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DETECTION OF CHRONIC KIDNEY DISEASE USING DEEP LEARNING TECHNIQUE

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ABSTRACT

Chronic Kidney Disease is a silent condition. Signs and symptoms of CKD, if present, are generally not specific in nature and unlike several other chronic diseases (such as congestive heart failure and chronic obstructive lung disease), they do not reveal a clue for diagnosis or severity of the condition. Early detection and treatment can often keep chronic kidney disease from getting worse. CKD is a progressive condition that results in significant morbidity and mortality. Because of the important role the kidneys play in maintaining homeostasis, CKD can affect almost every body system. Early recognition and intervention of CKD is essential to slow disease progression, to maintain quality of life and improve outcomes. CKD can also be defined as damage to kidney or Glomerular Filtration Rate (GFR) < 60 mL/min/1.73 m2 for 3 months or more, irrespective of the cause a result, kidney damage. Our aim is to develop a CNN model for Classification of CKD.

Keywords: CKD, CNN, GFR

I . INTRODUCTION

Chronic Kidney Disease (CKD) is considered as an important threat for the society with respect to the health in the present era. Chronic kidney disease can be detected with regular laboratory tests, and some treatments are present which can prevent development, slow disease progression, reduce complications of decreased Glomerular Filtration Rate (GFR) and risk of cardiovascular disease, and improve survival and quality of life. CKD can be caused due to lack of water consumption, smoking, improper diet, loss of sleep and many other factors. This disease affected 753 million people globally in 2016 in which 417 million are females and 336 million are males. Majority of the time the disease is detected in its final stage and which sometimes leads to kidney failure. The existing system of diagnosis is based on the examination of urine with the help of serum creatinine level. Many medical methods are used for this purpose such as screening, ultrasound method. In screening, the patients with hypertension, history of cardiovascular disease, disease in the past, and the patients who have relatives who had kidney disease are screened. This technique includes the calculation of the estimated GFR from the serum creatinine level, and measurement of urine albumin-to-creatinine ratio (ACR) in a first morning urine specimen. This paper focuses on machine learning techniques like ACO and SVM by minimizing the features and selecting best features to improve the accuracy of prediction.Blood pressure is increased due to fluid overload and production of vasoactive hormones created by the kidney via the renin–angiotensin system, increasing the risk of developing hypertension and heart failure.

People with CKD are more likely than the general population to develop atherosclerosis with consequent cardiovascular disease, an effect that may be at least partly mediated by uremic toxins. People with both CKD and cardiovascular disease have significantly worse prognoses than those with only cardiovascular disease.

Urea accumulates, leading to azotaemia and ultimately uraemia (symptoms ranging from lethargy to pericarditis and encephalopathy). Due to its high systemic concentration, urea is excreted in eccrine sweat at high concentrations and crystallizes on skin as the sweat evaporates ("uremic frost").

Potassium accumulates in the blood (hyperkalaemia with a range of symptoms including malaise and potentially fatal cardiac arrhythmias). Hyperkalaemia usually does not develop until the glomerular filtration rate falls to less than 20–25 mL/min/1.73 m2, when the kidneys have decreased ability to excrete potassium. Hyperkalaemia in CKD can be exacerbated by academia (which leads to extracellular shift of potassium) and from lack of insulin.

II. RELATED WORKS

Various existing systems can detect chronic kidney on different inputs such as text data, CT Scan images .For example prediction algorithm uses a text data to recognize the chronic kidney .Some other algorithms uses the CT scan image to detect the CKD .But the text data needs the data of bp , urine and blood tissue data of patient .These patients undergo with some test like Bp test ,Urine test ,tissues test by gathering these information they will proceed further analysis. Doing these all test takes the time, some times the text data has missing value, invalid parameters it leads to a delay of results and treatment. CT scans include the risks from exposure to ionizing radiation and possible reactions to the intravenous contrast agent, or dye, which may be used to improve visualization. Detection of CKD by CT scan is also a risk factor. Machine learning models can also be limited by the quality and quantity of data used for training, which can impact the accuracy of the predictions. If the training data used for these systems are biased or incomplete, the predictions made by these systems can be similarly biased and lead to unfair outcomes. The previous system's machine learning algorithms were not utilized to improve classification skills for a vast number of images.

