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Analysis of Real-Time Data for Sepsis Prediction Using Machine Learning

Dr K. Sailaja MCA, M.Tech , M.Phil , Ph.D [1], Sundharrajan Srinivasan [2]

[1] Professor & HOD, Department of Computer Applications

[2] Student, Department of Computer Applications

[1],[2] Chadalawada Ramanamma Engineering College (Autonomous)

ABSTRACT

Sepsis which is also known as Septicemia, is a life- threatening condition that results from both infection and the body's response to infection, ultimately causing injury to ones tissues and organs, and finally leads to death. Severe sepsis and septic shock can develop from untreated sepsis. The fundamental problem is that diagnosing the diseases and predicting their various stages takes a long time. Usually, a culture test is used to do this. The outcome might not be available for at least two to three days. When the organs begin to dysfunction. Sepsis primarily affects adults, but it strikes youngsters extremely quickly as well. Children can be more prone to acquiring sepsis, especially newborns and early babies. Finding the disease is a difficult task. Then many machines used to monitor body function such as heart rate, blood pressure etc. and ventilator to help the child breathe. It needs to be handled right away. When sepsis is not treated, the death rate climbs every hour. As a result, we have focused our project in the paediatrics area (1-12 years). The medical teams currently use the patient's medical history, symptoms, physical examination, and tests to determine the disease. Sepsis cannot be stopped once it starts. But sepsis risk can be decreased by avoiding infection. We employ the concept of machine learning to prevent the delay. It is a technique used to resolve intricate models and algorithms that are amenable to forecasting. Sepsis can have a positive impact on patient outcomes and cost of care when caught early. The algorithm might give doctors enough time to act before patients experience Sepsis' worst side effects. Thus by using this method the performance of prediction has been increased to 90% and the mortality rate can be reduced.

Keywords— sepsis, Machine Learning, Disease, Children, Risk, Impact.

I. INTRODUCTION

In today's era, each and every human-being on earth depends on medical treatment and medicines. Every day we can hear some new diseases or new symptoms of the existing disease being discovered. Disease prediction using patient treatment history and health data by applying data mining and machine learning techniques is ongoing struggle for the past decades. Many works have been applied data mining techniques to pathological data or medical profiles for prediction of specific diseases. These approaches tried to predict the reoccurrence of disease. Also, some approaches try to do prediction on control and progression of disease. The recent success of deep learning in disparate areas of machine learning has driven a shift towards machine learning models that can learn rich, hierarchical representations of raw data with little pre processing and produce more accurate results. With the development of big data technology, more attention has been paid to disease prediction from the perspective of big data analysis; various researches have been conducted by selecting the characteristics automatically from a large number of data to improve the accuracy of risk classification rather than the previously selected characteristics. The main focus is on to use machine learning in healthcare to supplement patient care for better results. Machine learning has made easier to identify different diseases and diagnosis correctly. Predictive analysis with the help of efficient multiple machine learning algorithms helps to predict the disease more correctly and help treat patients.

The healthcare industry produces large amounts of healthcare data daily that can be used to extract information for predicting disease that can happen to a patient in future while using the treatment history and health data. This hidden information in the healthcare data will be later used for affective decision making for patient's health. Also, this areas need improvement by using the informative data in healthcare.

II. RELATEDWORKS

Bo L, Jianxin Li proposed A resource-efficient IaaS cloud monitoring system based on networked intrusion detection system virtual appliances. The networked intrusion detection system

