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Forecasting the Recurrence of Chronic Ailments Using ML with Primary Personalized Healthcare for Patients

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Abstract

Major clinical disorders, known as chronic illnesses, can significantly reduce a person's well-being. The warning symptoms and indications of chronic conditions should be recognised, and when any of these symptoms continue, you should consult your doctor. Early detection and intervention can lower the risk of complications and assist in managing the symptoms. This can help enhance the precision of evaluations and therapies by spotting patterns in medical information. Also, depending on each patient's unique requirements, personalised therapies may be created using machine learning. Algorithms for machine learning should improve in accuracy as even more data is made accessible to healthcare providers. Healthcare professionals may reduce their time on normal responsibilities and concentrate on clinical outcomes through automating repetitive tasks. By generating more precise forecasts, machine learning can lower the chance of chronic illnesses recurring in disease prediction chronic ailments dataset from GitHub repository. Recurrence of chronic illness can cause long-term types of diseases that damage people. In this research, based upon the personalised healthcare of patients with chronic illness, we reduce the chance of recurrence using a machine learning approach.

Keywords: *Chronic Condition, Machine learning, Chronic illness, Personalized Healthcare*

1. Introduction

Healthcare might undergo a transformation due to the strength of machine learning. There are various other things you may do to control the symptoms of chronic illnesses in addition to adhering to the medication regimen prescribed by your doctor. They involve obtaining enough sleep, maintaining a healthy diet, engaging in regular exercise, and avoiding stimuli that might exacerbate symptoms. A diagnostic test and an evaluation of the medical records of the patient are often required for the identification of long-term conditions. In some circumstances, subsequent testing could be required to validate the diagnosis. A chronic condition may be treated with medicine, lifestyle modifications, or other methods. Persistent pain, exhaustion, respiratory problems, and appetite changes are all typical signs of chronic illnesses. Chronic conditions can occasionally also result in psychological symptoms like anxiety and sadness. It is significant to remember that individual symptoms may differ and may not be the same for everyone. Early detection and intervention can lower the risk of consequences and assist in controlling the symptoms. It is indeed essential to take precautions against chronic illnesses, along with managing their signs. According to the ailment, persistent illness indicators might change. Fatigue, soreness, respiratory difficulties, and loss of appetite or obesity are usual signs. It's critical to note any variations in their concerns and let their doctor know about them. Machine learning is an effective method for detecting and forecasting the return of chronic diseases. Algorithms based on machine learning are able to discover patterns in patient records that can point to a higher likelihood of recurrence.

Medical experts can effectively avoid and manage chronic diseases by comprehending those patterns. Moreover, personalised therapies for chronic illnesses may be generated using machine learning. A chronic illness is a condition that persists for a prolonged period, typically more than three months. Managing the impacts of chronic conditions may be challenging. Following the recommended course of therapy is crucial since it means paying attention to any indications, as doing otherwise can result in further health issues. In order to successfully manage stress, one must have a chronic illness.

It's crucial to adhere to your doctor's prescribed treatment schedule. This could entail using drugs, altering one's lifestyle, or receiving other therapies. It's also important to keep track of any possible pharmaceutical side effects and to let your doctor know if any of them worry you. Moreover, it's critical to take preventative measures against chronic illnesses, including such things as maintaining a healthy diet, engaging in regular exercise, and refraining from tobacco use and heavy drinking. Through the examination of vast volumes of patient records, algorithms using machine learning can discover patterns that might indicate a higher risk of recurrence. It can help physicians better predict and manage chronic diseases. People who have chronic diseases can help lower their chance of recurrence and improve their standard of living. Chronic disease leads to a high rate of disability and death, which causes the overall death rate to be high all over the globe. Chronic disease is linked with lifestyle choices based on nutritious foods and junk foods, which cause different diseases. Different types of diseases, such as heart ailments, diseases, and arthritis, occur due to long-term chronic illness with recurrences. Chronic illness is the most common type of chronic condition that harms one's health through harmful behaviours. Particularly due to a lack of physical activity and obesity, tobacco use can prolong illness. The rise of chronic disease is a serious problem that has an impact on health and is harmed by irregular daily activities. One of the complications of chronic illness is depression. People with chronic illnesses have to adjust to both the illness and its treatment. Based upon the lifestyle conditions of the people, the medical treatment needs to be followed.

