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SERVICES FOR SCIENCE AND EDUCATION

Design Smart Phone Application for E-Health System (ICE) Urban Cities Based on Open-Source Software: Machine Learning Based Approach

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ABSTRACT

Industry, environment, communication technology and many things have been revolutionized with the invention of mobile phone. Various technologies have been invented for the transfer of data. Mobile phones are considered a big hit for the devices to be connected without physical wires. The health aware mobile application developed in Android has been proposed. A patient is given some of the authorities and features to be active in various situations and store much of the information which can be easily used in difficult situations. Various health applications are already available and many of the features are available and the proposed app uses accelerometer for the detection of number of steps walked every day and the energy consumed and others. Medical sciences are improving the way of living a healthier life with constant flow, but no one knows about the E-health diseases. We are here to save human life from tragic accident by an emergency application. The main goal ICEApp is to improve the quality of care, reduce wastage of time, reduce the stress in emergency, reduce health care cost and most importantly save many lives. Health care has always been a challenge for every other person. Nowadays the health sector is evolved, and it turns toe-health systems where electronic devices give proper care to humans. This study was conducted by using the operating system we get the data from the clouds. This data was analysis in the machine learning algorithms. In this research, we get 70% accuracy of the heart attack disease 30% of the general emergencies results we get the results through the analysis of the machine learning algorithms. The result of e-health emergency application is presented in such a way that can be used as an aid to reduce emergency incidents that may occur. Through this application, we get almost 100% results by providing it to a client that was satisfied with the one clicks emergency feature and easy to use navigation.

Keywords: Emergency, Disease Identification, E-health, Medicine Suggestion, Specialist Recommendation, machine learning, Information Technology

INTRODUCTION

In1990s hospital emerged computer-based hospital system. It contains some of the fields that worked to update these areas that are actually implemented. It measures the level of data extracted from healthcare systems, which improved health care because it has grown and developed health care. The use of techniques of personal medicine and analyzes of so-called guidance analyzes in addition to the intervention of this huge data in clinical risks and analyzes that predict diseases. However, the proportion of data in health care is increasing daily. Through this amount of data, they stored this data in electronic health records and data from the patient and the data. In healthcare have emerged from ethical challenges, ranging from influencing individual and security to revealing the truth, trust, and transparency at work[1, 2].Machine learning is getting really popular in lots of different areas, especially in medicine. Using machine learning can make a big difference in healthcare. You can use it to find diseases, sort them into categories, analyze X-ray images, and even suggest treatments. There are lots of different types of machine learning and deep learning models that can do these things. Using machine learning can help doctors make better decisions and be more reliable. Loads of organizations are working really hard to use machine learning to improve healthcare. Google, for example, has used machine learning to find breast cancer with 89% accuracy, which is better than the 73% accuracy of human pathologists[3]. It tends that information communication technology (ICT)organization that implement in system to supply the service to the electronic health systems take holder/organization Its goal to make in strategic manner in electronic health system present work as relatively in term to donate the healthcare practice supported by electronic communication process. Some persons argued that it exchanges the health information with electronic devices to cover the health system. In other words that can argue that to share the health information through the internet. It studies for the urban cities and poor people. Urban health emergency out of control peoples becomes danger for everyone. it is often very hard to find services for health or substance[4, 5]. That situation must treat to avoid injuries include extreme treating harmful, problems are getting care to lead the health/substance use condition, missed opportunities potentially, intensive emergency health care services. In many cases, emergency arise due to medical illness [6, 7]. The aim of machine learning technologies is to assist the diagnosis, disease identification, and decision-making rather than to take the role of healthcare providers. Many nations frequently struggle with a scarcity of qualified doctors, pathologists, lab technicians, and other medical professionals. This scarcity leads to numerous challenges in the healthcare system. In such situations, it's crucial to focus on using cost-effective technologies that can compensate for the lack of professionals. Machine learning tools can effectively address these challenges and enhance productivity. They can streamline tasks for everyone involved[8].Machine learning has already found successful application a number of industries, including factory production, automation process , recognition of speech, smart appliance design, security, several more where solved problems was previously challenging, machine learning has showing promises .It's clear that machine learning models can offer practical solutions to real-world problems[9].In the medical industry, the scarcity of trained professionals often results in limited access to healthcare services for many people, making medical services expensive and leaving a large portion of the population vulnerable to healthcare issues[2]. In some situations, a lack of access to therapy might be fatal. While modern technologies are increasingly improving the situation, developing countries continue to struggle to satisfy the increasing demands in the medical field[10]. Medical science

is the biggest and most important science in the world. As the most famous saying "Health is wealth", is hundred percent true E-health is everything because if a person is not healthy, he/she cannot do his work properly and with perfections, therefore, medical science is important to help in live longer. Healthcare workers are often looking for a way to monitor the emergency through the mobile apps. As more people start to use smart devices like mobiles, iPad, they may provide a tool to help the emergency mobile application are a program that collects the data from application and device this app help in emergency time. to describe the monitor of health system must provide service 24*7 hours in emergency[11]. To analyze the concept of software ecosystem health [12] identifies the health research is mainly based on business natural ecosystem open-source software.

Smart E-Healthcare System

The E-Health Economics program has focused on investigating the evolution of digital health for seven years. Since the inaugural study on the mobile health application industry, 6.7 million data points have been published, indicating the growth of the digital health and E-Health markets since 2010. The E-Health Economics program is the world's largest digital health research initiative. There have been over 15,000 participants since the beginning. The initiative aims to assess existing market conditions and potential developments in the digital health sector.[6]. It also analyzed the successful functioning properly, market changes, and governance of E-Health application publishers. This helps interested parties comprehend the current and future market changes[13, 14]. Every year, the program covers a number of current digital health trends. In 2017, the most recent themes covered the digital health business model, typical project budget, and the digital health accelerator program. This year's program includes the launch of numerous free download reports. This year, more than 2,400 decision makers and mobile and digital health professionals participated in market research to contribute to this year's report [4]. In 2017, a total of 325,000 health applications were available in 2017 whereas in 2022 the total number of health applications increased to 16 million. 82000 apps were added last year. Samsung and other compete in health apps but the Android are taking the lead in health apps. The gap of supply and demand is responsible for the widening of the gap between the developers and the download growth rates.

