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Chronic Kidney Disease

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Abstract: *Chronic kidney disease (CKD), also known as chronic renal disease. Chronic kidney disease involves conditions that damage your kidneys and decrease their ability to keep you healthy. You may develop complications like high blood pressure, anemia (low blood count), weak bones, poor nutritional health and nerve damage. . Early detection and treatment can often keep chronic kidney disease from getting worse. Data Mining is the term used for knowledge discovery from large databases. The task of data mining isto make use of historical data, to discover regular patterns and improve future decisions, follows from the convergence of several recent trends: the lessening cost of large data storage devices and the ever-increasing ease of collecting data over networks; the expansion of robust and efficient machine learning algorithms to process this data; and the lessening cost of computational power, enabling use of computation ally intensive methods for data analysis. Machine learning, has already created practical applications in such areas as analyzing medical science outcomes, detecting fraud, detecting fake users etc. Various data mining classification approaches and machine learning algorithms are applied for prediction of chronic diseases. The objective of this research work is to introduce a new decision support system to predict chronic kidney disease. The aim of this work is to compare the performance of Support vector machine (SVM) and K-Nearest Neighbors (KNN) classifier on the basis of its accuracy, precision and execution time for CKD prediction.*

Keywords: SVM, Preprocessing, Feature Extraction

I. INTRODUCTION

We all knows, that Kidney is essential organ in human body. Which has main functionalities like excretion and osmoregulation? In simple words we can say that all the toxic and unnecessary material from the body is collected and thrown out by kidney and excretion system. It is adangerous disease of the kidney which produces gradualloss in kidney functionality. CKD is a slow and periodical loss of kidney function over a period of several years. If CKD is not detected and cured in early stage then patient can show following Symptoms: Blood Pressure, anemia,week boans, poor nutrition health and nerve damage, Decreased immune response because at advanced stages dangerous levels of fluids, electrolytes, and wastes can buildup in your blood and body. Hence it is essential to detect CKD at its early stage but it is unpredictable as its Symptoms develop slowly and aren't specific to the disease.Some people have no symptoms at all so machine learning can be helpful in this problem to predict that the patient has CKD or not. Machine learning does it by using old CKD patient data to train predicting model and determine thechronic kidney disease.

II. LITERATURE SURVEY

"Prediction of Chronic Kidney Disease using Adaptive Hybridized Deep Convolutional Neural Network on the Internet of Medical Things Platform" Guozhen Chen, Chenguang Ding. Chronic Kidney disease is a severe lifelong condition caused either by renal disease or by impaired functions of the kidneys. In the present area of research, Kidney cancer is one of the deadliest and crucial importance for the survival of the patients' diagnosis and classification. Early diagnosis and proper therapy can stopor delay the development of this chronic disease into the final stage where dialysis or renal transplantation is the only way of saving the life of the patient. The development of automated tools to accurately identify subtypes of kidney cancer is, therefore, an urgent challenge in the recent past.In this paper, to examine the ability of various deep learningmethods an Adaptive hybridized Deep Convolutional NeuralNetwork (AHDCNN) has been proposed for the early detection of Kidney disease efficiently and effectively. Classification technology efficiency de pends on the

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role of the data set. To enhance the accuracy of the classification system by reducing the feature dimension an algorithm model has been developed using CNN.

"Diagnostic Decision Support System of Chronic Kidney Disease Using Support Vector Machine" Mubarik Ahmad, VitriTund jungsar. Kidney disease or commonly known as kidney failure is a condition when the renal function is declining that could result in the inability of the kidneys to perform their du ties. Kidney disease patients have the potential to get into the chronic phase. Chronic kidney disease is a decrease in kidney function gradually during thethree months which resulted in the cessation of kidney function in total. The purpose of this development is a decision support system for a doctor in diagnosing of the kidney disease patients. The system displays the results of predicting whether patients with renal disease have entered aphase of chronic kidney disease or not. The methodology of this study consists of two main phases: classification modeling and system development. Classification modeling consists of data collection, data preparation, data grouping, classification, rules extraction. System development was based on the extracted rules before. This study resulted in a system that can detect a chronic condition of kidney disease based on several factors with an accuracy of 98.34.

"Early Prediction of Chronic Kidney Disease Using Machine Learning Supported by Predictive Ana lytic" Ahmed J. Aljaaf1, Dhiya Al-Jumeily. Chronic Kidney Disease is a serious lifelong condition that induced by eitherkidney pathology or reduced kidney functions. Early prediction and proper treatments can possibly stop, or slow the progression of this chronic disease to end-stage, where dialysis or kidney trans plantation is the only way to save patient's life. In this study, we examine the ability of severalmachine-learning methods for early pre diction of Chronic Kidney Disease. This matter has been studied widely; however, we are supporting our methodology by the use of predictive analytics, in which we examine the relationship inbetween data parameters as well as with the target class attribute. Predictive analytics enables us to introduce the optimal subset of parameters to feed machine learning to build a set of predictive models. This study starts with 24 parameters in addition to the class attribute, and ends up by 30% of them as ideal sub set to predict Chronic KidneyDis ease. A total of 4 machine learning based classifiers have been evaluated within a super vised learning setting, achieving highest performance outcomes of AUC 0.995,sensitivity 0.9897, and specificity 1. The experimental procedure concludes that advances in ma chine learning, with assist of predictive analytics, represent a promisingsetting by which to recognize intelligent solutions, which in turn prove the ability of predication in the kidney disease domain and beyond.