The development of depression within people denotes the prolongation of long-term medical illnesses, which are interlinked with physical and sustainable qualities over the health factor. Around one-third of the population is suffering from prolonged illness, which can cause serious medical conditions due to physiological trauma. A chronic medical condition may be addressed through medication, dietary modifications, and therapy. It is really crucial to collaborate with a health professional to create a customised treatment plan. In general,

having a network of support is crucial for both managing the disease and offering supportive care. Finding healthy coping mechanisms for the stress and emotions brought on by the disease, such as consulting a psychologist and establishing a support network, is also crucial. Healthcare might undergo a transformation thanks to the strength of machine learning. It's an application of artificial intelligence (AI) that interprets facts and predicts outcomes using various methods. Overall reliability of evaluations and therapies could be increased by using this method for identifying patterns within medical information.

2. Literature Review

(Sanmarchi 2023) assessed the AI with ML to deploy the prediction, diagnose, and also treat the chronic kidney disease, which reviews and evaluates the available evidence to improve the CKD diagnosis. It extracts the different variables that predict and classify the overall performance metrics. Different models are gathered, and clinical evaluation of the models is performed within a clinical context. This model ensures the safe application is performed in a routine clinical approach. According to (Alanzai 2022), identifying and predicting the different diseases at an earlier stage is difficult, so the author mainly focused on identifying and predicting chronic illness using the machine learning approach with CNN and KNN to calculate the exact precision in the dataset. The preparation of the dataset deals with individuals' living standards based on doctor consultations that have been considered. Even the comparative study is done with various algorithms. (Deepanshu 2022) indicates that ML extracts relevant patterns that correlate and associate across multiple features. ML predictive analysis uses an enhanced decision-making approach that focuses on the survey over an open-source dataset. Different datasets are analysed and compared based upon the different researches published. Chronic diseases are the severe health issues where ML assists in the early diagnosis where the imbalanced data are classified. A network-limited polynomial neural network algorithm handles the high-level features of hidden chronic disease datasets. The class imbalance issue proposes an algorithm that diagnoses sick cases based upon their performance using accuracy, f1-support, recall, and mean variance, respectively. This framework generalises and diagnoses chronic diseases with early-stage accuracy. (Pal 2022) determines the CKD diagnosis, which develops and validates a predictive state model that classifies diseases. The chronic disease dataset in the UCI machine repository focuses on features with different classification algorithms. Chronic kidney disease dataset trains up with machine learning and gives better performance with overall accuracy of DT and bagging ensemble methodology with high accuracy.

(Hara 2021) Identification of those medical conditions with high dependency on knowledge also does not optimise those target conditions. Machine learning with different classified approaches identifies patients with common chronic factors based on the corresponding condition. The ROC curve with ML methods compares with the conventional knowledge-based approach. (Priya 2021) denotes that ageing is considered a direct correlation that assists and also prevents diseases at the right time for elders. Elders with chronic health conditions were evaluated in order to avoid emergency situations. Generic architecture reviews the various literature papers with associated outcomes using different prediction models using conventional and modernised approaches. (Xu 2020) explores the feasibility of predicting the occurrence of postoperative risk among stage IV cancer patients. The ML algorithms use a prediction mechanism for research samples that randomly divides the training and test groups of patients with colorectal cancer. ML predicts the risk of tumour recurrence in patients where gradient boosting is performed for better performance. Influential variables for tumours with various resources are analysed using the gradient boosting method. (Avi 2020) evaluates older patients with geriatric clinical care based upon different functional assessments. AI improves the care for elderly patients, with the main purpose being to understand geriatric clinical care for elderly patients. In this review, it evaluates the metrics and also the data governance to handle the ML, which could aid the overall clinical care.

3. Methodology

Healthcare professionals may use machine learning to boost the accuracy of their evaluations and therapies. Through examining patient records, physicians can see patterns and make better-informed decisions. Also, depending on each patient's overall requirements, personalised therapies may be created using ML algorithms. Moreover, machine learning may be used to save expenses and increase productivity. The shortage of data is one of the most significant challenges confronting machine learning in healthcare. Medical professionals typically do not have access to the data needed to train machine learning algorithms. Inadequate health data is another issue that makes it challenging to train algorithms with accuracy.