Overall, $ 6 billion health startups are fueling the market. In [15], Features of 5 G E-Health could offer more bandwidth, extensible encryption, and nearly latency-free communication. The notion of fifth generation technology is broad and encompasses not just human connectivity but also machine and IoT device connectivity, machine-to-machine (M2M) communication, and application connectivity. place patients watch medical staff [16] Since hospitals are remote from the general public, we have created an ICE app to assist patients in dire situations. The suggested ICE app makes use of the soon-to-be 5G network's high data rate as well as reduced latency, which may provide medical professionals and nurses with an effective way to monitor patients remotely and assist patients in an emergency.

A Strategic Study for E-health System

In 1990s hospital emerged computer-based hospital system. It contains some of the fields that worked to update these areas that are actually implemented. It measures the level of data extracted from healthcare systems, which improved health care because it has grown and

developed health care from the use of techniques of personal medicine and analyzes of so-called guidance analyzes in addition to the intervention of this huge data in clinical risks and analyzes that predict diseases[17]. However, the proportion of data in health care is increasing daily. Through this amount of data, they stored this data in electronic health records and data from the patient and the data. In healthcare have emerged from ethical challenges, ranging from influencing individual and security to revealing the truth, trust, and transparency at work[18]. It tends that information communication technology (ICT) organization that responsible to implement in system to supply the service to the electronic health system stakeholder/organization its goal to make in strategic manner in electronic health system present work as relatively in term to donate the healthcare practice supported by electronic communication process. Some persons argued that it exchanges the health information with electronic devices to cover the health system[19]. In other words that can argue that to share the health information through the internet. It studies for the urban cities the framework is Fig. 1 shows this concept.

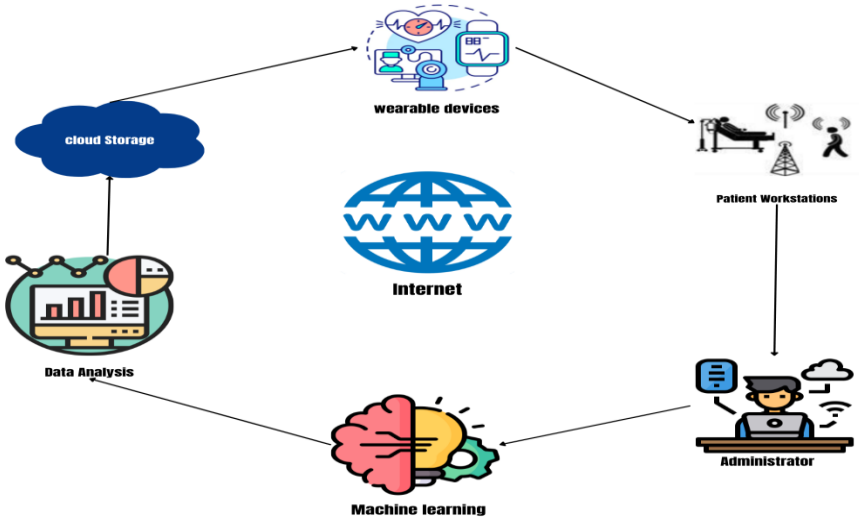


Figure 1: framework of ICEAPP

Quality Characterization of E-health

An urban health emergency out of control peoples becomes danger for everyone. it is often very hard to find services for health or substance. That situation must treat to avoid injuries include extreme treating harmful, problems are getting care to lead the health/substance use condition, missed opportunities potentially, intensive emergency health care services. In many cases, emergency arise due to medical illness [20]. In study of the American hospital of 2021, the health department medical software usability was tested and evaluated the results showed that the more than 55% of the used software does not possess the capabilities in accordance with the health department.

Open-Source Software

The term is related with specific approach of software development originated for the computer programs. In this context the open source is related with free software or software

which is free to avail and free to use along with the openness to enhancement in the existing code. Open source is a type of software in which any programmer can modify, inspect, remove, add and enhance the properties of the source code or any model or part of the software[21]. So, the part of the code can be modified by anyone who is intended to do so. A programmer can access the code will be able to improve and modify the accessed code and this is called open-source software and can fix the problems so that the code can work perfectly and work without errors.

PROPOSED MODEL

In this study, we used machine learning approaches to diagnose two diseases: heart attacks and diabetes. We used Decision Tree, Gaussian Naive-Bayes, Random Forest, Logistic Regression, k-Nearest Neighbors, Multilayer Perceptron, and Support Vector Machine classifiers to identify each disease. A disease detection model, a medical specialist referral model, and a medication suggestion model are all part of the web-based E-health system. The results of a condition diagnostic model act as the foundation for suggestions made by medical professionals and medication suggestion models. To utilize these E-health system features, users must provide disease-specific data.

METHODOLOGY

In this methodology the most common diseases regularly come in the urban cities that we were chosen, specific disease and emergencies for this research purpose. Prediction of diabetes and prediction heart attack disease is very common in Pakistan as well as in other urban cities.

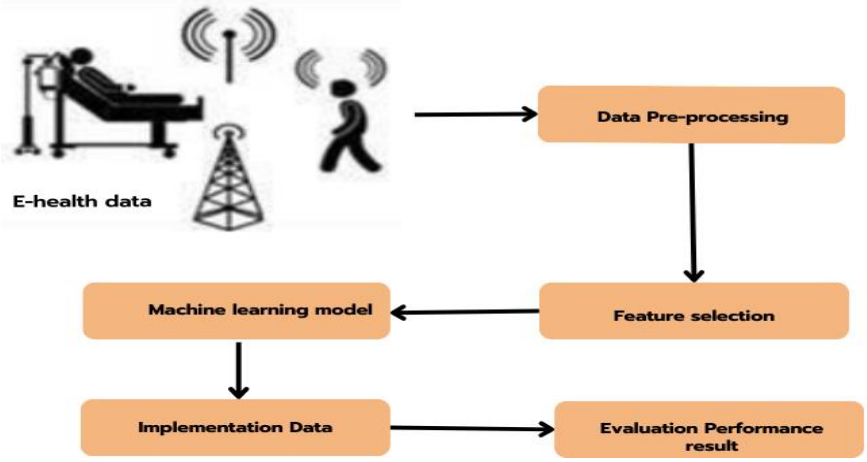


Figure 2: Research Methods of ICEAPP

Every emergency and disease have specific criteria for recognition. Certain data may need specific pre-processing and optimization in order to be appropriate for machine learning algorithm implementation. The research methodologies that were employed in this study are following below Figure 2.

