally, the analysed data or results can be accessed by the physician with the patient's consent. Collaboration with physician is necessary as the medical experts and cardiologists help to validate the model's prediction and integrate in clinical workflows. This also helps us to maintain open lines of communication with healthcare professionals for continuous improvement of our model.

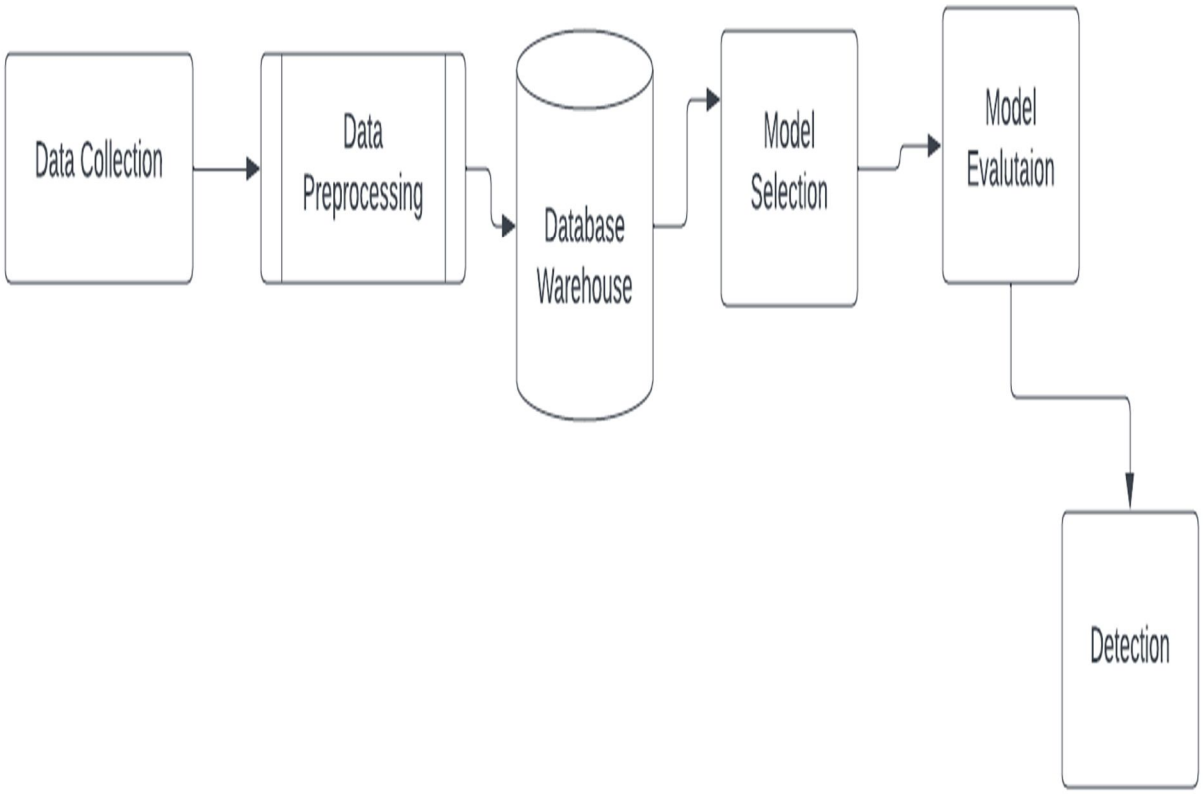


Fig 1: Block diagram of proposed model.

As shown in the above figure 1. It explains the process flow of the proposed model. The outlined steps form a coherent process, often represented as a block diagram, guiding the journey from raw data to valuable outcomes. We initially start with Data Collection procedure, the foundation of any data-centric endeavour lies in collecting relevant and comprehensive data. This initial step involves gathering information from various sources. The next step involves analysing predefined data also called as data pre-processing, raw data generally requires data cleansing, hence, pre-processing becomes imperative. This step involves cleaning, organizing, and transforming the data to enhance its quality and usability. Data Warehousing is a process where a well-structured data warehouse serves as a central repository for processed data. This facilitates efficient storage and retrieval, providing a solid base for subsequent stages in the analytical pipeline. Model selection involves choosing an appropriate model as it is an important decision that impacts the success of the analysis. This step includes selecting a machine learning or statistical model that aligns with the specific objectives of the study. Further, in Model Evaluation, rigorous evaluation of the chosen model is essential to understand its performance and reliability. Metrics such as accuracy, precision, and recall provide insights into how well the model aligns with the desired outcomes. Lastly, the process concludes itself with Detection, since the goal is often to detect patterns, anomalies, or trends within the data. This step involves applying the selected model to gain meaningful insights, assisting in making informed decisions.