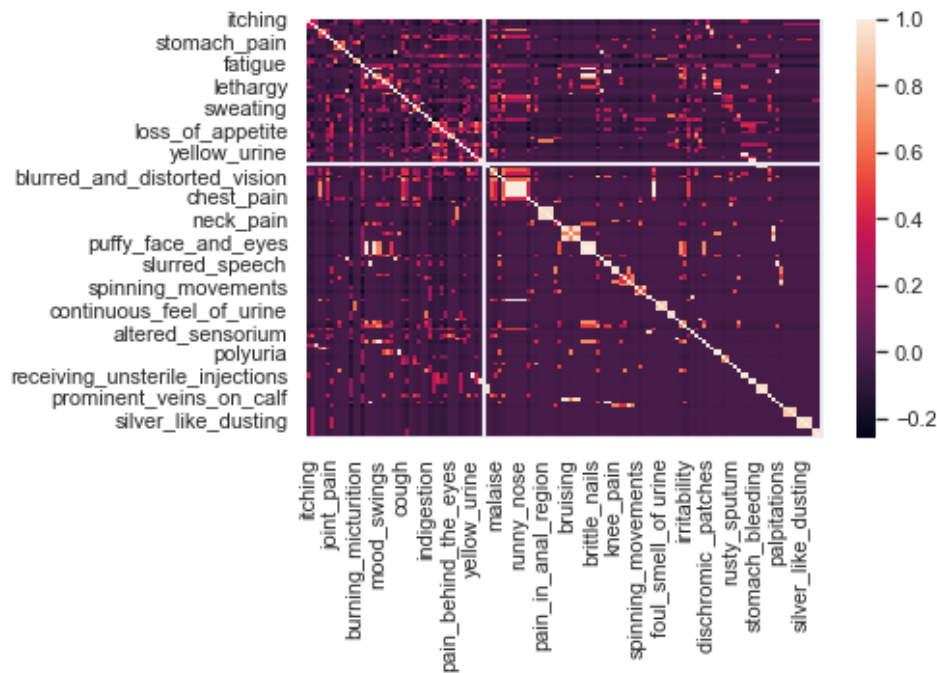


Figure 1: Different Attributes in Chronic Ailments

Recurrence of Chronic Illness

A chronic condition is a severe and persistent medical condition. It might be difficult to control and lead to severe psychological, intellectual, and physiological distress. Unfortunately, several chronic diseases are also prone to recurrence, which means that following a time of recovery, the signs and/or consequences can return. Chronic conditions frequently recur, and they may be brought about by a range of factors, including a particular behavior, the atmosphere, their heredity, or other medical complications. In order for patients to take precautions to lessen the possibility of recurrence, it is critical to comprehend the reasons and hazards of it. Although managing the signs and symptoms of a chronic disease can be difficult, it is crucial to take this into account. To help manage the disease, it is crucial to have a solid support network that consists of family, friends, and medical professionals. It's crucial to have a good attitude and concentrate on what can be done to control the situation. This could entail practising relaxing methods like mindfulness and meditation in addition to taking part in enjoyable and satisfying pursuits. Self-care can help lower the chance of recurrence and enhance the general quality of life.