Data Collection and Pre-Processing

Cardiovascular disease as well as emergencies having e-health databases created. Numerous medical hospitals, clinics, medical center representatives, and healthcare organizations have

provided these datasets. Medical facilities in urban areas as well as impoverished neighborhoods have provided data for the collection. We made an effort to guarantee that the medical patients that comprise our dataset come from a wide range of demographics areas. For diabetes, heart attack diseases, we were added our collected data with the two existing datasets of those diseases. For diabetes, heart attack diseases, we were added our collected data with the two existing datasets of those diseases.

Heart Attack Disease Dataset

Nowadays, machine learning according the survey of the world organization (WHO), in 2020 to 2021 the 17.5 million people are deaths in heart attack. In Pakistan, heart disease accounts for about 65% of fatalities, and these deaths typically happen in metropolitan areas. A huge amount of heart attack disease diagnoses from the patients. That is generated by healthcare industries[14, 22]. Many types of health-instruments technology were analyzed by them. The support monitoring home healthcare system and discussed guidance system which was schemed in china and in 2019[19].the health emergency of Pakistani urban cites data sets has 918 instances of heart attack data in our self-made datasets, we have collected more than 918 instances. Our datasets have created based on heart attack attributes for urban cities in Pakistan. Following these attributes are formed in this dataset.

- Pregnancies: The total number of pregnancies
- Glucose: After two hours, the plasma glucose levels during an oral glucose tolerance test
- Blood Pressure: Blood pressure at diastolic level (mm Hg)
- Insulin: 2-Hour Serum Insulin (micro-Units/milliliter)
- BMI: Body mass index (kg of weight divided by m of height) ^2)
- Diabetes Family History
- Age: The health of the patient its age
- Outcome: Variable of class (0 or 1) 1 is positive and 0 is negative.

There are 721 positive cases of diabetes out of the merged dataset's 918 incidences.

Diabetes Dataset

The machine learning predicting diabetes algorithms application dataset collecting the demographic and medical information developed the diabetes risk of predictive model that support the machine learning approaches for effectiveness of machine learning. Diabetes underscores that detection of strategies of diabetes and highlights the prediction accuracy of machine learning[23, 24].Diabetes machine learning investigates the AI methods for diabetes predictions .the healthcare emphasizes feature analysis of prediction of the diabetes disease. The hospital can understand the rationale behind the prediction and decisions for the diabetes patient care[5, 25]. The diabetes of deep learning model that predictive types of diabetes. the surveys of diabetes effectiveness for predicting algorithms. The machine learning approach synthesizing finds and identifies the prediction of diabetes. The study of diabetes in Pakistan urban cities datasets are found at urban cites in our datasets. In medical health organization of Pakistan urban cities diabetes datasets has been integrated with dataset. The Pakistan urban cities datasets have 918 instances of diabetes data and self-made datasets, we collected 1200

instances. Our datasets have created based on diabetes attributes of the Pakistani urban cities. Following these attributes are formed in this dataset

- Age: The health of the patient its age for significant risk factor and get the risk of older age.
- Cholesterol: elevated level of (LDL / HDL). the LDL is high level bad cholesterol and HDL is low level good cholesterol that increases the risk of heart attacks.
- Blood Pressure: high Blood pressure at diastolic level (mm Hg)
- Physical Inactivity: Lack of regular physical activity is associated with numerous risk factors for heart attack, including obesity, high blood pressure, and high cholesterol.
- BMI: Body mass index (kg of weight divided by m of height) ^2)
- Heat attack: A family history of heart disease can increase an individual's risk of experiencing a heart attack.
- Diabetes: Diabetes increases the risk of heart attacks in its patients because of things like insulin resistance and high blood sugar.
- Outcome: Variable of class (0 or 1) 1 is positive and 0 is negative.

There are 721 positive cases of diabetes out of the merged dataset's 1018 incidences.

Parameter Setting

We implement our models using Tensor flow and sklearn methods on a Windows computer with an 8GB RAM, 64-bitOS, and2.70 GHz processor. Wesplitthedatasetsinto attitudes are used in our research. As discussed earlier, the PRIME model that is purposed in this study will provide certain levels of efficiency based on the input data. As we talked about medical knowledge and the need to create it in the proposed model in order to obtain more efficient predictive results, medical knowledge contains several key factors contributing to the formation of medical knowledge. In order to contribute to the prediction of different risk factors for diseases and to obtain predictive results entirely based on the health and physiological behavior of people infected.

Process Missing Values and Feature Scaling

As all datasets are collected in real-time, some attributes may contain missing values. To address this issue, the Simple Imputer class from Python's sklearn library is utilized. Mean values are employed to fill in the missing attributes. Additionally, Feature Scaling is carried out to standardize the datasets for machine learning models. This is achieved using the Standard Scaler class from Python's sklearn library.

Feature Selection

To determine the optimal features in our datasets, the univariate feature selection process is employed. This method involves assigning a test score to each feature by comparing it with the dependent variable of the dataset. The SelectKBest class from high-bias algorithm is utilized for this purpose, utilizing the chi-square score function.

$$p(i|S_{dibaties}) = \sum_{w \in S_{predicted\,(u)}} p(i|TN) + p(TN) \quad (1)$$

Decision Tree Classifier

The sklearn tree classification Decision Tree groups of sklearn. trees have been imported for implying this PRIME model. After tuning the parameters, the model with the standard settings performed most effectively. The Decision Tree (DT) Classifier is a straightforward, common machine learning technique. In this classifier, all the data points in a dataset are plotted and then divided into smaller groups based on some parameters or conditions. The data present in the same small group get a similar decision.