LIMITATIONS OF EXISTING APPROACHES

Prediction of chronic kidney using Machine learning techniques is not suitable for all the problems. On ultra sound images the machine learning models has low result. Diagnosing chronic kidney diseases generally invasive(Risk) because mostly diagnosing of chronic kidney disease will be done based on the numerical data. It diagnosis based on the blood pressure and urine test. By using these numerical data of patient record the diagnosis of chronic kidney disease take place. A large space is required for complete dataset. Large computation time(time-consuming) because numerical dataset mostly have the noisy data and missing values it takes the time for normalization.

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III. PROPOSED METHOD

To summarize the previous CKD prediction models ,we find that most of them suffering from either the method used to impute missing values has a limited application range or relatively low accuracy. Therefore in this work, we propose a methodology to extend application range of the ckd diagnostic models. At the same time, The accuracy model is further improved. The contributions of the proposed work is neural networks for filtering of image and classification of CKD. Input-Labelled Ultrasound images Pre-processing-for refining image data, such as removing distortion, so that it may be utilized to process data more effectively. The images is passed through a stack of convolutional layers.

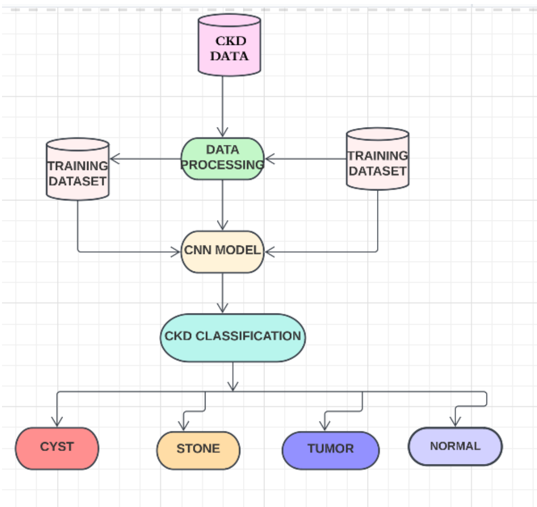

Fig.No-3.1 Working Of Proposed System

Our proposed model will detect the chronic kidney disease using the CNN model and its layers. The system will analyze the ultrasound images of kidney, Based on the analysis the system will detect whether the kidney has effected with disease or not. The system will detect chronic kidney disease in to four categories. The image we given to the system if it is detected that image is normal then model will show Normal Detect on the image we given. The will process will same like other three categories (NORMAL,STONE, CYST).In this way our proposed model will detect the chronic kidney disease using deep learning.

IV. ALGORITHMS

The input layer takes preprocessed images with a fixed size and number of channels as input. The convolutional layer applies convolutional filters to extract features from the input images. The ReLU layer introduces non-linearity to the output of the convolutional layer, and the pooling layer performs down-sampling to reduce the spatial dimension of the feature maps.

To prevent overfitting, the dropout layer randomly drops out a fraction of nodes in the previous layer during training. The fully connected layer applies weights to the output of the previous layer to produce scores for each class, and the SoftMax layer normalizes the scores to produce a probability distribution over all possible classes. Finally, the loss layer computes the loss function that measures the difference between the predicted probability distribution and the ground truth labels and backpropagates the error to update the model parameters.

This CNN architecture can be trained on a large dataset of preprocessed images with ckd labeled data using the CNN model layers. The trained model can then be used to detect the chronic kidney. By using the this CNN architecture, we can build a robust and accurate detection system that can be used in early treatment.

V. EXPERIMENTS

In this section, we first present the datasets scripts and their specifications and submit experimental analysis and test results when evaluating the accuracy of the chronic kidney categories. By categories of the kidney image detection, we evaluated the proposed model on the Kaggle dataset. 12224 images we from the Kaggle. Those images are classified in to four types of labelled classes {Normal-‘0’, Stone-‘1’, Tumor-‘2’, cyst-‘3’}.We evaluate these 4 classes and detect the disease occurred to the kidney. In this 4 classes there are three types of images in each class. We evaluate these images on their original shape of image (619,714) but evaluating with original shape of image took large computation ,So we resized the original shape of image into (200,200) after the

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resizing the image it took the less time for evaluating the model. The accuracy of model is 96 per.

