Identification of Chronic Kidney Disease using Artificial Neural Network

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Abstract - CNN technology is now being employed in the field of health image processing for the detection of diseases such as cancer and diabetes. Another health concern gaining prominence is related to disorders arising from the substances and elements we consume. Failure to address these disorders promptly can lead to imminent and unavoidable death within a short span. Neglecting issues related to order malfunction can result in the development of habitual order complaints, eventually leading to fatal consequences. Chronic Kidney Disease (CKD) is one such disorder characterized by mild symptoms that often go unnoticed for extended periods, only becoming apparent later on. The Original Government of Yobe state in Nigeria has attracted attention from medical experts due to the high frequency of CKD cases. Unfortunately, a specialized approach to effectively address this issue is yet to be established. In our study, we collected a dataset consisting of 400 cases with 10 attributes from Bade General Hospital. The results indicated that two attributes, namely Creatinine and Bicarbonate, exert the greatest influence on the prediction of CKD. Utilizing a Deep Neural Network (DNN), Convolution Neural Network (CNN) and Recurrent Neural Network model, Additionally, we conducted an analysis to highlight the significance of each feature, providing a ranking of their influence on the CKD prediction.

Keywords
Convolution Neural Network, Machine Learning, Chronic Kidney Disease, Deep Neural Network, Recurrent neural network.

I.INTRODUCTION

Chronic Kidney Disease (CKD) stands out as a significant health challenge that demands attention due to its profound impact on both individuals and society at large. Grasping the significance of CKD involves acknowledging its widespread prevalence, potential complications, and the imperative for early detection and effective management. CKD is a pervasive condition affecting millions of individuals worldwide, characterized by a gradual decline in kidney function that results in the accumulation of waste products and disruptions in fluid balance within the body. If left unchecked, CKD can advance to end-stage renal disease (ESRD), necessitating interventions such as dialysis or kidney transplantation for survival. Recognizing the ubiquity of CKD enables healthcare systems to allocate resources strategically and devise comprehensive strategies to address this escalating public health challenge .CKD is intricately linked to a range of complications and comorbidities. Individuals grappling with CKD face an elevated risk of developing cardiovascular disease, hypertension, anemia, bone disorders, and various other health issues. These complications not only significantly diminish the quality of life for affected individuals but also contribute to escalating healthcare costs. Through a profound understanding of the importance of CKD, healthcare professionals can proactively implement preventive measures and offer appropriate management strategies to alleviate the impact of these complications.

Kidney stone disease poses a significant global health threat, often remaining undetected in its early stages, leading to detrimental effects on kidney function as it progresses. Many cases are attributed to conditions like diabetes mellitus, hypertension, glomerulonephritis, among others, resulting in a substantial number of individuals experiencing kidney failure. Given the potential severity of kidney breakdown, early identification of the issue is crucial .In recent times, deep learning algorithms have become widely utilized for processing biomedical signals, offering valuable tools for automated diagnosis. Point birth and bracketing are two essential components in machine learning operations. The extraction of optimal features from signals plays a pivotal role in achieving high classification accuracy. This study introduces a novel CNN-machine learning model designed to automatically analyze detector responses and make predictions. The CNN performs the point birth operation,

leveraging its ability to automatically discern crucial features from the detector response, leading to improved bracketing performance compared to traditional machine learning methods. Notably, the advantage lies in the integration of point birth and bracketing within a single CNN, eliminating the need for two separate algorithms. This not only reduces computational complexity but also minimizes simulation time for the network. Overall, CNN proves to be computationally efficient when compared to conventional machine learning approaches [1]-[3].

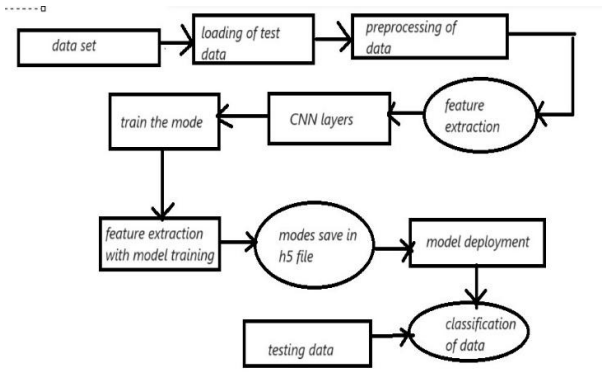
SYSTEM AND DESIGN DEVELOPMENT

An artificial neural network (ANN) is a computational model inspired by the structure and functioning of the human brain. It consists of interconnected nodes, or artificial neurons, organized in layers. Each neuron receives input signals, processes them using activation functions, and produces an output signal that is passed on to the next layer. ANNs are capable of learning from data through a process called training, where the network adjusts the weights and biases of its connections to optimize its performance. They have proven to be highly effective in various fields, such as pattern recognition, image and speech recognition, natural language processing, and predictive modeling. ANNs have revolutionized the field of artificial intelligence and continue to be a powerful tool for solving complex problems and making accurate predictions [4]-[7].