Datasets

Feature Selection of Heart Attack:

Table 1: Average scores of heart attack dataset

Age	Sex	ChestPain	Resting BP	Cholesterol	Fasting BS	Resting ECG	MaxHR	Exercise	Oldpeak	ST_ Slope	Heart attack
40	M	ATA	140	289	0	Normal	172	N	0.0	Up	0
49	F	NAP	160	180	0	Normal	156	N	1.0	Flat	1
37	M	ATA	130	283	0	ST	98	N	0.0	Up	0
48	F	ASY	138	214	0	Normal	108	Y	1.5	Flat	1
54	M	NAP	150	195	0	Normal	122	N	0.0	Up	0

Feature Selection of Diabetes:

Table 2: Average scores of diabetes dataset

No	Age	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigree	Outcome
0	50	6	148	72	35	0	33.6	0.627	1
1	31	1	85	66	29	0	26.6	0.351	0
2	32	8	183	64	0	0	23.3	0.672	1
3	21	1	89	66	23	94	28.1	0.167	0

Datasets

Evaluation Metrics:

It takes expertise to evaluate an artificial intelligence model. With the evaluation metrics, the majority of the effectiveness measures are computed. The following are the terms:

- True positive (TP): The evaluation metrics both predicated the actual output is positive.
- True negative (TN): the evaluation metrics having both are predicated and actual output is negative.
- False positive (FN): Although the expected assessment metrics are good, the actual results are negative.
- False positive (FP): The evaluation metrics predicted is negative but actual output is positive.

The performance of evaluation metrics that have been used for machine learning models PRIME evaluating performance. The majority of the time metrics of performance are utilized to accurately assess machine learning models; nevertheless, they can be inaccurate when applied to datasets with unequal output classes. Although it assesses excellent performance with great accuracy, it cannot ensure that the machine learning (ML) model will be reliable. There is little emphasis on untrue negatives metrics in the precautions. Ignoring a negative result could be seen as disease model identification.

$$(TP + TN + FP + FN)/(TP + TN) \quad (2)$$

The evaluation metrics' score indicates whether the model's right value is valid. The precision score of the fraction of the patient's disease prognosis was indicated by the disease identification model. Consistency and reliability are higher in the highest accuracy model. This is the formula that follows.

$$(TP/(TP + FP) \quad (3)$$

The recall score calculates the percentage of right answers that were not predicted. This score includes patients who were classified as having a negative outcome in a disease classification model. As a result, it represents the model's actual positive rate. The following is the recall equation:

$$(TN/(TN + FN) \quad (4)$$

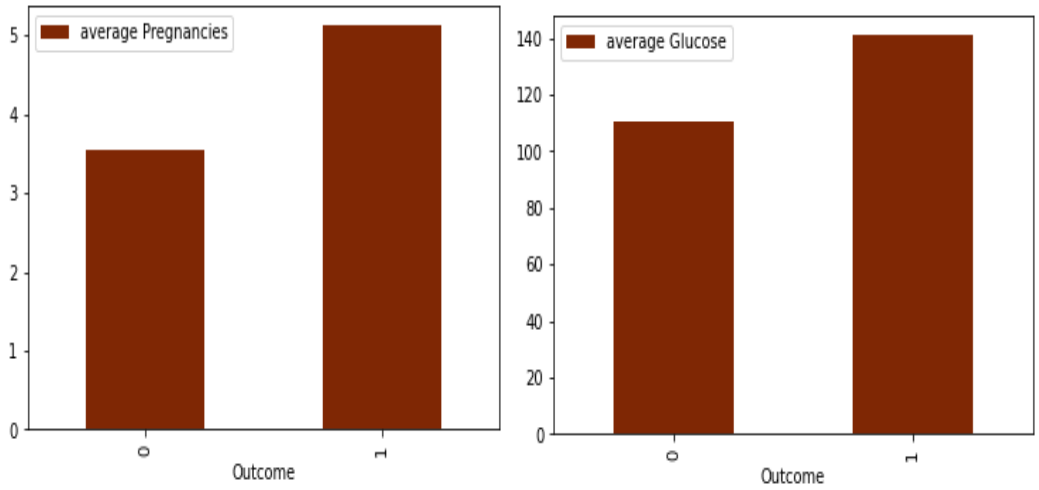
Research Questions

We propose the following research questions to assess how well our suggested model performs:

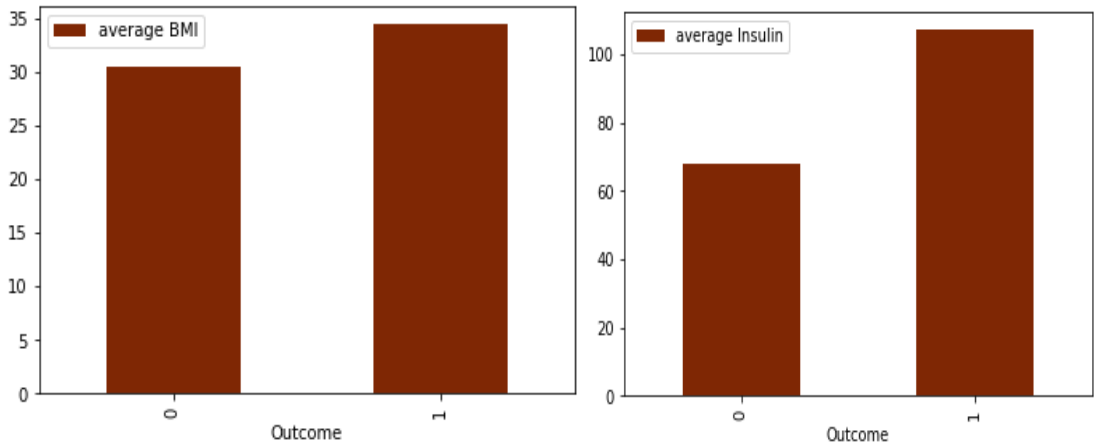
1. Constraint Feature Analysis of diabetes
2. Investigate Confidence Matrix Learned PRIME on the diabetes Dataset
3. Learned Weights by PRIME for Disease Duration on the diabetes for patients Dataset
4. Constraint Feature Analysis of diabetes
5. Investigate Confidence Matrix Learned PRIME on the diabetes Dataset
6. Learned Weights by PRIME for Disease Duration on the diabetes for patients Dataset