"Analysis of Chronic Kidney Disease Dataset by Applying Machine Learning Methods." Yedilkhan Amir galiyev, Shahriar Shamilu ulu. Now days, Skin cancer is life threatening disease which causes human death. Abnormal Currently, there are many people in the world suffering fromchronic kidney dis eases worldwide. Due to the several riskfactors like food, environment and living standards many people get diseases suddenly without understanding of their condition. Diagnosing of chronic kidney diseases is generally invasive, costly, time-consuming and often risky. That is why many patients reach late stages of it without treatment, especially in those countries where the resources are limited. Therefore, the early detection strategy of the disease remains important, particularly in developing countries, where the diseases are generally diagnosed in late stages. Finding a solution for above mentioned problems and riding out from dis advantages became a strong motiveto con duct this study. In this research study, the effects of using clinical features to classify patients with chronic kidney disease by using support vector machines algorithm is investigated. The chronic kidney disease dataset is based on clinical history, physical examinations, and laboratory tests. Experimental results showed over 93% of success rate in classifying the patients with kidney diseases based on three performance metrics i.e., accuracy, sensitivity and specificity.

"Extraction of Action Rules for Chronic Kidney Disease using Naiive Bayes Classifier" Dr. Uma N Dul hare, Mo hammad Ayesha. Chronic kidney disease (CKD), also known as chronic renal disease, which is progres sive lossin kidney function over a period of months or years. It is defined by the presence of kidney damage or decreased glomerular filtration rate (GFR). The estimated preva lence of CKD is about 9-13adult population. Individuals with CKD have a far greater like lihood of cardiovascular deaththan progres sion to end-stage renal disease. CKD is more prevalent in patients with CVD or with CVD related risk factors, such as hypertension, di abetes mellitus, dyslipidemia, and metabolic syndrome In proposed work, we are not only extracting action rules based on stages but also predicting CKD by using na¨ıve bayes with OneR attribute selector which helps to prevent the advancing of chronic renal dis ease to further stages. t the achieved classification accuracy is 92.1.

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"Cellular-Level Structure Imaging with Micro-optical Coherence Tomography (μOCT) for Kidney Disease Diagnosis". Chi Hu1, Xiaojun Yu1, Qianshan Ding. Chronic kidney disease (CKD) is one of the public health threats around the world, which may cause serious health problems like cardiovascular disease ,kidney failure, or evenmore serious as premature death. Although CKD usually could be managed by general internists, such a way of treatment can be applied only when significant symptoms appear, which is very slow. It has also been reported that CKD could be characterized by means of glomeruli, and classified by the stages of disease severity for early treatment. However, due to lack of reliable method to detect the cellular-level microstructures for dis ease severity characterization, the diagnosis is troublesome, and thus, the treatments might be delayed while the best treatment time could be missed. For early detection of CKD, it is imperative to develop reliable tools to detect and characterize the disease at an early stage with minimal or noninvasiveness. For this research, the micro-optical coherence tomography (OCT) was assessment it feasibility as a cellular level structure imaging tool in kidney disease diagnosis at an early stage. Specifically, by measuring the number of glomeruli within a volumetric kidney tissue, a new diagnostic criteria is also established. Imaging resultsof the kidney specimens as compared their corresponding histology show that the cellular level glomeruli structures could be identified clearly, and as a basic functional unit of kidney, it could be utilized as a reliable parameter to access the severity of the CKD.

"Texture Analysis of Ultrasound Images of Chronic Kidney Disease" Fadil Iqbal, Aruna S. Pallewatte. Chronic Kidney Disease of unknown aetiology (CKDu) is a prevalent disease in the North Central Province of Sri Lanka. Towardsthe latter stages of the disease, kidney function fails by80interstitial fibrosis is formed and grows as the disease progresses. The cause of the disease remains elusive and early detection is vital to arrest the progressive decline of kidney function. The objective of this study is to construct a computer program to perform texture analysis on ultrasoundkidney images and extract various features that can be used to distinguish between normal and diseased kidney patients.

The computer program was developed using MATLAB and a user interface was created to perform mathematical operations such as: Fourier analysis to extract Root Mean Square and First Moment values and Grey Level Co- occurrence Matrix (GLCM) to extract Homogeneity and Sum Average values. A sample of ultrasound images were taken from 32 patients. Region of interest (ROI) selection was performed on entire kidney, cortex region and white (renal medulla or renal sinus) region separately. Amongthese methods Root Mean Square values over the entirekidney (p=0.03) and cortex region (p=0.0049) gave significant results in distinguishing between normal and diseased kidneys.