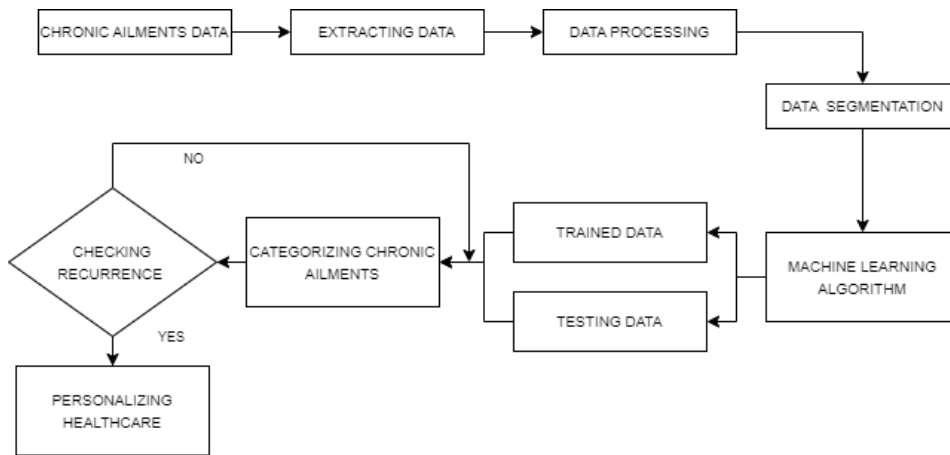


Figure 2: Proposed Methodology

Chronic diseases require overall medical attention, which limits activities of daily living. Some of the health conditions are life-threatening and can cause stroke, heart disease, and other ailments with a prolonged effect. The recurrence of this chronic illness in the same state, which can be treated based on symptoms, The key risk behaviour of chronic disease occurs due to tobacco use and other risks. Even poor nutrition, which includes a low intake of green vegetables, and physical inactivity are two major factors in prolonging chronic illness. Chronic illness conditions necessitate comprehensive medical care, which inhibits regular life. Certain health problems are fatal and can result in cardiovascular disease, stroke, and other long-lasting ailments. If the chronic condition persists in its previous state, it can be addressed depending on the indications. The main risk factor for chronic illness is tobacco smoking, along with additional dangers. Lack of physical activity and a poor diet, which includes a deficiency in vegetables, were two significant variables in the prolonged development of chronic disease.

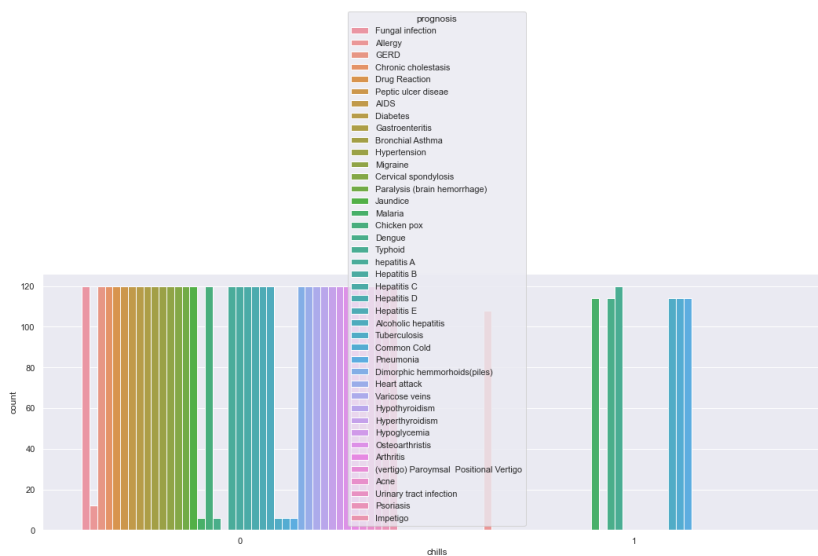


Figure 3: Prognosis Condition State

sources to provide the necessary decision-making to improve the accuracy and also identify the chronic detection. Different operations are used to identify the patterns and trends based upon the trained dataset. Data-driven, personalised treatment is provided to the patient to improve their health and reduce the complexity of chronic diseases. Healthcare practitioners may enhance outcomes for patients and improve their choices about how to treat patients by using predictive analytics. This can assist medical personnel in identifying possible issues with clinical outcomes and making more knowledgeable choices regarding the treatment of patients. Moreover, data analytics may assist medical personnel in tracking clinical outcomes and expenses as well as identifying variations and trends in illness-related available treatments. Health practitioners may handle resources with greater effectiveness with the use of analytics. Health providers may enhance clinical outcomes and improve their choices regarding treatment by using data. Improved clinical outcomes and decreased healthcare expenditures may result from handling the personalised treatment.

	itching	skin_rash	nodal_skin_eruptions	continuous_sneezing	shivering	chills	joint_pain	stomach_pain	acidity
count	42.000000		42.000000	42.000000	42.000000	42.000000	42.000000	42.000000	42.000000
unique	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
top	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
freq	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
mean	0.166667	0.190476	0.023810	0.047619	0.023810	0.166667	0.142857	0.047619	0.047619
std	0.377195	0.397437	0.154303	0.215540	0.154303	0.377195	0.354169	0.215540	0.215540
min	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
25%	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
50%	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
75%	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
max	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000

Figure 5: Dataset Attributes

Personalized Healthcare

Personalized healthcare strives to customise medical care to each patient's unique needs. To analyse the large amount of data using machine learning with personalised treatment and the individual needs of the patient. This can reduce the overall cost of the treatment and also improve the patient's health with prior intervention. The availability of medical care, preventative therapies, and medications that assist in preserving and enhancing overall physical and emotional wellbeing is made possible by healthcare. This can give access to preventative treatment, which can potentially reduce the likelihood of getting significant ailments or disorders, as well as monetary stability in the event of an emergency. In addition to increasing the availability of medical education and services, healthcare can help lower the

cost of prescription drugs and therapies. This is critical to understanding the constraints on receiving healthcare and striving to eliminate them. Technologies can be utilised to make medical diagnosis and therapies more accurate and effective, and to make health information and providers more accessible. The basis of personalised healthcare is the concept that each patient must receive care that is specifically designed to meet their requirements based on their medical history, way of life, and other aspects. This type of medical treatment prioritises giving each patient the finest care, even while considering the particulars of their ailment. Personalized healthcare, depending on the illness, may also use technology in addition to conventional therapies. This may involve telemedicine, wearable technology, and other technological advancements that can help track the patient's condition and offer individualised feedback and direction.

