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Review on Diagnosis of Chronic Kidney Disease using Machine Learning

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Abstract— Early diagnosis and characterization are the important components in determining the treatmentofchronic kidney disease (CKD)CKD is anailment which tends to damage the kidneyand affect their effective fuctioning ofe xcreting waste and balancing body fluids.Some of the complications included arehypertension, anemia (low bloodcount),mineral bone disorder, poor nutritional health, acid base abnormalities, and neurological
The data used is collected from the UCI Repository with 400 data sets with 25 attributes. This data has been fed into Classifi cation algorithms. The experimentalresults show that KNN, LR, SVM handsout an accuracy of 9 4%, 98% and 93.75%respectively. TheRF classif ier gives out a maximum accuracy of 100%

Keywords—Machine learning; chronic kidney disease; RF classifier; Logistic regression; K-NN classifier; CKD prediction, SVM

1. Introduction:

A condition of kidney failure is labelled as chronic kidney disease (CKD). When the kidney functions abnormally or when the renal functioning fails progressively through every month or year. Usually defined by identification of damage in the kidney which lasts longer than three months with decreased glomerular filtration rate (GFR). CKD involves conditions like Heart disease, High blood pressure or anaemia. CDKcanbecaused by various reasons which inc ludediabetes, high blood pressure, and polycystic kidney disease. People having glomerular filtration rate < 60 ml/min for every 1.73 m2 for 3 months' time period are classified as having CDK. The function of kidney is to filter the blood. As blood goes inside and comes outside of kidney, it removes waste products, controls the fluid balance in body and also regulate the electrolyte balance. We will have only 10% of the kidney functioning and the failure of 90% will not result in experience of any symptoms. Therefore, it is also known as _silent killer'. There are numerous factors which lead to kidney disease such as diabetes, hypertension, smoking, obesity, aging, family history, alcohol consumption and so on. Some of the symptoms include blood in urine, shortness of breath, nausea and vomiting, changes in the urinary function etc. In short, CKD is a condition where the kidneys are not functioning as theyareexpected to, resulting in infiltration of blood . A countless number of patients are ending at fifth stage of renal disease and they need to replace thekidney or to do dialysis to save the patient. So, the persons who are likely to get affected by this disease can take the test periodically and they can take the necessary step if they arediagnosedwithCKD.Itwould really helpful for t he doctor to predict this with a machine learning algorithm than to take various tests which are costly. We can just feed the computer with some of the acquired details of the patient and within a complications.Earlyanderrorfree detectionof CKD can be helpful inaverting further deterioration of patient's health. These chronic diseases are prognosticated using various types of data mining classification approachesandmachine learning (ML) algorithm s. This Prediction is performed usingRandomForest (RF) Classifier, Logistic Reg ression (LR) and K-Nearest Neighbor (K-NN) algorithm and Support Vector Machine (SVM)

short time we would be able to diagnose the condition of CKD in patients. By doing this we can save an ample time and patient doesn‘t need to undergo difficulties during the various tests. This simple model can be built by using machine learning algorithms like K-NN, Naïve Bayes classifier, Support Vector Machine, Random Forest classifier
and so on. The intention of this research is to compare the results of different classifiersbased upon their performance and to brin gup a model which is effective in prediction of CKD by very few predictors.

2. Related Work : The experimental results show that K-NN classifier was better with an accuracy of 78.75% compared to SVM with an accuracy of about 73.75%. Performance of the algorithms was calculated on the basis on accuracy, execution time and precision.
For early prediction of CKD, K. A. Padmanaban and G. Parthiban did a research work by using classifiers namely Naïve Bayes and Decision tree methods in the WEKA tool. They concluded that decision tree had highest accuracy of 91% as to Naïve Bayes .
In order to save lives, doctors have to determine theexacttreatments.Fordoing so, they need help of machine learning algorithms. Charleonnan and team explored a bunch of machine learningalgorithmsforthis purpose. They employed DT, LR, SVM, and KNN as classifiers for CKD detection.Their results confirms that the SVM technique is a superior one for the detection of this disease .
CKD can lead to increase in albumin excreted via urine. Celik et al. aimed to diagnose and predict CKD using the dataset comprised of 250CKDpatientsand 150 healthy patients . They ha ve utilized classifiers like support vector machine and decision tree classifier. For implementing these classifiers, they used sequential minimal optimization (SMO) algorithm and J48 program of the WEKA tool.
In 2017, Wibawa and team employed AdaBoost as a technique for ensemblelearning2021 International Conference on Recent Trends on Electronics, Information,Communication& Technology (RTEICT) | and also used correlation-based featureselection (CFS). They did a comparison wit hNaive Bayes, KNN and SVM for CKD detect ionandconcluded that AdaBoostandCFS to be the most assuringclassifi ers forthe purpose of CKD detection.
Devikaetalproposed an analogy of classifiers for CKD prediction.
Their work is based on Naïve Bayes, K-NN and Random Forest classifiers. The outcome of the experiment shows that RF classifier is comparatively better. Over the year, Machine learning has gained a massive importance in the field of disease diagnosis and it took the medical diagnosis to a whole new level.
Sivaranjani et al. published a research paper where they used ML Algorithms with Feature Selection and Dimensionality Reduction. Their paperwork dealt with ML algorithms such as SVM and RF. Feature selection was done using forward and backward selection and also implemented Principal Component Analysis for dimensionality reduction. The results show that RF gave best accuracy compared to SVM.
Shaikh F.J et al. did a research work centered on artificial neural networks (ANN), support vector machine(SVM)and decision trees (DT) for the purpose of cancer prediction. In 2019, Dahiwade D et al. in their research paper used K-NN and convolutional neural network for accurate prediction of disease.
In the year 2020, Amritavarshini and team came up with a paperwork regarding multimodal systems that ameliorates the performance of the authentication system that interminglethephysical or behavioral qualities of an individual person .
Machine learning has set foot in all the fields of medical background including emotional recognition.
Veni S and Thushara S published a paper which dealt with a multimodal system for emotion recognition.

Saiharsha B et. al did a noticeable work to estimate the performance of deep learning structures in the text of image classification. accuracy rate.

Conclusion:

In the context of developing countries, the costs resulting from the usage of software to assist in CKD diagnoses needs to be as low as possible, especially in hard-to-reach and rural settings. The number of CKD attributes used during CKD risk classifications impacts the cost of usage and the performance of the classifiers. The machine learning techniques present different levels of accuracy for the CKD diagnosis depending on the number of attributes considered during the classification. In this study, the J48 decision tree and RF exhibited the best performance using the CKD dataset, comprising of hypertension, DM, creatinine, urea, albuminuria, age, gender, and GFR attributes. These attributes are commonly used by nephrologists to diagnose CKD in developing countries.. The application of algorithms (interpreters) is required to interpret the results before presenting them to primary care physicians. Conversely, the decision tree addresses the interpretation problem still presenting nearly perfect agreement with an experienced nephrologist who has treated CKD patients in developing countries for more than 30 years.

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