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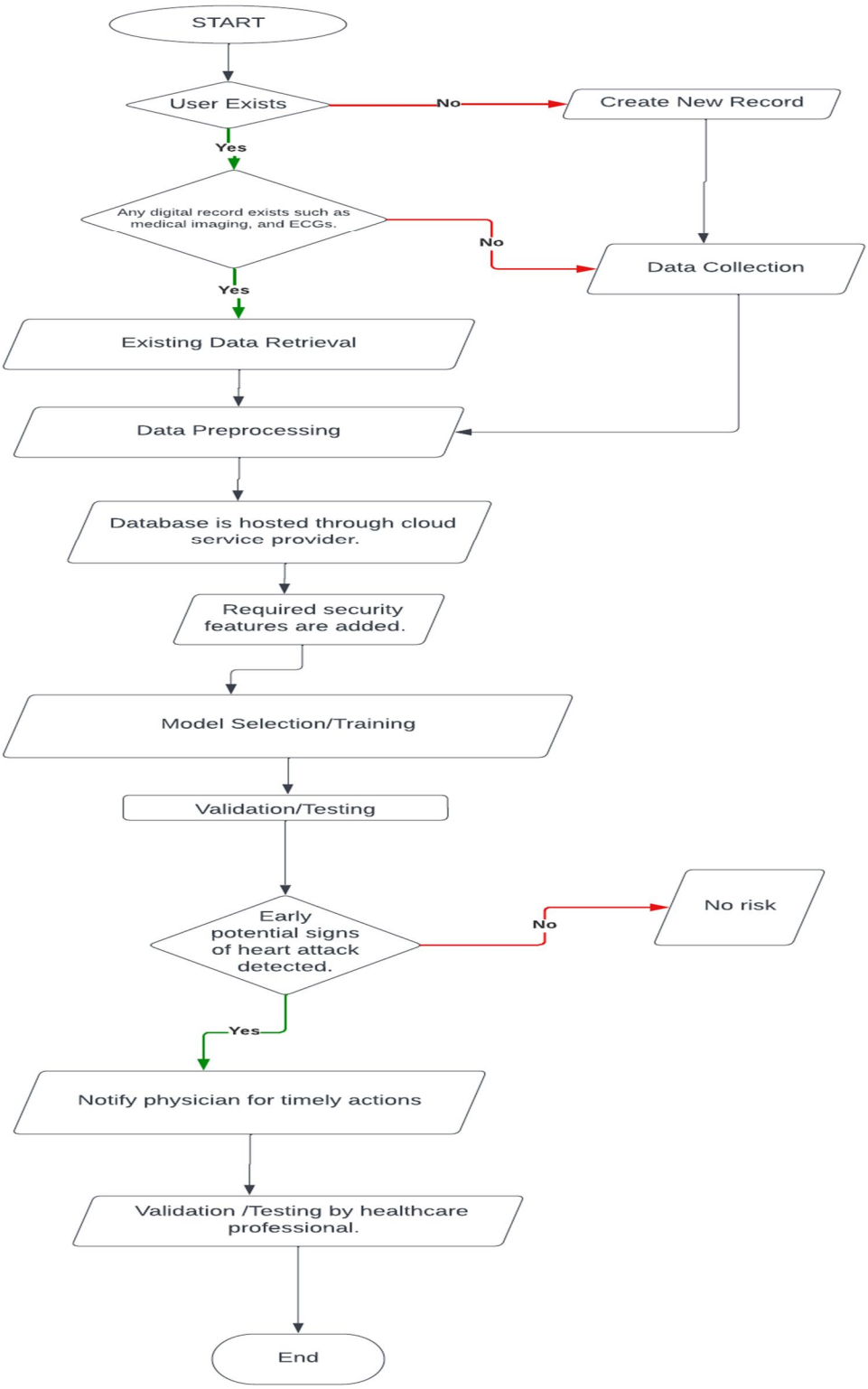


Fig 2: Flow chart of proposed model

As shown above, in figure 2, we are going to maintain the data which is collected from different sources such as hospitals and labs. The medical data will be hosted on Azure. Azure provides security providing appropriate azure security services and by using secured storage account such as Blob storage. After that, if a new user arrives at the clinic, a new record of that patient will be created by collecting the basic tests and symptoms from the patient. ECG images will be collected or converted to raw ECG signals into image-like representations. After that, pre-processing of data will be done if necessary, such as resampling, normalization, and data augmentation. After that, splitting of dataset will be done into training, validation, and test sets to train and evaluate CNN. After that, nature of ECG will be determined from the captured images. After that, the model will be trained, and it will extract relevant information, features and make predictions. Lastly, testing will be done to determine the robustness and to ensure the model's performance on the new and unseen ECG data. And then this analysis will be shared to the physician if timely action is needed.