<p>Different Parameters</p>	<p>itching_skin_rash nodal_skin_eruptions continuous_sneezing shivering chills joint_pain stomach_pain acidity ulcers_on_tongue muscle_wasting vomiting burning_micturition spotting weight_gain anxiety cold_hands_and_feets mood_swings weight_loss restlessness lethargy patches_in_throat irregular_sugar_level cough high_fever sunken_eyes breathlessness sweating dehydration indigestion headache yellowish_skin dark_urine nausea loss_of_appetite pain_behind_the_eyes back_pain constipation abdominal_pain diarrhoea mild_fever yellow_urine yellowing_of_eyes acute_liver_failure fluid_overload swelling_of_stomach swelled_lymph_nodes malaise blurred_and_distorted_vision throat_irritation redness_of_eyes sinus_pressure runny_nose congestion chest_pain weakness fast_heart_rate pain_during_bowel_movements pain_in_anal_region bloody_stool irritation_in_anus neck_pain dizziness cramps bruising obesity swollen_legs swollen_blood_vessels puffy_face_and_eyes enlarged_thyroid brittle_nails swollen_extremities excessive_hunger extra_marital_contacts drying_and_tingling_lips slurred_speech knee_pain hip_joint_pain muscle_weakness stiff_neck swelling_joints movement_stiffness spinning_movements loss_of_balance weakness_of_one_body_side loss_of_smell bladder_discomfort foul_smell_of_continuous_feel_of_urine passage_of_gases internal_itching toxic_look_(typhos) depression irritability muscle_pain altered_sensorium red_spots_over_body belly_pain abnormal_menstruation dischromic watering_from_eyes increased_appetite polyuria family_history mucooid_sputum rusty_lack_of_concentration visual_disturbances receiving_blood_transfusion receiving_unsterile_injections coma stomach_bleeding distention_of_abdomen history_of_alcohol_consumption fluid_overload blood_in_sputum prominent_veins_on_calf painful_walking pus_filled_pimples blackheads scurring skin_peeling silver_like_dusting small_dents_in_nails inflammatory_nails blister red_sore_around_nail yellow_crust_ooze</p>
<p>Fungal infection</p>	<p>Hepatitis C Hepatitis E Alcoholic Hepatitis Tuberculosis Common Cold Pneumonia Dimorphic haemorrhoids (piles) Heart attack Varicose veins Hypothyroidism Hyperthyroidism Hypoglycaemia Osteoarthritis Arthritis Urinary tract infection Psoriasis Hepatitis D Hepatitis B Allergy hepatitis A GERD Chronic cholestasis Drug Reaction Peptic ulcer disease AIDS Diabetes Gastroenteritis Bronchial Asthma Hypertension Migraine Cervical Spondylosis Paralysis (brain haemorrhage) Jaundice Malaria Chicken Pox Typhoid Impetigo</p>

Table 1: Infection & Different Parameters

5. Experimental Analysis

ML Technique

Machine learning recognises patterns and trends when they are explicitly programmed and then learns using trial and error techniques. ML has greater potential because it sustains the data in an efficient manner and extracts only meaningful information. Machine learning predicts based upon the data patterns, which improves the conjunction with large datasets. Efficient algorithms with different frameworks and other applications to handle the precision Machine learning can be employed to assess a patient's data and offer individualised treatments and medications. Personalized healthcare ensures that patient health is maintained as per the standards using machine learning. The accuracy with which data-driven programmes can forecast consequences for specific patients can be constrained by numerous established methodologies. The cost of adopting individualised treatment as well as difficulties with data collection and analysis are further issues. Yet, these difficulties can be addressed through the advancement of machine learning.

