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Achieving Diabetes Patient Satisfaction Through Machine Learning

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Patient satisfaction is defined as the service and the treatment given to patients when he or she need it in the healthcare department, Patient satisfaction constructs a remarkable contribution to measuring the level of progress of the healthcare department, this paper presents the definition of satisfaction of chronic disease patients in the healthcare department; the primary purpose of this study was to assess patient satisfaction in the healthcare department for chronic disease patients, in addition, a chronic illness is known as the long-lasting disease, and the umbrella team of chronic diseases includes many diseases like Cancer, Liver disease, Arthritis, Asthma, Heart disease, chronic kidney disease, and Diabetes, machine learning techniques will impact with high level in predicting chronic disease and it will give accuracy result for predictive of status, on other hands the accuracy will affect in patient satisfaction.

KEYWORDS: Patient satisfaction-chronic disease, Machine learning.

Introduction

The huge advancement and rapid progress in technology techniques tied up with both of healthcare department and patients' satisfaction in health care area, The end-user opinion plays a significant responsibility in the measurement of performance satisfaction in any sector, So the company or organization looking for the achievement of key performance indicators with a high percentage for end-user. In the healthcare department, Patient satisfaction is measured by the quality and speed of service which the patients receive (speed of treatment, decision making from the doctor, delay time, and data set evaluated and categorized in which

department), moreover, the speed of treatment in healthcare depends on data or patient health records which play a major role in the speeding of treatment (Alelaiwi, 2019).

A. Patient satisfaction

Two factors measure patients' satisfaction, the first factor consists of two-part the ways and types of service that the patients received separately, on another hand, the second factor is the type of diagnosis to predict the disease in the early stage, assessment of patient satisfaction in the healthcare department tied up with many impact factors, and these factors are divided into two types according to palpability and in palpability, palpability related to the speed of treatment, waiting time, quality of service, nurse and doctor treatment, and the in palpability related to medical checkup and Electronic Health Record, that's why the assessment will play a vitally important role and be the critical points in developing the healthcare department (Alelaiwi, 2019).

Patient satisfaction is linked with the excellence of healthcare department services, patient opinion is essential and recommended to any process of modifying and progress in the healthcare department (Sabarmathi and Chinnaiyan, 2019).

Decrease the waiting time in the healthcare department will play an important role in patient satisfaction with the service, despite the complexity of this type of service or the complex of measuring the role of machine learning techniques come out with accurate results to predict the waiting time for any patients with chronic disease(Javadifard et al., 2019).

B. Chronic disease

The continued sharp spreading of chronic disease is one of the leading ones that cause death and danger for humans and health, The umbrella team of chronic diseases includes many diseases like Cancer, Alzheimer's, Arthritis, Asthma, Heart disease, chronic kidney disease, liver disease, and Diabetes. as a result of these diseases, the lifestyle will change to an abnormality new style with more restrictions, As the permanent diabetes patients number increased rapidly, Diabetes is defined as the lack of response to treatment and making insulin inside the human body, also when the sugar in the blood is too high diabetes will be found in the patient life (Mahedy Hasan et al., 2020).

C. Chronic kidney disease

Chronic Kidney Disease has many cases of diseases like (Diabetes, Blood pressure, and heart disease. The signally for that Kidney does not work well by one of the following notices or symptoms (abdominal pain, Back pain, diarrhea, fever, nosebleeds, rash, vomiting) (Chittora et al., 2021).

Chronic Kidney Disease is the miscarriage of Kidney function, Chronic Kidney Disease is invasive and costly, so the patients reach the end stage of the CKD without treatment and knowledge so that the early stage of prediction remains to play vitally important roles, there are three types of tests to check the Kidney condition:

I. Estimated Glomerular Filteration Rate(eGFR).
II. Urine test
III. Blood pressure

By the first type of testing, if the result of the test is more than 90 that means the kidney properly works well, on another hand if the result was less than 60 the patient suffering from Chronic Kidney Disease. whereas the second type of test if the result contains blood and protein in Urine that means the Kidney not working well.in addition, the last type of testing depends on blood pressure and with the first type of test(eGFR). if the result of eGFR reaches 15 or less then the patient's Kidney reaches the end of the kidney stage which means the Kidney is incurable the patient must choose one of two important choices (dialysis and kidney transplant).