III. CONCLUSIONS

The proposed model mentioned in this paper solves the burning problem with cutting-edge technology. Our research has made a great stride in the field of cardiovascular health. Using CNN-based automated detection of heart attacks improves the diagnostics accuracy and can lead to a new kind of emergency response systems. These findings will keep on being honed to ensure that early intervention will be nothing but a possibility, but indeed a reality, as a result saving lives and improving the quality of life for the patients.

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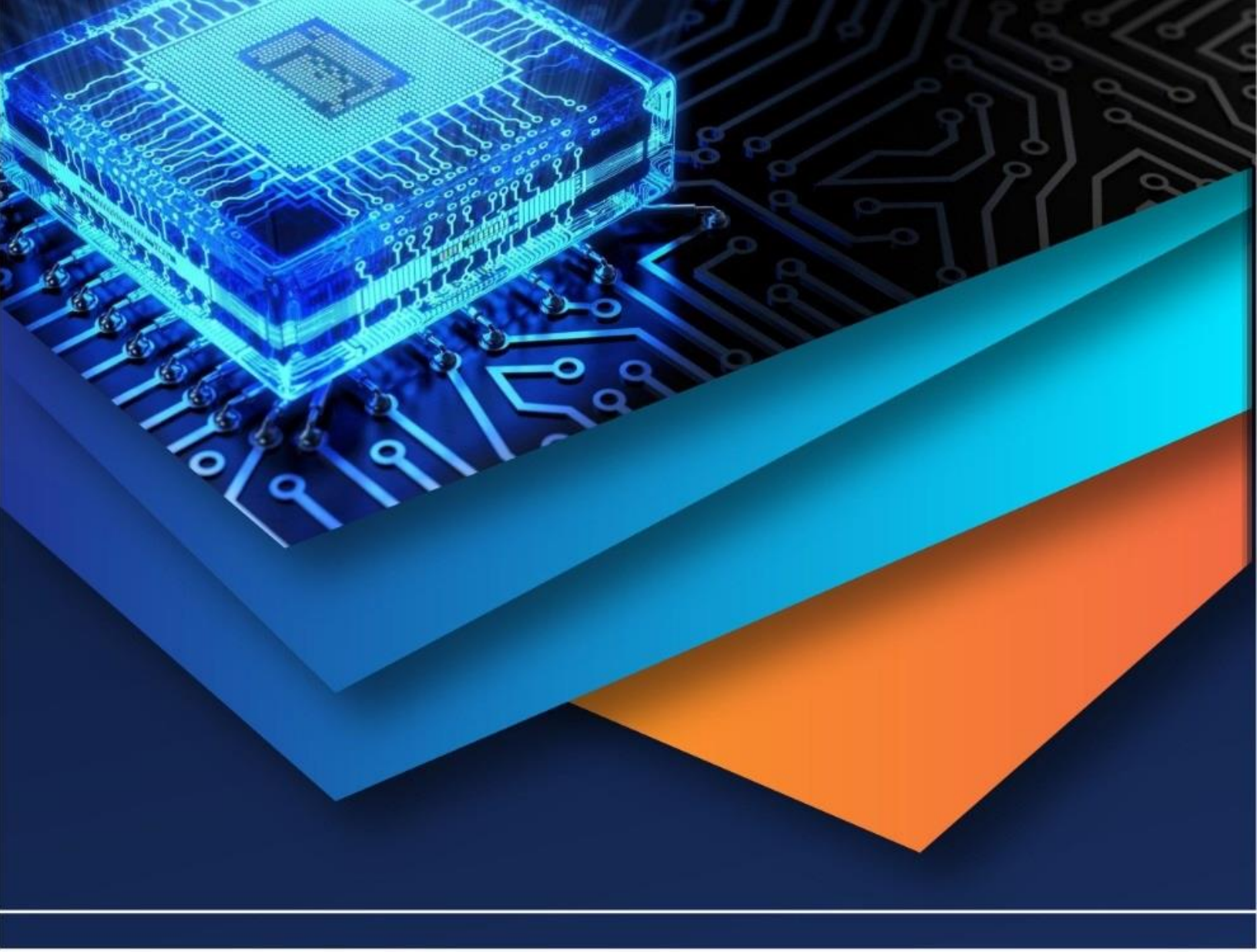
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