A deep neural network (DNN) is a type of artificial neural network that is designed to mimic the structure and functioning of the human brain. It consists of multiple layers of interconnected nodes, or artificial neurons, that process and transform input data to produce desired outputs. Each layer in a DNN extracts and learns increasingly complex features from the input data, allowing the network to model intricate patterns and relationships. The depth of the network enables it to handle large and complex datasets, making it particularly effective in tasks such as image and speech recognition, natural language processing, and data analysis. By leveraging its hierarchical structure and powerful computational capabilities, deep neural networks have revolutionized various fields, driving advancements in machine learning, artificial intelligence, and data-driven decision-making [8]-[9].

A Convolutional Neural Network (CNN) is a type of deep learning algorithm specifically designed for processing and analyzing visual data, such as images or videos. It is widely used in computer vision tasks, including image classification, object detection, and image segmentation. The key feature of CNNs is their ability to automatically learn and extract meaningful features from input data through the use of convolutional layers. These layers apply filters or kernels to input images, capturing local patterns and spatial relationships. By stacking multiple convolutional layers, along with pooling and activation functions, CNNs can progressively learn more complex and abstract features, enabling them to make accurate predictions and classifications. The hierarchical nature of CNNs, combined with their ability to handle large amounts of visual data, has made them a powerful tool in various applications, revolutionizing the field of computer vision [10].

Data collection plays a crucial role in understanding and addressing the challenges posed by chronic kidney disease (CKD). Collecting comprehensive and accurate data on CKD prevalence, risk factors, progression, and treatment outcomes is essential for informing public health policies, healthcare planning, and research efforts. This data enables healthcare systems to identify high-risk populations, allocate resources effectively, and develop targeted interventions. Additionally, data collection facilitates monitoring and evaluation of CKD management strategies, allowing for continuous improvement in patient care and outcomes. By systematically collecting and analyzing CKD data, healthcare professionals and policymakers can make informed decisions and implement evidence-based interventions to mitigate the impact of this chronic condition [11]-[12].



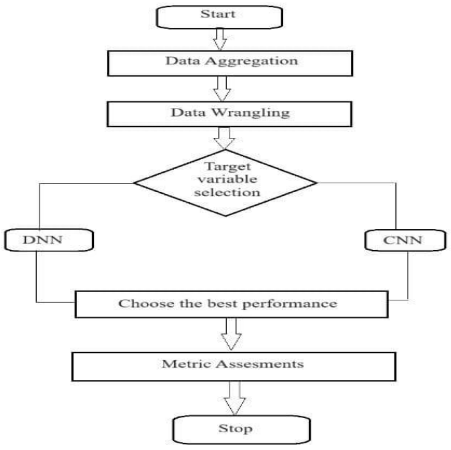
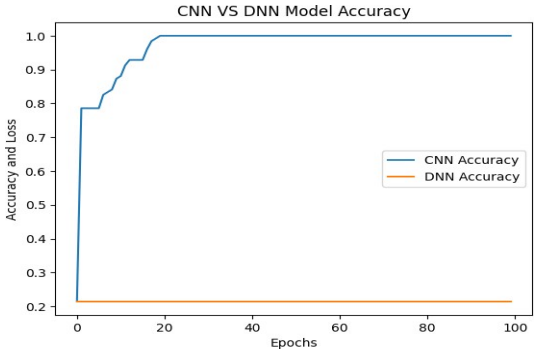


Figure1 Block diaegram of the proposed system design.

II. PROPOSED SYSTEM AND PYTHON PROGRAMMING

Machinelearningmethodsusedwithconvolutionalneuralnetworkclassifiermodelsonthesamedatabase, with 96.7 percent of high-definition support machine models and networks are used. A CNN based kidney disease detection and classification system uses a machine learning algorithm to accurately diagnose and classify various kidney diseases from digital images of kidney lesions. The system is trained on large datasets of images to learn the features and patterns of different kidney diseases .The use of CNN based kidney disease detection and classification systems has the potential to greatly improve the efficiency and accuracy of kidney disease diagnosis and treatment, ultimately leading to better patient outcomes.
Python is an interpreter, high- level, general- purpose programming language. Python is dynamically typed and scrap- collected. It supports multiple programming paradigms, including procedural, object- oriented, and functional programming. Python is frequently described as a" batteries included" language due to its comprehensive standard library. Python was conceived in the late 1980s as a successor to the ABC language. Python2.0, released in 2000, introduced features like list perceptions and a scrap collection system able of collecting reference cycles. Python3.0, released in 2008, was a major modification of the language that isn't fully backward-compatible, and important Python 2 law doesn't run unmodified on Python 3.