virtual appliance (NIDS-VA), also known as virtualized NIDS, plays an important role in the protection and safeguard of IaaS cloud environments. However, it is nontrivial to guarantee both of the performance of NIDS-VA and the resource efficiency of cloud applications because both are sharing computing resources in the same cloud environment. To overcome this challenge and trade-off, we propose a novel system, named CloudMon, which enables dynamic resource provision and live placement for NIDS-VAs in IaaS cloud environments. CloudMon provides two techniques to maintain high resource efficiency of IaaS cloud environments without degrading the performance of NIDS-VAs and other virtual machines (VMs). The first technique is a virtual machine monitor based resource provision mechanism, which can minimize the resource usage of a NIDS-VA with given performance guarantee. It uses a fuzzy model to characterize the complex relationship between performance and resource demands of a NIDS-VA and develops an online fuzzy controller to adaptively control the resource allocation for NIDS-VAs under varying network traffic. The second one is a global resource scheduling approach for optimizing the resource efficiency of the entire cloud environments. It leverages VM migration to dynamically place NIDS-VAs and VMs. An online VM mapping algorithm is designed to maximize the resource utilization of the entire cloud environment. Our virtual machine monitor based resource provision mechanism has been evaluated by conducting comprehensive experiments based on Xen hypervisor and Snort NIDS in a real cloud environment. The results show that the proposed mechanism can allocate resources for a NIDS-VA on demand while still satisfying its performance requirements.

JieCuiHan, ZhouHongZhong proposed Attribute-based keyword search with efficient revocation in cloud computing. With the advent of cloud computing, it is becoming increasingly popular for data owners to outsource their data to public cloud servers while allowing indented data users to retrieve these data stored in the cloud. For security and privacy reasons, data owners usually encrypt their data prior to outsourcing to the cloud server. At the same time, users often need to find data related to specific keywords of interest, this motivates research on the searchable encryption technique.

In this paper, we focus on a different, yet more challenging, scenario where the outsourced dataset can have contribution from multiple owners and are searchable by multiple users. Based on our research of attribute-based encryption (ABE), we propose an attribute-based keyword search with efficient revocation scheme (AKSER). Our scheme is highly efficient in terms of user revocation and can achieve fine-grained authorization of the search under the distributed multiple-attribute authorized institution. Security analysis demonstrates that the proposed scheme AKSER can achieve keyword semantic security, keyword secrecy, trapdoor unlinkability, and collusion resistance.

Zhong et al. [26] developed a mutual authentication and key agreement scheme based on elliptic curve cryptography for the peer-to-peer cloud. The elliptic curve certificate-free cryptography method was used for key generation.

Blockchain technology [23] provides higher security in data transmission and this is not suitable for cloud-stored data. Attribute-based methods [24][25][26] was suitable for cloud storage and lower efficiency in large dataset. Commonly, existing methods have limitations of doesn't support data integrity or lower efficiency in large datasets.

Generally, the communication overhead and information leakage risk increase with a greater number of delegation decryption keys. In existing key assignment schemes (symmetric-key encryption, key-aggregate encryption [26], etc.), the decryption key generation depends on previous classification files. When a new file class is uploaded to the cloud server, the whole classification structure must be changed in these methods. ..

JieCui proposed Attribute-based keyword search with efficient revocation in cloud computing. With the advent of cloud computing, it is becoming increasingly popular for data owners to outsource their data to public cloud servers while allowing indented data users to retrieve these data stored in the cloud. For security and privacy reasons, data owners usually encrypt their data prior to outsourcing to the cloud server. At the same time, users often need to find data related to specific keywords of interest, this motivates research on the searchable encryption technique. In this paper, we focus on a different, yet more challenging, scenario where the outsourced dataset can have contribution from multiple owners and are searchable by multiple users. Based on our research of attribute-based encryption (ABE), we propose an attribute-based keyword search with efficient revocation scheme (AKSER).

Our scheme is highly efficient in terms of user revocation and can achieve fine-grained authorization of the search under the distributed multiple-attribute authorized institution. Security analysis demonstrates that the proposed scheme AKSER can achieve keyword semantic security, keyword secrecy, trapdoor unlink ability, and collusion resistance. High mortality rates and the use of a sizable part of healthcare expenditures are caused by sepsis.Sepsis is varied and mysterious, making early diagnosis and rapid therapies difficult, despite the fact that they are linked to improved results. The systemic inflammatory response syndrome (SIRS) criteria, which have been proved to be nonspecific, and the centrality of inflammation have been dropped from the most current definitions of sepsis. According to current definitions, sepsis is a "life-threatening organ failure brought on by a dysregulated host response to infection."