"Characterizing volumes of kidney segments in Streptozo tocin induced diabetic rat model utilizing 4D contrast enhanced ultrasound" Kennita A. Johnson, A. Gloria Nyankima, Paul A. Diabetic Kidney Disease is adisease that if left uncontrolled may eventually lead to end stage kidney disease. Clinicians utilize biomarkers, such as albuminuria and serum creatinine, to identify diabetic populations at risk for kidney disease, but these markers of ten lag behind histologic disease. Contrast enhanced ultrasound (CEUS) presents a potential tool to identify at risk patients, begin early intervention and prevent development and progression of kidney disease. Utilizing4D CEUS, we observed the progressive effect of diabetes in a rodent streptozotocin (STZ) model, over a 12-week period.The following describes the experimental proto col andimage process for characterization of the kidneys. Image datasets estimated to tal volume changes accurately in comparison to water displacement volume measurements. Treated animals displayed an increase in total volume, as expected. Individual cortical and medullary volumes were estimated using the same datasets and showed a greaterincrease in medullary than cortical volumes. Further investigation is required to validate CEUS as a tool for earlyDKD diagnosis.

III. Related Work

3.1 Machine Learning

Machine learning is an artificial intelligence (AI)application that allows systems to automatically learn and improve from experience without being explicitly programmed. Machine learning is concerned with the creation of computer programmers that can access data and use it to learn on their own. Machine learning is used in search engines, email filters to filter out spam, websites to make personalized recommendations, banking software to detect unusual transactions, and many apps on our phones, such as voice recognition.

3.2 SDLC Model

The software development cycle is a combination of different phases such as designing, implementing and deploying the project. These different phases of the softwaredevelopment model are described in this section. The SDLCmodel for the

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project development can be understood using the following figure The chosen SDLC model is the waterfall model which is easy to follow and fits bests for theimplementation of this project.

Requirements Analysis: At this stage, the business requirements, definitions of use cases are studied and respective documentations are generated.

- **Design:** In this stage, the designs of the data models will defined and different data preparation and analysis will be carried out.
- **Implementation:** The actual development of the model will be carried out in this stage. Based on the data model designs and requirements from previous stages, appropriate algorithms, mathematical models and design patterns will beused to develop the agent's back-end and front-end components.
- **Testing:** The developed model based on the previous stages will be tested in this stage. Various validation tests will be carried out over the trained model.
- **Deployment:** After the model is validated for its accuracy scores its ready to be deployed or used in simulated scenarios.

3.3 Artificial Intelligence

The simulation of human intelligence processes by machines, particularly computer systems, is known as artificial intelligence. Expert systems, natural language processing, speech recognition, and machine vision are some of the specific applications of AI. The fundamental goal of AI is to enable computers and machines to perform cognitive tasks such as problem solving, decision making, perception, and comprehension of human communication. Artificial intelligence (AI) is the foundation for simulating human intelligence processes by developing and deploying algorithms in a dynamic computing environment. Simply put, AI is an attempt to make computers think and act like humans.

IV. Proposed Methodology

4.1 Objective

The proposed system deals with the prediction of chronic disease from the clinical data. The healthcare generates large data, so it is necessary to collect this data and effectively use it for analysis, prediction, and treatment.

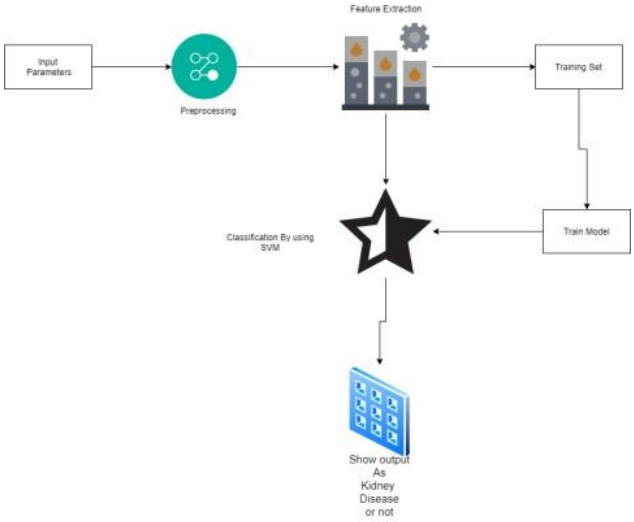

Figure 1.1: Proposed System Architecture

5.2 Algorithms

Support Vector Machine (SVM) is a supervised machinelearning algorithm used for both classification and regression. Support Vector Regression is a supervised learning algorithm that is used to predict discrete values. Support Vector Regression uses the same principle as the SVMs. The basic idea behind SVR is to find the best fit line.In SVR, the best fit line is the hyper plane that has the maximum number of points.

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5.3 Motivation

Motivation for change often depends on the existence of a discrepancy between the patients' current behavior and important values or goals.

VI. CONCLUSION

As we have already seen the applications of data mining andmachine learning in medical sector. In this project, a SVM isimplemented for prediction of CKD. A1 though the classifiers worked efficiently in prediction of other diseases also. In this project, Chronic Kidney Disease is predicted using SVM Algorithm and a comparative study of their performance is done. From the analysis we found that, out of one classifiers. SVM classifier performed better than the other. The rate of prediction of CKD is improved.

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