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# Utilizing Artificial Neural Networks for Predicting Chronic Kidney Disease

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**Abstract.** The goal of the Chronic Kidney Disease Prediction project is to create a model based on machine learning that can predict a person's chance of getting chronic kidney disease by utilizing a variety of demographic data, medical history, and test results. Globally, the prevalence of chronic kidney disease is increasing, and early detection is crucial for optimal treatment and therapy. The suggested model will be trained on a large patient dataset and will use a range of machine learning methods to evaluate the data and predict the likelihood that an individual will develop chronic kidney disease. This research uses an artificial neural network-based method for the forecasting of chronic illness. When an artificial neural network is trained on a dataset with several informative properties, backpropagation procedures are employed for patients. The output of this neural network enables us to assess whether a patient has persistent renal disease. Artificial neural networks may predict renal illness more accurately than alternative machine learning algorithms.

***Keywords:*** Chronic kidney disease, Artificial neural network, Estimated Glomerular filtration rate, Data preprocessing, Correlation-based feature subset selection.

## 1. INTRODUCTION

Chronic kidney disease occurs when the kidneys sustain damage, affecting their capacity to filter blood effectively. Waste builds up in the body as a result of this progressive deterioration. To produce urine, the kidneys are essential for removing waste and excess water from the blood. CKD is a chronic condition that poses a significant global health challenge. Its origins can stem from various causes, with diabetes, hypertension, and heart disease being among the primary culprits. When kidneys function poorly, symptoms as fever, nosebleeds, rash, nausea, diarrhea, back pain, and abdominal pain might manifest. The key contributors to CKD are diabetes and high blood pressure, necessitating their careful management for prevention. Notably, CKD often progresses without apparent symptoms until the kidneys suffer severe damage. Research indicates a rapid increase in prevalence of CKD, leading to a rise in hospital admissions by 6.23% annually. Despite this, the global mortality rate remains constant, underscoring the importance of early detection and proactive management of this condition. There are not many di- agnostic tests available to determine the status of CKD:

Estimated Glomerular Filtration Rate (EGFR)
(i) urine test
(ii) Blood pressure.

*A. EGFR*

The EGFR number indicates the states of your kidneys are cleaning the blood. Your kidney function is good if your EGFR value is higher than 90. You have congestive kidney disease if your EGFR is less than 60.

*B. URINE TEST*

Since the kidneys produce urine, the doctor also requires a urine test to access kidney function. Your kidney is malfunctioning if there is blood and/or protein in your urine.

*C. BLOOD PRESSURE*

A medical professional collects your blood pressure because it indicates how effectively your heart is pumping blood. If the patient's EGFR is less than 15, end-stage kidney disease is indicated. Currently, the only therapies that are currently offered are:
Dialysis (i) and kidney transplantation (ii). Numerous factors affect a patient's life after dialysis, such as age, gender, the frequency and duration of dialysis, physical activity, and mental well-being. The doctor's only

option, in the event that dialysis is not feasible, is kidney transplantation. However, the cost is really high. As a result, it is crucial for early disease detection, monitoring, and treatment. The dynamic and covert nature of chronic kidney disease makes accurate prediction of its course crucial, especially in its early stages and patient abnormality. The stages of CKD dictate the medical treatment recommended. If not, there are a few symptoms that make it extremely important to describe how the infection is organized. The guarantee of essential prayers and drugs is supported by it.

## 2. RELATED WORK

As machine learning has shown its efficacy in identifying and predicting severe illnesses in recent times. The early diagnosis and investigation of novel methods for managing chronic kidney disease (CKD) is one topic that has attracted a great deal of interest from researchers and medical experts. Numerous research works have demonstrated the efficacious use of Using machine learning and deep learning models to diagnose chronic kidney disease. Numerous artificial intelligence models designed to forecast chronic kidney disease have been developed as a result of these investigations. Interestingly, the Light GBM model found important CKD predictors, including age, gout, diabetes mellitus, sulfonamide use, and angiotensin use. Furthermore, convolutional neural networks performed better than previous models, outperforming them in delivering an intelligent predicting system for chronic kidney disease with an astounding AUROC measure of 0.954. Additionally, cutting-edge **techniques like density-based feature selection have been used to eliminate unnecessary** features. To improve the accuracy of CKD prediction, a subset of characteristics is then given into the Ant Colony-based Optimization classifier.

## 3. SYSTEM ANALYSIS

### *3.1 EXISTING SYSTEM*

Currently, the traditional diagnostic methods for CKD detection include viral culture, PCR assays, and clinical diagnosis based on symptoms such as fever, rash, and lymphadenopathy. But both approaches have drawbacks in terms of sensitivity, specificity, and turnaround time, especially in resource-limited settings where laboratory infrastructure and trained personnel are scarce.