RQ1: Constraint Feature Analysis:

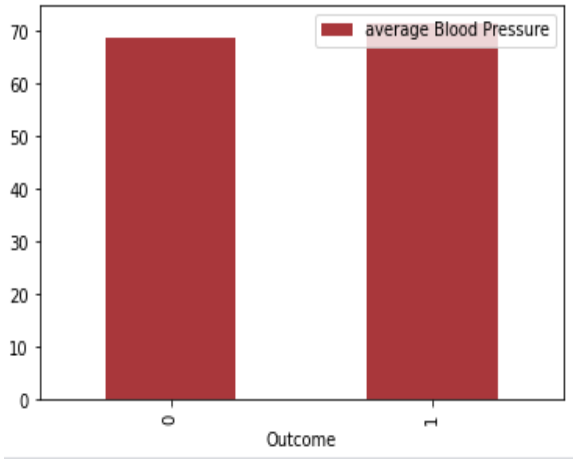
The proposed machine learning Models on the diabetes dataset yielded good results. The PRIME model was used to train the models. The figure displays 0 outcome means healthy patients and 1 shows diabetes patient. These attributes are used in the datasets its shows (a) pregnancies (b)Glucose(C)BMI (d) Insulin(e) Blood pressure.



(a) **(b)**



(c) (d)



(e)

Figure 1: Constraint Feature Analysis

RQ2: Investigate Confidence Matrix Learned PRIME on the diabetes Dataset:

The figure 1 shows the level of the assessment and reliability levels shows in the PRIME Model, which we were measure the collected dataset of patient records for diabties.it is possible to observe the normalized the density values, with the effectiveness of the application and integrated with the medial, as well machine learning techniques in predicting diabetes and investigate the disease accurately.

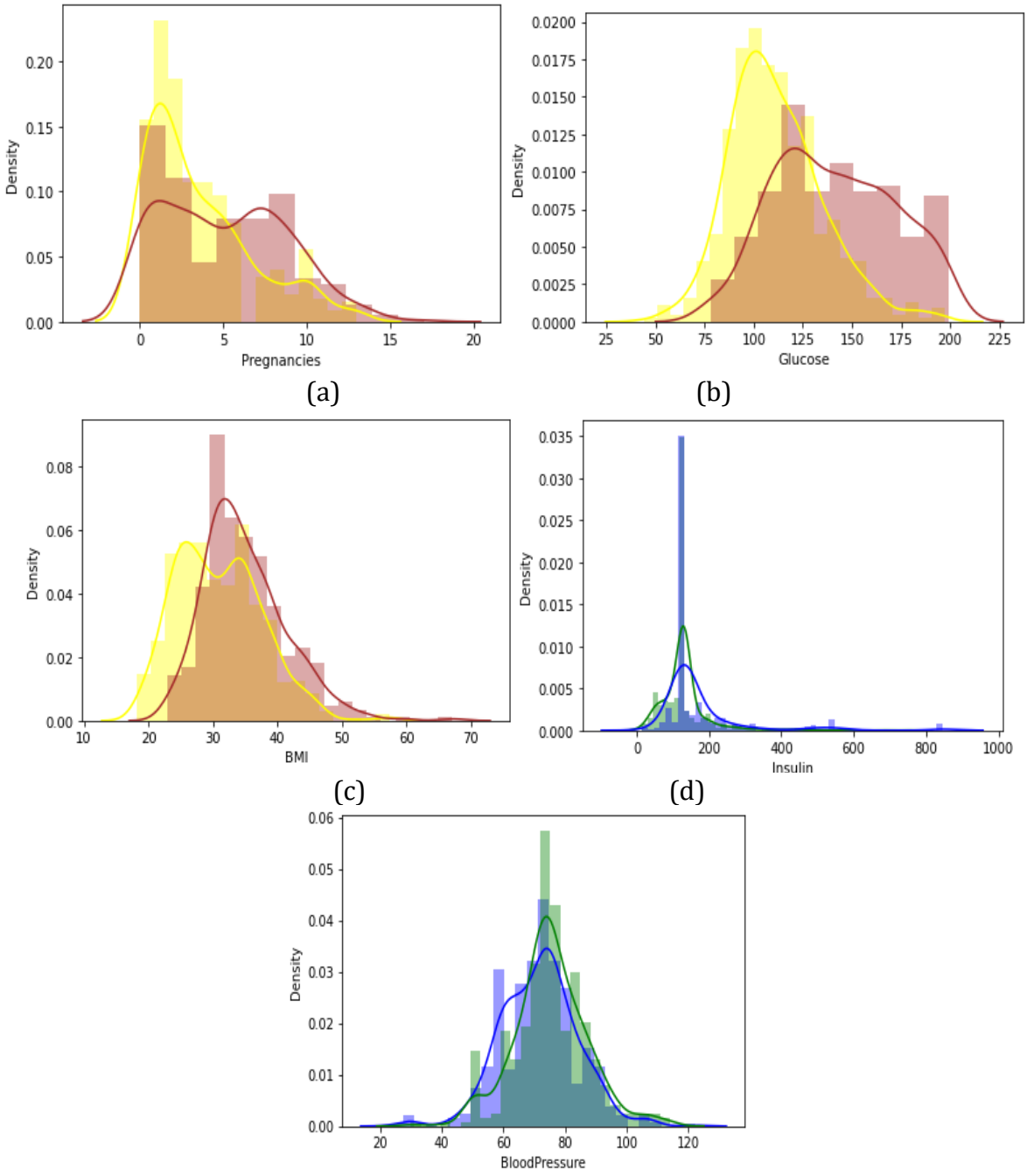


Figure 2: Investigate Confidence Matrix Learned MLP on the diabetes Dataset

RQ3: Learned Weights by PRIME Model for Disease Duration on the Diabetes for Patients Dataset:

In this figure, the range of Max values applied to diabetes patients is illustrated within the proposed pattern of prediction with the formation of medical knowledge. The evaluation data in our proposed PRIME model has shown the effectiveness and accuracy of results. The diabetes constraint characteristics shown in figure 1 red dot are showing male have no diabetes and blue dots shown No diabetes female. Other red shows male 80%have diabetes and females have

20% diabetes.