Traditional Sepsis scoring systems include the SOFA, ACUTE and SAPS. The SOFA's (Sequential Organ Failure Assessment) sophisticated ICU-focused scoring system on criteria that aren't usually gathered on a regular basis in possibly septic ED patients might make some of its components unfamiliar. These include total bilirubin for hepatic impairment and arterial blood gases for evaluating the respiratory system. In addition, qSOFA has been criticism for being insensitive for sepsis screening13–21 despite potential gains in specificity for predicting mortality22–23 and organ dysfunction. The Quick (q) Sequential (Sepsis-related) Organ Failure Assessment (SOFA) score is suggested as a stand-in for organ dysfunction and may serve as both a risk predictor for patients with known or suspected infections as well as a reminder to doctors to consider the diagnosis of sepsis. Early warning scores (EWS) are physiological monitoring systems that track and alert when patients are rapidly deteriorating. They have been integrated into many healthcare systems. In a sample of patients with a suspected infection, Churpek and colleagues recently evaluated the ability to predict mortality or unscheduled intensive care unit (ICU) admission using qSOFA to more known alerting criteria. Early identification of patients who are at high risk of dying is essential to the correct therapy of sepsis. Historically, serum biomarkers and severity ratings have been used to determine this. The Acute Physiology and Chronic Health Evaluation II score is the one that is used the most frequently (APACHE II). However, APACHE II has a number of flaws that might result in an inaccurate score. For instance, despite the possibility of a poor end, the APACHE II score may be quite modest in young patients with severe sepsis but no chronic organ failures. While the probability of sepsis-related death is minimal, elderly septic patients with persistent organ failures may nevertheless have high APACHE II scores. The factors were chosen and weighted using logistic regression analysis to create SAPS II. 12 physiological factors, age, the kind of admission (medical, surgical, or unplanned), and three underlying disease-related variables make up the 17 variables that make up the 7 SAPS II (acquired immunodeficiency syndrome, metastatic cancer, and hematologic malignancy). The worst value recorded during the first 24 hours of ICU admission is utilised to calculate the physiological variables. With information from successive admissions to 137 ICUs in 12 countries, the SAPS II score was verified. Similar to the APACHE, measures were made to increase the SAPS II's accuracy once it became clear that some precision had been lost over time. Six additional admittance variables—age, sex, length of pre-ICU hospital stay, patient location before ICU, clinical category, and presence of drug overdose—were added to the original version and published in an expanded form in 20058. Compared to the original SAPS, this model offered superior calibration, discrimination, and consistency of fit.

The aforementioned educate medics on the severity of the disease and can aid in separating survivors from non-survivors. They are not devices for sepsis early detection. To identify sepsis, doctors use a variety of clinical criteria that exhibit very noticeable alterations in reaction to the physiological shock brought on by an infection. Contrarily, temporal relationships and subtle physiological changes could suggest sepsis before the critical organ failure required to fulfil the current sepsis diagnostic criteria.

III. PROPOSED SYSTEM ARCHITECTURE

The Sepsis LSTM model was created by training an LSTM network to predict whether or not a patient will develop septic shock during their hospital stay. The model is fed patient data from the MIMIC-III database during training, with each patient labelled as positive or negative depending on whether or not they developed septic shock during their stay. The input features utilised to generate the TREW Score are the same as those used by Henry et al.14, and comprise patient biometrics, vital statistics, and laboratory test results organised by the closest complete hour following admission. We also followed Henry et al's septic shock criteria. For the

model evaluation, the full data set was partitioned into two equal portions.The model was then trained twice, with each training session using a different set of two of these sections as training data and the last as test data. The ML model is fed into the application, which is designed to improve software utilisation. The application has an extremely simple user interface and is quite secure. The application receives user inputs such as patient names, reports, and so on. The trained model analyses the image and produces accurate and highly dependable results.