The KNN (K-Nearest Neighbor) is one of the supervised types on machine learning algorithms are the most reliable of six classifiers algorithms used for accuracy of diagnoses and it gives better accuracy of 99.7% (Shanmugarajeshwari & Ilayaraja, 2021).

D. Chronic Diabetes Disease

Unstoppable increase of Diabetes makes it one of the more important diseases which need to predict and to know the ways to try to avoid it, Diabetes has three types: the first type's defined as when the pancreas can't produce enough amount of insulin, the second definition comes when the body can't respond to dealing with insulin effectively, and the last one is pregnancy diabetes is due to insulin-blocking hormones produced during pregnancy. This type of diabetes only occurs during pregnancy, highlighted prominently in the information from the World Health Organization (WHO), In 2019 the main reason for 1.5 million death occurred by diabetes whereas the percent of 4.8% for those with age is less than 70 years (Mahedy Hasan et al., 2020).

The pancreases operation focus on producing the main hormone which is called insulin, this hormone will affect the cell absorption blood sugar operation from foods, lack of insulin in the body will be called Diabetes, in these days Diabetes is still one of the most diseases that lead to death and will change the life to uncomfortable life style, increasing or decreasing the sugar in the blood will play an opposite role in the parts operation in the human body, However, the existence of too much sugar level in the blood is known as Hyperglycemia, The main reason for accruing this type of situation is one of both, the first reason has come when the pancreas does not correctly produce insulin and the second main one is the response operation of the body to the insulin correctly, many problems will be accrued by this type of diabetes for example(hyperglycemia can cause vomiting, excessive hunger and thirst, rapid heartbeat, vision problems, and other symptoms), according to International Diabetes Federation (IDA) in 2035 number of diabetes patients will arrive at 592 million all over the world, the machine learning techniques play a critical impact on predicting diabetes, Undoubtedly, the advance and update of progress technology connect to the healthcare, for this reason, the doctors said the early stage of prediction will impact recovery with a high

percent of achievement of treatment with new techniques will be supported by Artificial Intelligence (Yahyaoui et al., 2019).

Diabetes is the main reason causes of kidney disease and heart attack and blindness, poor knowledge on management the treatment and early prediction of diabetes will lead to blindness by Clogged arteries and branches of the ophthalmic artery, on other hand, Diabetes will lead to Diabetic Retinopathy(DR) and this is the main reason of blindness, according to WHO the 17% percent of blindness in the United State of America is come out from DR where the percent on China is less than USA percent of blindness causing with 7% percent, in addition, the etiology percent of blindness on Brazil is 7.6% of populations whom suffering of this disease(Alves et al., 2020).

Many people these days claim that Diabetes is very dangerous and destroy the internal part of the human body, but in fact, The two most popular reasons for diabetes is the pancreas product level of insulin and the other is sugar in the blood, however, diabetes is a non-communicable disease and the people who have suffered from it can live with stable life just if they follow the instruction of chronic disease doctors on diabetes control management (Tanvir Islam et al., 2019).

E. Machine learning algorithms

Machine learning is a particular method of artificial intelligence it collects information from training data, Machine learning is a modern and highly sophisticated technological application become a huge trend in the industry. moreover, machine learning plays a crucial role in many fields like finance, healthcare, and insecurity. Machine learning has four categories of algorithms:

Supervised learning

Unsupervised learning

Semi-Supervised learning

Reinforcement learning

We use the first type of machine learning (Supervised learning) the output data must relate to input by training and developing an exercise (Winter, 2019).

The huge information about the patients founded, So it is impossible processing by the human without any external intervention, that why machine learning provide algorithms to predict the future outcome, moreover there are many types in the healthcare sector like(clinical, sensor data, genomic data omics data, Transcriptomic data and proteomic) (Islam et al., 2020).