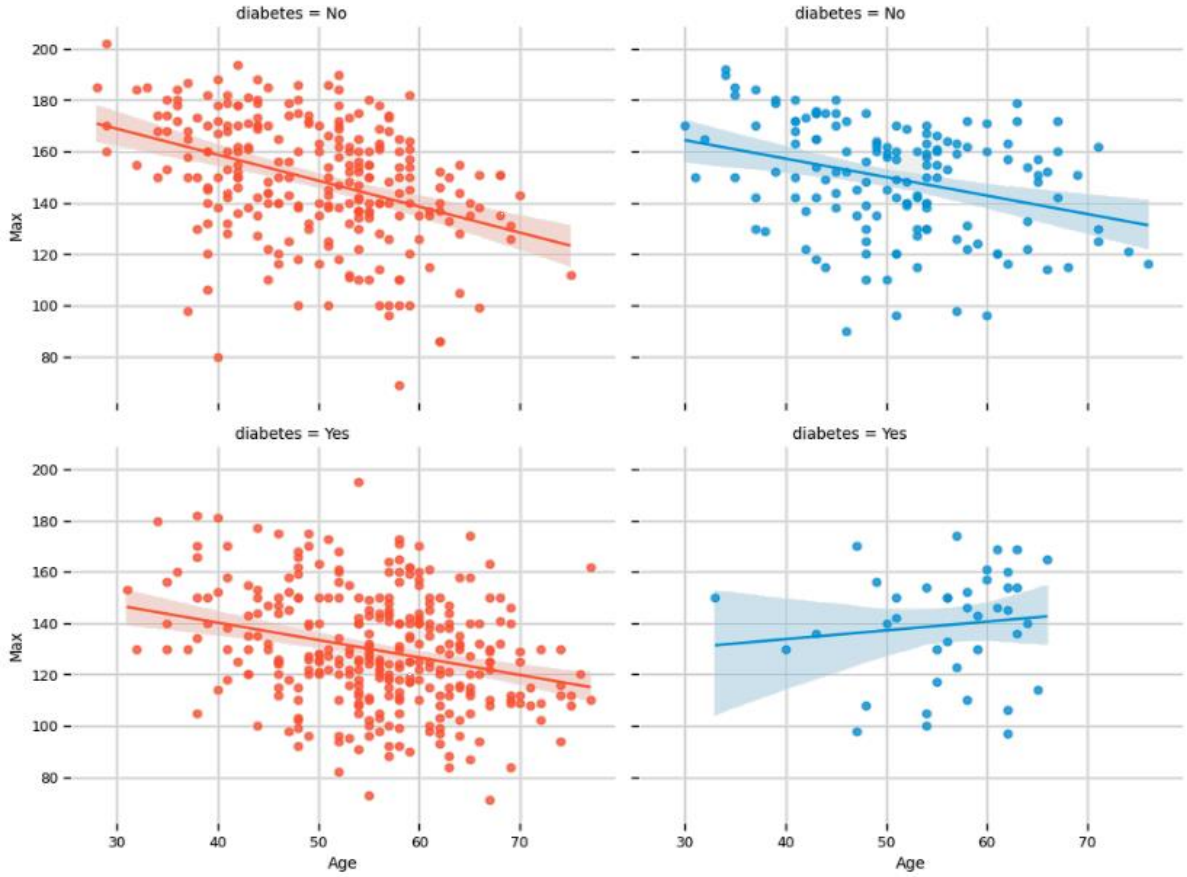
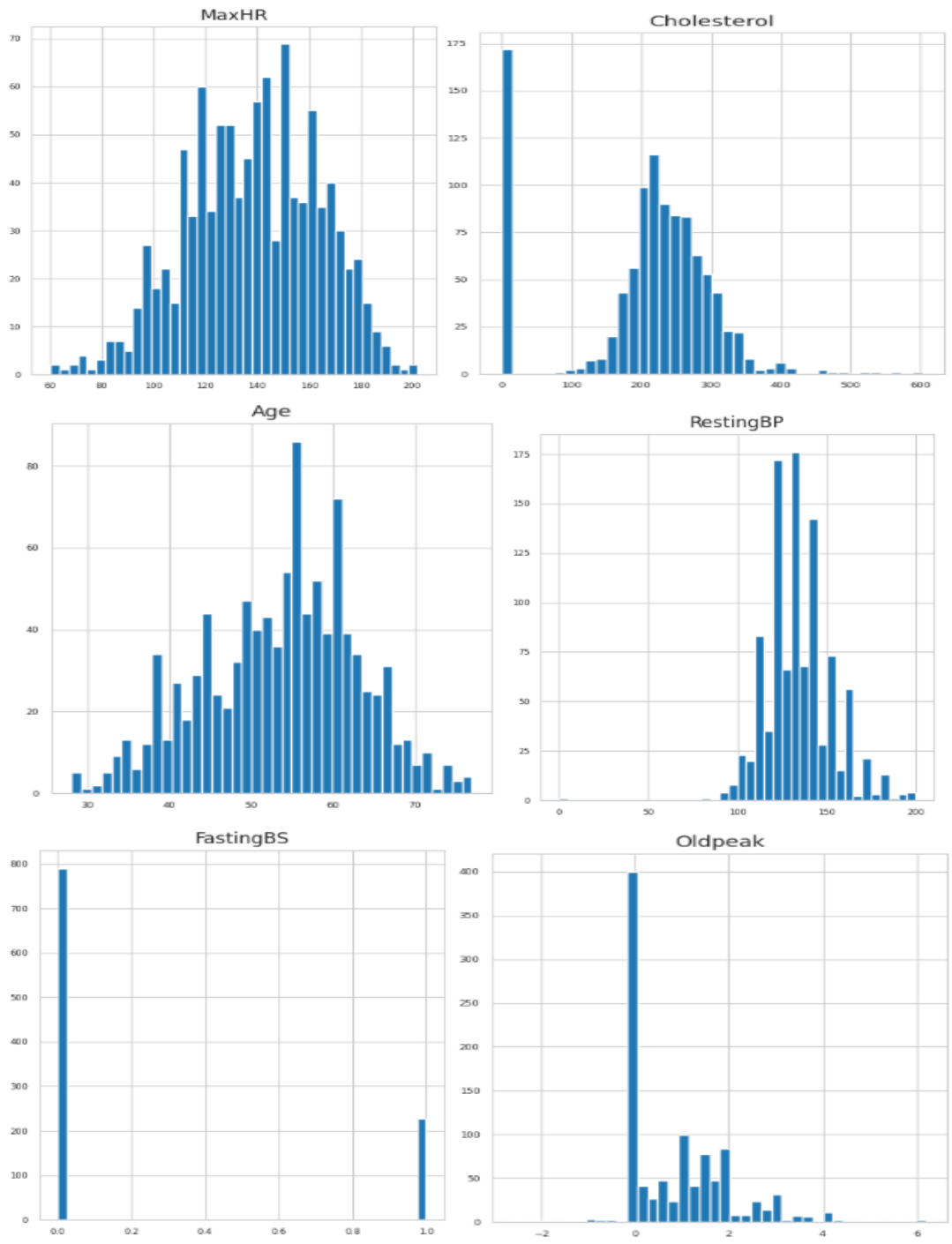