The Python 2 language, i.e. Python2.7.x, was officially discontinued on 1 January 2020 (first planned for 2015) after which security patches and other advancements won't be released for it. With Python 2's end- of- life, only Python3.5.x and latterly are supported. Python practitioners are available for numerous operating systems. A global community of programmers develops and maintains Python, an open source reference perpetration. Anon-profit association, the Python Software Foundation, manages and directs coffers for Python and Python development.

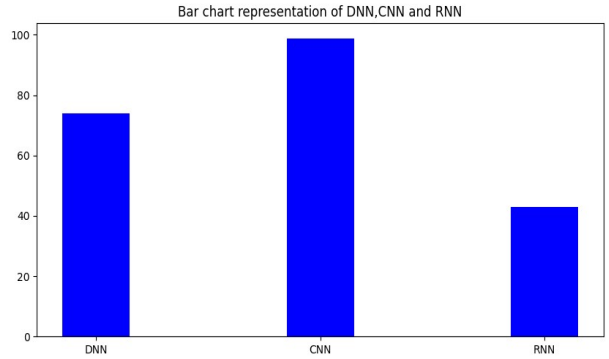


Python's large standard library, generally cited as one of its topmost strengths, provides tools suited too multitudinous tasks. For Internet- facing operations, multitudinous standard formats and protocols analogous as MIME and HTTP are supported. It includes modules for creating graphical user interfaces, connecting to

relational databases, generating pseudorandom numbers, calculation with arbitrary perfection figures, manipulating regular expressions, and unit testing.
Some corridor of the standard library are covered by specifications (for illustration, the Web Garcon Gateway Interface (WSGI) performance as brief follows hardihood 333), but utmost modules are not. They are specified by their law, internal documentation, and test suites (if supplied). still, because utmost of the standard library is cross- platform Python law, only a numerous modules need altering or rewriting for variant executions.

RESULTS AND DISCUSSION

In our analysis, we've observed advanced yield values in CKD samples. This is because of the elevated urea situations in the CKD samples. When the feathers are weakened, they fail to discharge urea from the body. We've carried out our examination by taking samples.



The CNN network achieved an average accuracy of 98.6% and a sensitivity and specificity of 97.5% and 97.83%, respectively. The conventional model achieved an average accuracy of 98.56%. We have compared our proposed model with other existing algorithms, and it is observed that the performance achieved by this model is higher than other well-known data classification method.

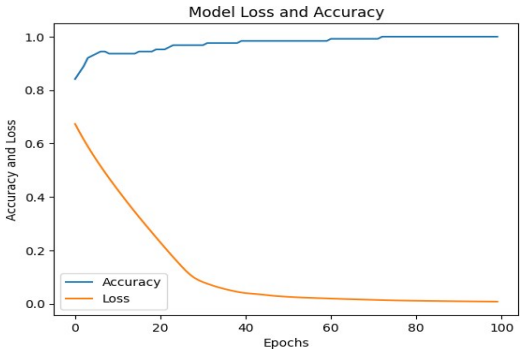


Figure 3 Graphical representation of an output of CNN
The above graphical representation (figure 3) shows the accuracy and loss percentage of CNN. The accuracy of CNN above 98% and loss of the CNN is below 10% for the output. Accuracy is used to identify the number of correctly predicted data points out of all data points. It is defined as the number of all correct predictions made divided by the total number of predictions made. The above mentioned graph shows the accuracy percentage difference between the CNN and DNN neural networks. This CNN network achieved the higher accuracy compared to the DNN models.

CONCLUSION

Data mining classifiers such as ANN and Naive Bayes have been used to predict and diagnose chronic kidney disease. To evaluate the results of these methods, Rapid Miner tools are busy. The results obtained show that CNN has an accurate classifier with an accuracy of 98.6% compared to ANN that has an accuracy of 71.73%. Some of the factors considered kidney disease. Further research can be done using other classifiers such as fuzzy logic, DNN, CNN, and RNN. This paper designed the deep learning based CNN (convolution neural network) based algorithm with consists input layer convolution layer ,Relu layer ,max pooling layer for extract the features for training of images In future work we designed real time implementation transfer The prospects

presented by the use of AI technology in the sphere of medical services should not be overlooked. AI advancements can assist in filtering through massive amounts of data to find patterns, correlations, and conduct complicated computations, activities that robots are better able to execute than people. The model, which is based on the Convolution neural network V2 and LSTM approaches, showed effectiveness for kidney disease detection while requiring little computing resources and effort

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