Depending on the data and the information to be extracted from the data, various machine learning algorithms for analysis and preprocessing are used. Support vector machines are used for analyzing the ECG and EEG data for diabetes classification (Site, Nurmi and Lohan, 2021).

Related Works By Machine Learning with patient satisfaction

I. Waiting Phlebotomy Unit

Developed an artificial neural network as a classification software tool to predict the patients' waiting time at the Phlebotomy Unit, and this tool helps the patients to expect the waiting time while it needs some necessary data like pregnant, polyclinics, and elderly, all of these statuses significant impact in the waiting time (Javadifard et al., 2019).

II. Heart disease prediction

The early prediction of heart disease plays an essential role in the control and managing the disease and will give the patients a chance to control and deal with suffering efficiently; machine learning is tied up with predicting and discovering heart disease early by using two applicable machine learning algorithm which is known as Hybrid grid search and Random search the patients will get the approximately result to predict the early stage of heart disease (Katarya and Srinivas, 2020).

III. Diabetes prediction

The health record is vital to collect the data about any diabetes patient; moreover, getting the previous result and test status will help to predict the future test status, using six machine learning techniques to predict diabetes and these techniques named (NB, KNN, SVM, LR, DT, and RF), in addition, the researcher used Indian data set and divided these data into two-part, the first 70% for training the machine and the other 30% for a test, the outcome of this research come out with the accuracy of using this machine learning techniques, The result of accuracy for (NB, KNN, SVM, LR, DT, and RF) will be (74%,77%,74%,71%,77%,77%) respectively(Sonar and Jaya Malini, 2019).

IV. Kidney prediction

Predicting chronic kidney disease in the early stage plays a vital role in saving the life, keeping the kidney working well, and managing the treatment with new patients' kidney issues status. in addition, chronic disease is tied up with machine learning. All Machine learning techniques play a crucial role in this predicting process, but the linear support vector machine (LSVM) comes out with the highest accuracy of 98.86% (Chittora et al., 2021).

V. Liver disease

Support Vector Machine (SVM)with 99.76% accuracy is the best one on the list of methods (KNN, BP, SVM, and NBC) to predict the liver disease (Shaheamlung, Kaur and Singla, 2019), Patients with Related Hepatocellular Carcinoma linked to Non-Alcoholic Fatty Liver Disease have a poor prognosis for survival. In patients with NAFLD, even low alcohol use was linked to a worse prognosis. Other risk variables that were found to condition increased

mortality at the time of HCC diagnosis in these individuals' included obesity, cirrhosis at any stage, and CSPH. When it came to determining prognostic markers for mortality at the diagnosis of HCC in patients with NAFLD, XGB was the algorithm that produced a more effective prediction model. In the day-to-day care of these patients, this model can be a useful tool(Suárez et al., 2024).

VI. Patient-Reported Outcomes Following Surgery

The application of AI and ML models to predict PROs following surgery has grown significantly in recent years. ML models have the potential to facilitate shared decision-making and improve patient outcomes by accurately predicting PROs following surgery.ML models can be used to identify patients at risk of poor outcomes and provide individualized care. Further research is needed to fully explore the potential of ML models in the surgical field. The study demonstrates the potential of ML models in predicting poor outcomes after lumbar discectomy, which can improve surgical outcomes and patient care, After breast reconstruction, PROs like contentment with the breasts are essential for gauging a patient's psychological health and quality of life. Breast reconstruction decisions are now made based on clinician preferences and population-based outcomes(Hassan et al., 2023).

CONCLUSION

In summary, the results and knowledge from prior studies in this paper will be used to develop an automation model for chronic disease patient satisfaction. Hence, this comprehensive study focuses on essential aspects like chronic disease, the type of machine learning, patient satisfaction, and the crucial role of machine learning in predicting chronic disease and how the machine learning play vital role in increasing patient satisfaction.

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