Figure 5: Learned Weights by MLP for Disease Duration on the diabetes for patients Dataset

RQ4: Constraint Feature Analysis for Heart Attack:

The proposed machine learning models produced satisfactory results on the diabetes dataset. The models were trained of PRIME model. this figure shows the heart attack attributes accuracy and analysis of the heart attack prediction datasets. These attributes are used in the datasets its shows in figure.


MaxHR
Cholesterol
Age
RestingBP
FastingBS
Oldpeak

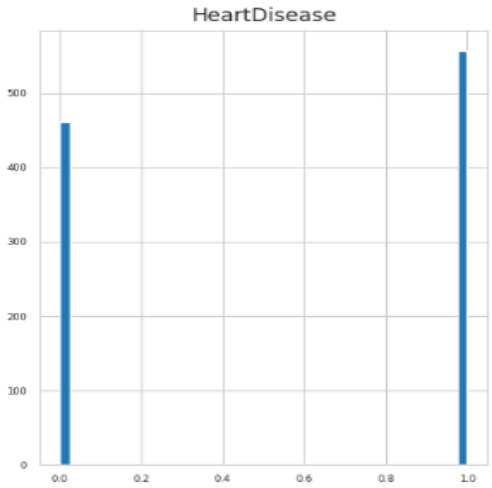
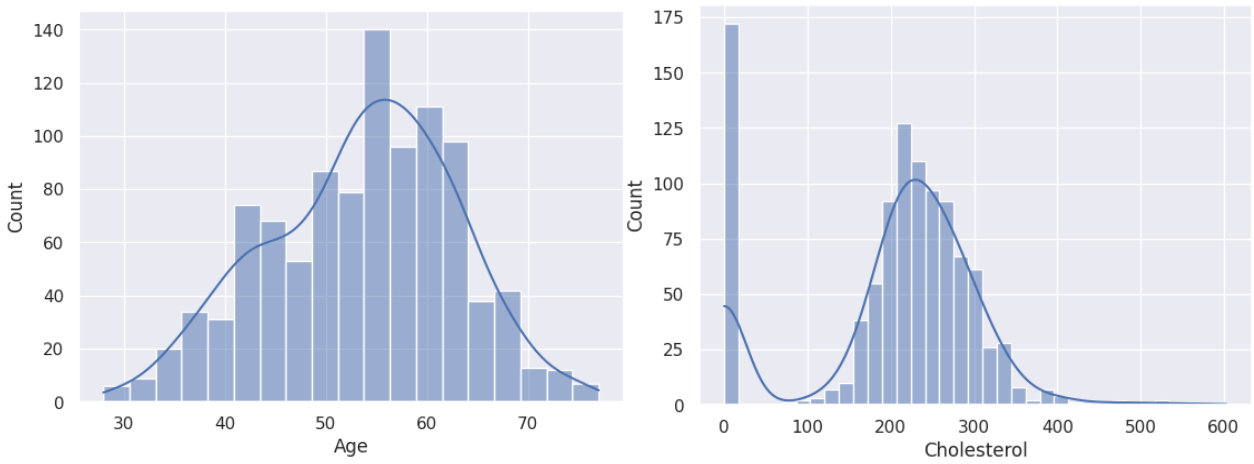


Figure 3: Constraint Feature Analysis for heart attack

RQ5: Investigate Confidence Matrix Learned PRIME Model on the heart attack Dataset: The figure 1 shows the level of the assessment and reliability levels shows in the PRIME Model, which we were measure the collected dataset of patient records for diabties.it is possible to observe the normalized the density values, with the effectiveness of theapplication and integrated with the medial, as well machine learning techniques in predicting diabetes and investigate the disease accurately.