	precision	recall	f1-score	support
(vertigo) Paroysmal Positional Vertigo	1.00	1.00	1.00	20
AIDS	1.00	1.00	1.00	29
Acne	1.00	1.00	1.00	27
Alcoholic hepatitis	1.00	1.00	1.00	19
Allergy	1.00	1.00	1.00	18
Arthritis	1.00	1.00	1.00	23
Bronchial Asthma	1.00	1.00	1.00	32
Cervical spondylosis	1.00	1.00	1.00	15
Chicken pox	1.00	1.00	1.00	26
Chronic cholestasis	1.00	1.00	1.00	22
Common Cold	1.00	1.00	1.00	23
Dengue	1.00	1.00	1.00	24
Diabetes	1.00	1.00	1.00	24
Dimorphic hemorrhoids(piles)	1.00	1.00	1.00	28
Drug Reaction	1.00	1.00	1.00	17
Fungal infection	1.00	1.00	1.00	31
GERD	1.00	1.00	1.00	24
Gastroenteritis	1.00	1.00	1.00	19
Heart attack	1.00	1.00	1.00	25
Hepatitis B	1.00	1.00	1.00	29
Hepatitis C	1.00	1.00	1.00	31
Hepatitis D	1.00	1.00	1.00	25
Hepatitis E	1.00	1.00	1.00	22
Hypertension	1.00	1.00	1.00	25
Hyperthyroidism	1.00	1.00	1.00	28
Hypoglycemia	1.00	1.00	1.00	20
Hypothyroidism	1.00	1.00	1.00	32
Impetigo	1.00	1.00	1.00	24
Jaundice	1.00	1.00	1.00	18
Malaria	1.00	1.00	1.00	22
Migraine	1.00	1.00	1.00	15
Osteoarthritis	1.00	1.00	1.00	25
Paralysis (brain hemorrhage)	1.00	1.00	1.00	26
Peptic ulcer diseae	1.00	1.00	1.00	30
Pneumonia	1.00	1.00	1.00	32
Psoriasis	1.00	1.00	1.00	21
Tuberculosis	1.00	1.00	1.00	22
Typhoid	1.00	1.00	1.00	19
Urinary tract infection	1.00	1.00	1.00	26
Varicose veins	1.00	1.00	1.00	27
hepatitis A	1.00	1.00	1.00	19

Figure 6: ML Technique Comparative Analysis

The machine learning algorithm which includes KNN, SVM, RF, Naïve Bayes and Decision Tree are comparatively analyzed with 100% accuracy as results. The main objective is to ensure finding patterns and connections that can be utilised to forecast results and deliver individualised care. The F1 score integrates recall and accuracy into a single data point. In its computation, the harmonic average of recall and accuracy is used, and a higher score denotes superior efficiency. This F1 score is frequently employed to evaluate many models and choose which is most effective for a certain task. Since it considers combined accuracy and recall, it's a relevant method to evaluate models with an unequal majority class. Another parameter used to assess a machine learning algorithm's effectiveness is accuracy. It serves as a benchmark for comparing with certain other metrics, such as the percentage of precise predictions the model generates. Machine learning is used in the healthcare sector to streamline procedures, improve quality, and speed up decision-making outcomes. Machine learning is an approach that medical practitioners are increasingly using to alter the health sector. With the provision of personalised medicine, illness evaluation and treatment, and predictive modeling, machine learning has been utilised to enhance clinical outcomes. It can be employed to spot criminal activity and misconduct in the healthcare industry, as well as to identify individuals and offer an early diagnosis. Moreover, machine learning may increase patient-advanced analytics, lessen the requirement for human data entry, and improve the precision of diagnostic imaging.

6. Conclusion

Machine learning could reduce the likelihood of chronic diseases recurring by producing more accurate projections. Recurrence of a chronic illness can result in illnesses that persist for a very long time and destroy lives. The Chronic Disease Prognosis dataset from the GitHub repository uses machine learning to reduce the likelihood of chronic illnesses recurring by generating more precise predictions. This research uses a machine learning strategy to lower the risk of recurrence based on the personalised healthcare of chronic disease patients. Severe clinical diseases, sometimes referred to as chronic diseases, can drastically lower a person's quality of life. One should be aware of the warning signs and indications for chronic conditions, and it's important to see a doctor when any of these concerns persist. Accurate diagnosis and management can help alleviate symptoms and minimise the likelihood of complications. It can help identify trends in medical data, improving the accuracy of assessments and treatments. Chronic illness recurrence is a prevalent and difficult medical condition. Recognizing the causes and consequences of

recurrence is crucial, as is taking preventative measures. Together with medications, counselling, and other therapies, this could entail making changes to one's way of life, including their nutrition and level of activity. To handle the disease, it's also critical to have a solid support network and take proper treatment with primary personalised treatment.

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