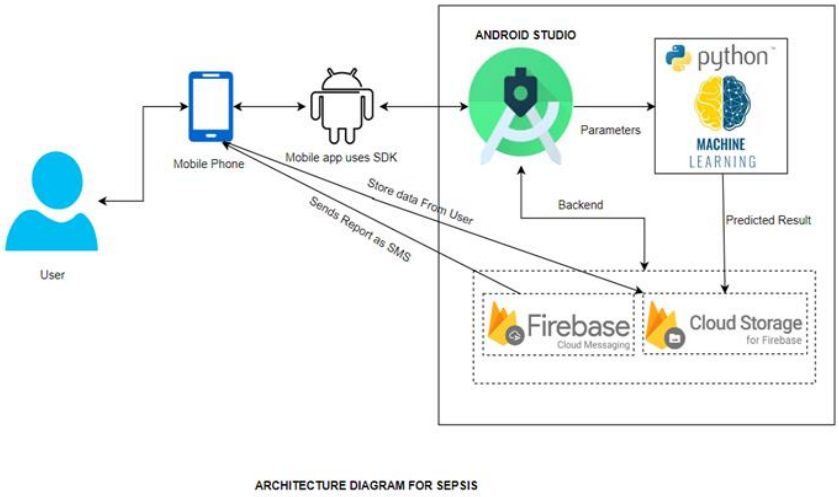

Fig.1 Proposed system architecture

IV. RESULTS AND DISCUSSION

The output screens obtained after running and executing system are shown from Fig.2 to Fig.5