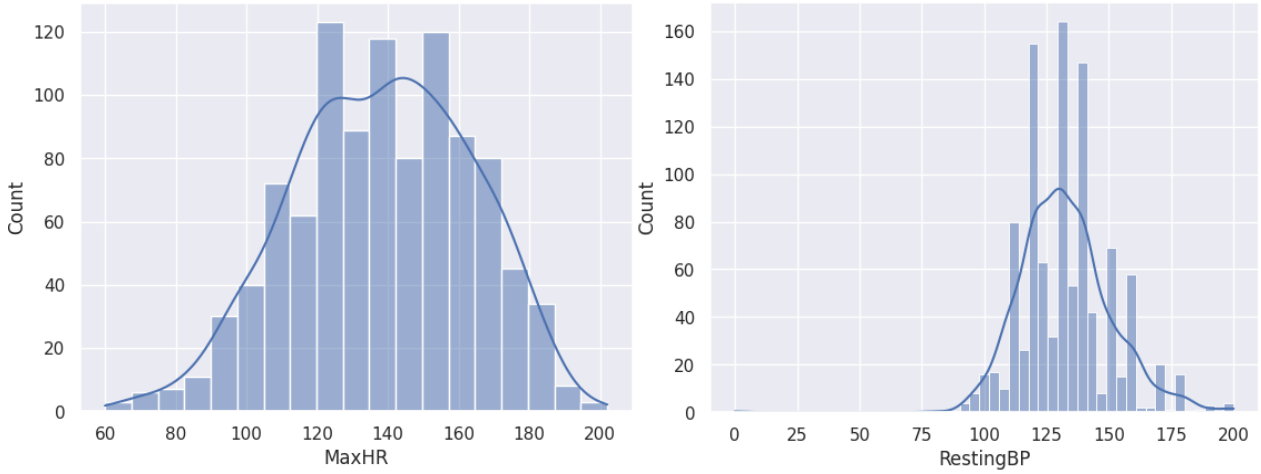
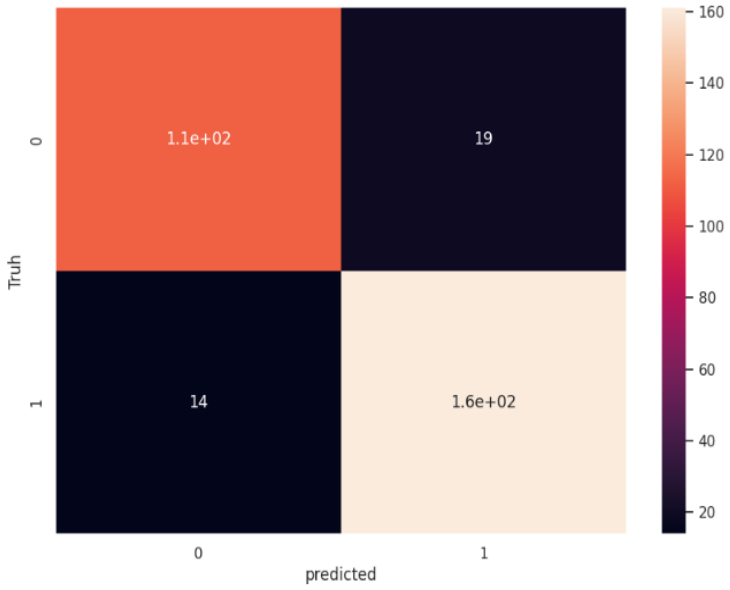


Figure 7: Investigate Confidence Matrix Learned PRIME on the heart attack Dataset

RQ6: Learned Weights by PRIME for Disease Duration on the Heart Attack for Patients Dataset:

In the two figures, the range of restriction values applied to heart failure patients is illustrated within the proposed patterns of prediction with the formation of prior medical knowledge. Evaluation data in our proposed PRIME model show the effectiveness and accuracy of prediction results. The constraint characteristics can be seen in Figure 3 (a). The risk of prediction may be increased due to congenital malformations generated by patients, deficiencies or abnormalities that impede the normal functioning of the heart valve and alcohol use plays an important role for patients.



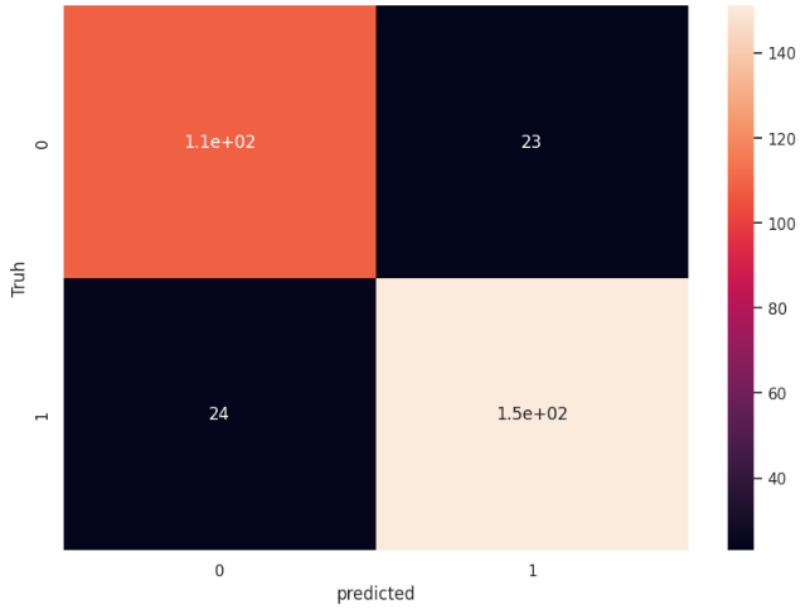


Figure 8: Learned Weights by PRIME model for Disease Duration on the heart attack for patients Dataset

CONCLUSION

In this paper, we developed an E-health system using machine learning, with a focus on the needs of developing and underdeveloped regions. Implementing machine learning for disease identification is challenging due to the sensitivity and time-consuming nature of data collection. Our models have shown impressive performance, motivating us to continue improving healthcare accessibility and impact for medical professionals and underserved patients. Our future goal is to gather more data on current diseases to enhance the performance of our identification model. Our website aims to provide E-healthcare to all, with a disease identification model to help patients and medical professionals categorize diseases effortlessly. The specialist recommendation model will facilitate easy connections between patients and doctors, while the medicine suggestion model aims to increase patient awareness about their medication. Moving forward, we aim to gather more data on current diseases to enhance our model's performance. Our website's goal is to offer E-healthcare to all. The disease identification model simplifies disease categorization for patients and medical professionals. The specialist recommendation model facilitates easy doctor-patient connections. Additionally, the medicine suggestion model enhances patient medication awareness. Though, the latter two models require further refinement for effectiveness and reliability. Both of these models require further refinement to enhance effectiveness and reliability. These research findings are promising and could significantly enhance the medical sector in develop and underdeveloped countries through the use of digital technology.

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