



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 12, Issue 9, September 2023

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.423

9940 572 462

6381 907 438

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Chronic Kidney Disease Prediction and It's Stages Prediction and Diet Recommendation Using ML

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ABSTRACT: Chronic Kidney Disease (CKD) is characterized by the gradual deterioration of kidney function over an extended period, often spanning months or even years. Effectively predicting this condition holds immense significance within the realm of medicine. To address this, an automated tool employing machine learning techniques has been proposed. This tool aims to assess a patient's kidney health, facilitating early prediction of CKD and thereby enabling more precise medical interventions.

The outlined system functions by extracting pertinent features linked to CKD. Subsequently, a machine learning process takes over, automating the classification of chronic kidney disease into various stages based on the degree of severity. The primary goal is to harness machine learning algorithms to analyze medical test records and generate tailored dietary recommendations for CKD patients. These recommendations are aligned with the patient's potassium levels, which are computed from blood tests. The intent behind this dietary guidance is to impede the advancement of CKD.

KEYWORDS: CKD Prediction, Stage Detection, Diet Recommendation

I. INTRODUCTION

The healthcare sector is generating vast volumes of data that hold the potential to be extracted for valuable insights, enhancing the efficacy of predictions, diagnoses, and decision-making. Within this landscape, kidney disease stands out as a pressing concern, significantly contributing to mortality rates in India. Chronic Kidney Disease (CKD) is marked by a gradual decline in kidney function, responsible for filtering waste and fluids from the blood, which are subsequently excreted in urine. As CKD advances, the accumulation of waste in the bloodstream can lead to complications such as hypertension, anemia, bone fragility, malnutrition, and nerve impairment. Additionally, CKD increases the vulnerability to heart and vascular ailments.

In response to these adverse outcomes, early detection has manifested as a pivotal strategy in on-going research. Despite growing awareness of CKD, it remains inadequate. According to the 2015 Global Burden of Disease (GBD) report, chronic renal disease is India's eighth leading cause of death. The country holds the highest number of diabetic patients globally, projected to reach 57.2 million cases by 2025. Furthermore, hypertension prevalence is expected to double between 2000 and 2025, positioning India as a hotspot for CKD cases.

Given the significant load on primary care providers (PCPs), effective CKD management requires an accurate, user-friendly, and automated detection method. Machine learning techniques offer a promising avenue to identify undiagnosed CKD, predict the likelihood of chronic disease development, and formulate patient-specific preventive measures. Health systems can leverage these techniques to construct precise predictive models, ultimately reducing risks and enhancing healthcare standards.

II. RELATED WORK

1. IEEE PAPER TITLE: An Empirical Evaluation of Machine Learning Techniques for Chronic Kidney Disease Prophecy.

YEAR OF PUBLICATION: 2020

AUTHORS: BILAL KHAN , RASHID NASEEM , FAZAL MUHAMMAD , GHULAM ABBAS AND SUNGHWAN KIM.

METHODOLOGY: NBTree, J48, Support Vector Machine, Logistic Regression, Multi-layer Perceptron.

LIMITATIONS:

- Used algorithms generates graphical outputs, not suitable for real time.
- Small datasets used.
- Prediction done for only static datasets.

2. IEEE PAPER TITLE: Chronic kidney disease analysis using Data Mining classification techniques.

YEAR OF PUBLICATION: 2016

AUTHORS: Veenita Kunwar, Khushboo Chandel, Sai Sabitha, Abhay Bansal.

METHODOLOGY: They have used readily available data tools such as Rapid Miner tool for implementation.

LIMITATIONS:

- Using tools like Rapid Miner and other such tools namely R-Tool, Weka tool the results can be easily obtained but the testing of these is not possible.

3. IEEE PAPER TITLE: A Deep Learning-based System for Automated Sensing of Chronic Kidney Disease.

YEAR OF PUBLICATION: 2019

AUTHORS: Navaneeth Bhaskar and Suchetha M.

METHODOLOGY: deep learning Convolutional Neural Network (CNN) algorithm which is incorporated with a Support Vector Machine (SVM) classifier.

LIMITATIONS:

- Data type is image, images used for prediction which leads to less accurate results.
- More time required for data processing.
- Less efficient.

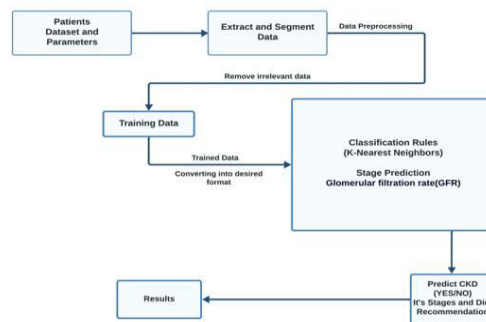
III. METHODOLOGY

A predictive model is employed in scenarios where the goal is to forecast one value based on other variables within the dataset. Supervised learning is the approach utilized, where predefined labels are assigned. This method involves categorizing an object into one of the predetermined categories based on specific parameters.

In the realm of supervised learning, there are numerous algorithms available for constructing predictive models, such as K-Nearest Neighbors (KNN). The choice of algorithm depends on factors such as the project's requirements, available labels, input parameters, and the dataset itself. These algorithms are instrumental in constructing models that can make predictions by considering available evidence in the face of uncertainty.