### *3.2 PROPOSED SYSTEM*

A model of neural network that we built was able to predict if chronic kidney disease would exist. Lists of parameters are used by it. More accurate predictions could be produced if this model can be properly trained utilizing a wide range of parameters. For a more rapid and digital approach to predicting chronic renal disease, clinics and hospitals can employ this. An expansion in the dataset would yield more encouraging results.

## 4. FRAMEWORK

St. Paulo's Hospital provided the study's data source. It is Ethiopia's second-largest public hospital, admitting a sizable number of patients with long-term illnesses. Both dialysis and a kidney transplant center are located within the hospital. The dataset that was utilized in this research consists of patient records related to people admitted to the renal ward with chronic kidney disease between 2018 and 2019, as Table 2 illustrates. A portion of them came based on same medical records information at various points in time. Experts in the field were interviewed to prepare the dataset and comprehend its features. Twelve of the 19 features in the sample are numerical, and seven are nominal, spanning 1718 occurrences. Table 3 displays the dataset's characteristics, which consist of the following: Heart disease, diabetes mellitus, anemia, blood pressure, specific gravity, age, gender, blood urine nitrogen, serum creatinine, hemoglobin, mean cell volume, platelet count, red blood cell count, and white blood cell count; chloride, sodium, and potassium. According to the multiclass distribution, 441 (25.67%) of the cases have end-stage renal disease, or stage five; 399 (23.22%) have severe stage four; 354 (20.61%) have moderate stage or stage three; 248 (14.44%) have mild stage or stage two; and 276 (16.07%) have neither severe stage four nor regular kidney disease.

## 5. EXPERIMENTAL RESULTS


**Figure 7.1: Home page**

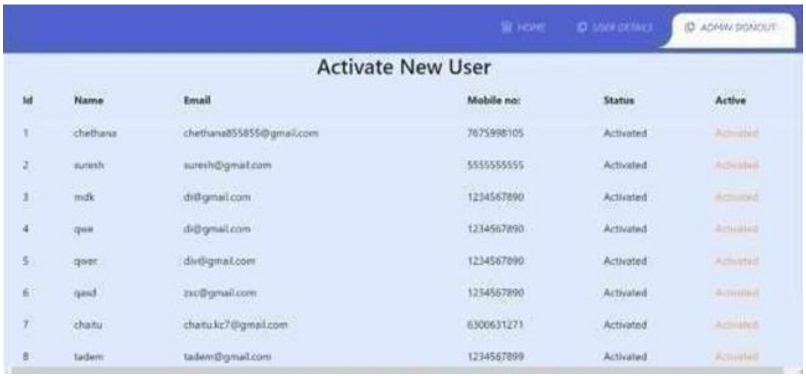


**Figure 7.2: Web based User-Interface**

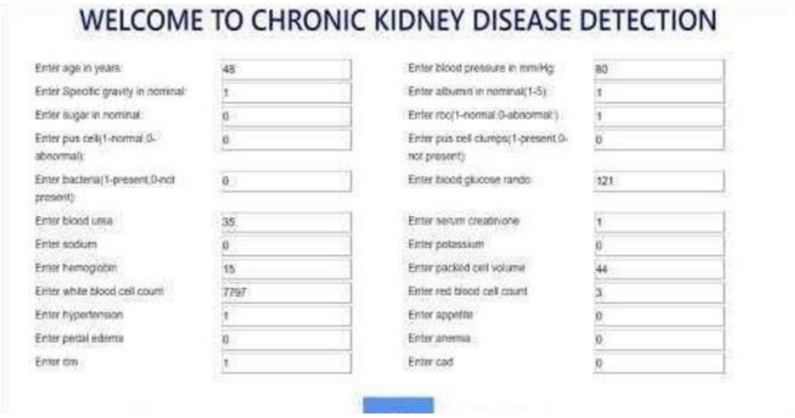


**Figure 7.3: Entering Patients Value**


**Figure 7.4: Final Output**

## 6. CONCLUSION

CKD detection and categorization can be utilized as a quick interpretation and analysis technique to give pathologists and physicians a second view. This study offers a method for employing artificial neural networks to forecast chronic major diseases. Following the experimental study, it was discovered that neural networks considerably outperformed K-NN, SVM, regression trees, and classification trees in the classification and detection of accuracy mean, mode, and median based pre-processing procedures. As a result, this framework can be used to forecast chronic diseases more accurately, with 98% accuracy, minimum error, and few false positives.

**Conflict of Interest**

The authors declare no conflicts of interest regarding the current research.

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