EVALUATION OF MODEL

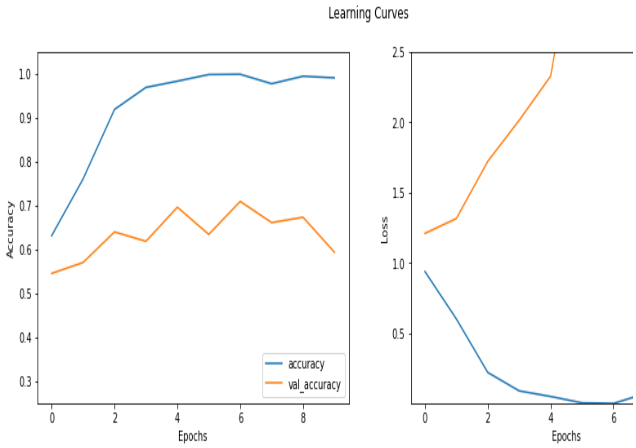
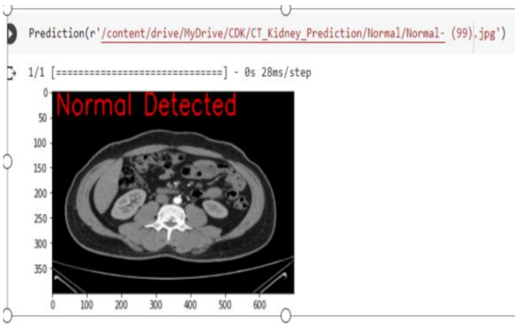


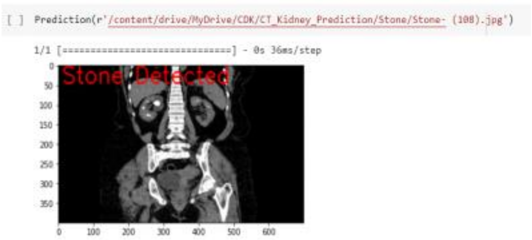
Fig.No-5.1 accuracy and loss graph of model

The evaluation model shows the two graphs with two learning curves in each graph. The graph showed the accuracy of the model and the Validation of the model and the second graph showed the loss and validation loss of the model.

RESULTS

These are the results of our model when give the any image path it will detect the trained disease types and shows the name of kidney on the image .





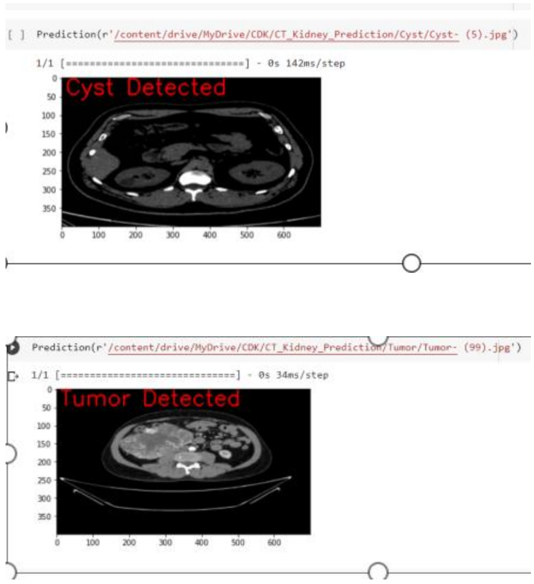


Fig.No-5.2 Stages of chronic kidney disease (CKD)

VI. CONCLUSION AND FUTURE WORK

The proposed CKD diagnostic methodology is feasible in terms of data imputation and detection. the integrated model could achieve a satisfactory accuracy. Hence, we speculate that applying this methodology to the practical diagnosis of CKD would achieve a desirable effect. In addition, this methodology might be applicable to the clinical data of the other diseases in actual medical diagnosis. However, in the process of establishing the model, due to the limitations of the conditions, the available of classes are only four categories, including 12224 samples. Therefore, the generalization performance of the model might be limited only four types of chronic diseases.

In the future a large number of more complex diseases of kidney and representative data will be collected to train the model to improve the performance of model in advanced way. We believe that this model will be more and more perfect for early detection of chronic kidney disease and avoids the delay of treatments

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