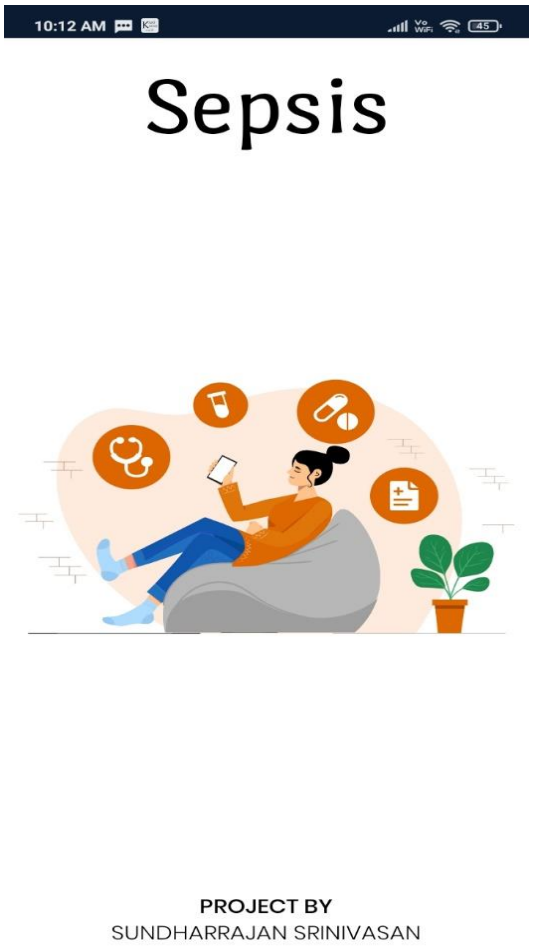

Fig.2 Splash screen

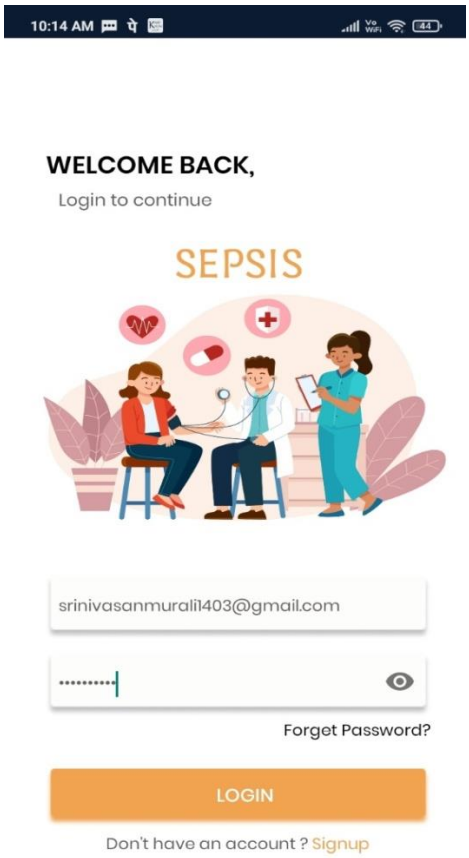

Fig.3 Login Page

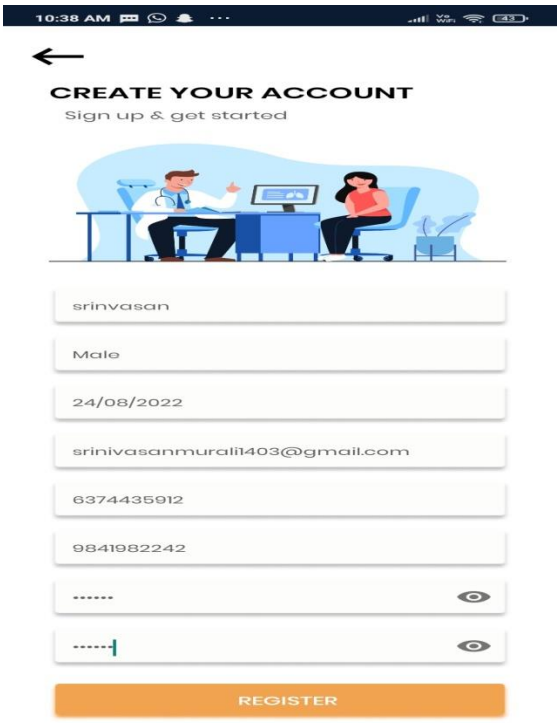

Fig. 4 Registration page

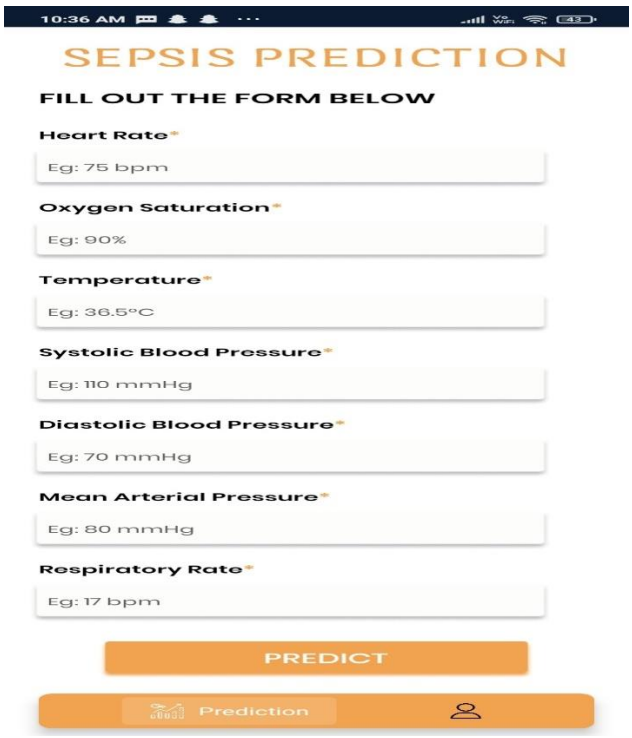

Fig. 5 Prediction Page

V. FUTURE SCOPE AND CONCLUSION

This project proposed a novel scheme to diagnosed sepsis quickly and accurately. Children's mortality rates could be cut in half as a result of this. The developed application is an important tool because it allows even the most inexperienced user to make the most of the software. The application not only automatically sends the report to the next of kin, but it also sends it accurately. Data is fed into the model at regular intervals, which improves it even more. This model significantly lowers the costs incurred as a result of the time-consuming tests, which are costly for many people. Many people can benefit for little or no cost by using our software.

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