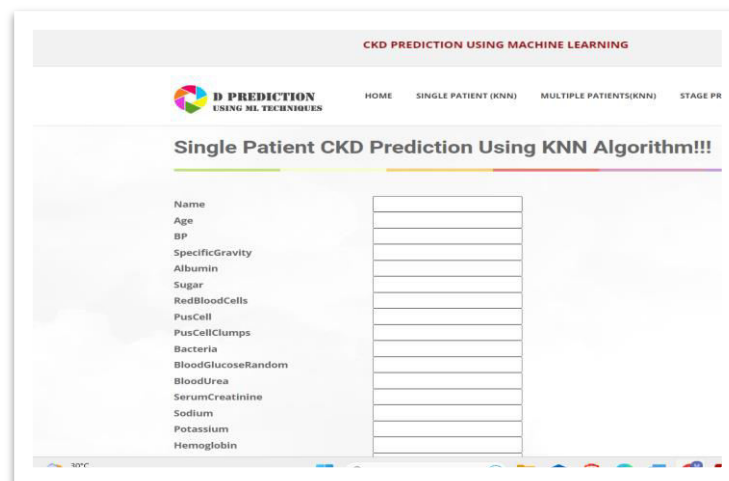
For this particular project focused on prediction, the KNN algorithm has been chosen due to its efficiency and adaptability to a wide range of parameter configurations. It consistently produces precise and reliable results across various scenarios.

Classification Rules: Classification involves the task of categorizing individual items within a dataset into specific pre-defined classes or groups. In the context of predicting Chronic Kidney Disease (CKD), the Glomerular Filtration Rate (GFR) is employed to make predictions regarding the disease stage.

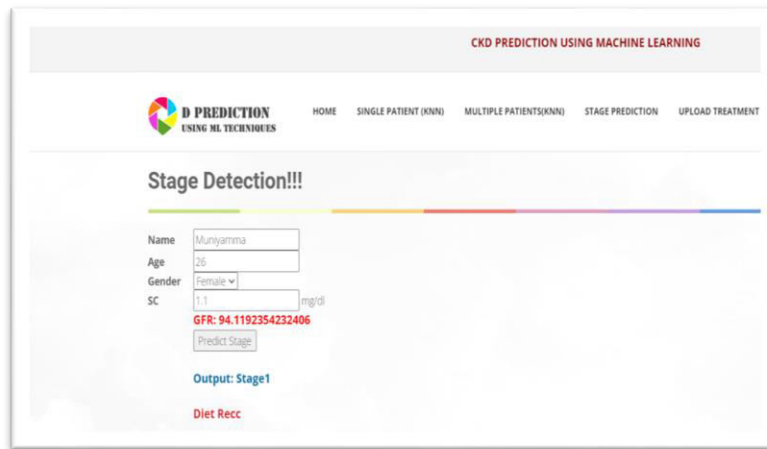


IV. EXPERIMENTAL RESULTS

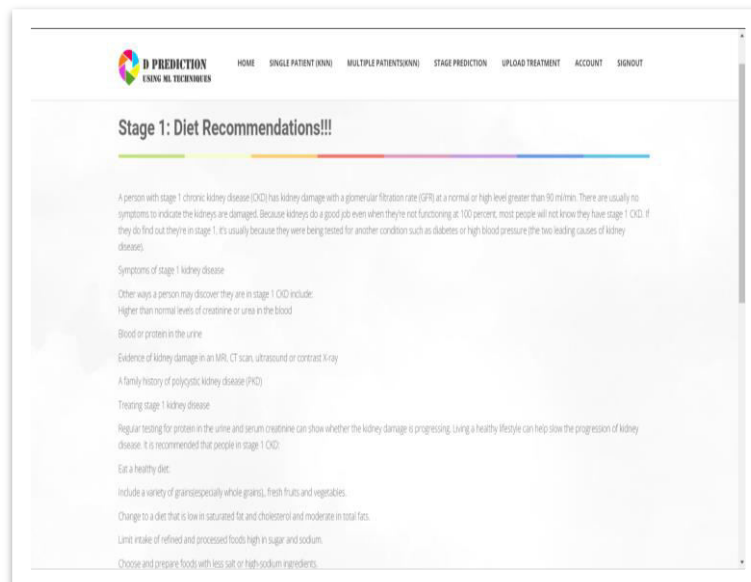
Figures shows the results of CKD prediction by inputting patient’s parameters. Figs. (a) shows to type parameters. Fig (b) In this picture we get Stage prediction. Based on stage prediction we get the diet recommendation for different stage there are 5 stages respectively. Fig (c) Picture shows the diet recommendation for stage 1 Chronic Kidney Disease(CKD).



(a)



(b)



(c)

V. CONCLUSION

This application focuses on the medical field, aiding healthcare professionals in predicting Chronic Kidney Disease (CKD) by analyzing CKD parameters. It automates the prediction process, swiftly determining the illness, its various types, and potential complications from a clinical database.

The successful execution of this proposed system is attributed to the utilization of the Naïve Bayes algorithm, a classification technique within the realm of data mining methodology. The input for this algorithm is taken from the CKD parameters and leverages historical data from previous CKD patients to foresee the occurrence of the disease.

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