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Kidney Stone Detection Using Deep Learning Techniques CNN & Mobilenet

Mrs J Sarada MCA,M.Tech,M.Phil,(Ph.D) [1], Pandi Vishnu Vardhan [2]

[1] Associate Professor, Department of Computer Applications

[2] Student, Department of Computer Applications

[1],[2] Chadalawada Ramanamma Engineering College (Autonomous)

ABSTRACT

Kidney stones as not a new subject to being one of the major health concerns of today's day and age, if not detected at early stages might also become life threatening. Detecting a kidney stone might require a technique that ensures precision andalso is in wide use. - In certain days, renal calculus has become a significant problem and if not detected at an early stage, then it's going to cause difficulties and sometimes surgery is additionally needed to get rid of the stone. Here, to detect the stone which too precisely paves the thanks to image processing because through image processing there's a bent to urge the precise results and it's an automatic method of detecting the stone. Doctor generally uses the manual method to detect the stone from the Xradiation image but our technique is fully automated so it's advantageous because the time is reduced and therewith the possibilities of error also reduce. Deep learning techniques Provide better result for prediction by constructing models from datasets collected from kidney stone patients. In this work, we will use deep Learning Classification like CNN and Mobile net on a dataset to predict kidney stone.

Keywords:- Kidney stones as not a new subject to being one of the major health concerns of today's day and age, if not detected at early stages might also become life threatening. Detecting a kidney stone might require a technique that ensures precision and also is in wide use.

I. INTRODUCTION

The kidneys, an organ with a distinctive bean shape. They are set on each side of the back, behind the spinal column. A pair of healthy kidneys may filter out harmful substances in the blood and restore chemical equilibrium by producing urine. Maintaining healthy kidney function is crucial to overall physical well-being.The kidneys are also able to regulate the body's levels of acidity, alkalinity, sodium, and potassium. Problems with the kidneys arise when they are unable to filter waste effectively. It is possible that diabetes, high blood pressure, and other chronic illnesses are the root causes of stunted growth, brittle bones, nerve damage, and malnutrition, among other health problems. The kidneys' ability to function might fail totally if the condition progresses. This indicates that kidney function will need to be replaced by dialysis. However, dialysis does not improve kidney function and simply extends life expectancy.

To prevent this problem, we use MobileNet. MobileNet V1, proposed presents a category of extremely economical neural network models referred to as MobileNets for mobile in addition to embedded computer vision applications. MobileNets use an efficient design that involves depth-wise separable convolutions operations, to form light- weight deep convolutional neural networks. It have introduced two easy global hyper-parameters that allow for a trad off between accuracy and latency in an exceedingly very economical manner. These hyper-parameters permit the top user to choose the acceptable sized model for his or her application supporting the software needs of the task. The authors present intensive experiments on resource and accuracy tradeoffs and show robust performance compared to alternative standard models on ImageNet classification.

II. RELATEDWORKS

In order to automate the process of identifying kidney stones, Nilar Theinet et al. [2] created a method that relies on precise segmentation methods. The goal of this research is to examine the three preprocessing techniques for noise deduction in CT images and draw comparisons between them. Size-based thresholding (method I), shape-based thresholding (method II), and a mix of the two (method III) are computed to provide

three distinct noise-reduction strategies (method III). The segmentation procedure in the kidney stone detection system may benefit from the improved readability and clarity of these approaches. Adaptive histograms, GAC segmentation, feature extraction, and morphological procedures are all cornerstones of the system presented by Shahina M K et al. [3]. This study aims to develop a method for automatically detecting and removing kidney stones using ultrasound images of the kidney.

A technique that may help diagnose chronic kidney illness and renal cell carcinoma is presented by Ishrat Nazeer et al. [4]. Patients are identified by inspecting ultrasound images. Apply contour finding to the kidney's focal region to hide CKD features, then use RCC recognition to segment objects. After that, the data set is uploaded to a cloud storage service. The results of these researches will provide healthcare professionals with the skills they need to communicate directly online and get access to online medical libraries. According to Nuhad A. Malallaet al. [5], a C-arm tomography procedure was investigated to provide three-dimensional kidney structural features with the goal of locating the tumour. A kidney phantom was exposed to a little amount of radiation, simulating the conditions of the experiment. C-arm tomographic reconstruction techniques using a distance driven (DD) approach were created. The suggested approach by M.Edhayadharshini et al. [6] has been trained using just 28 abdomen CT images. If just 6 of these photos are normal, then the presence of a kidney mass must be responsible for the abnormality shown in the other 22. The system achieved a 93.65% accuracy rate, which is unacceptable in healthcare since erroneous identification might have fatal consequences for patients. The kidney is a fist-shaped organ in the body that contains many different types of cells, arteries, and veins. It's possible for the algorithm to make a mistake and identify a cluster of veins as a tumour or stone if they're all in the same spot. In this case, the main issue is the unsatisfactory accuracy parameter.

III. PROPOSED SYSTEM ARCHITECTURE

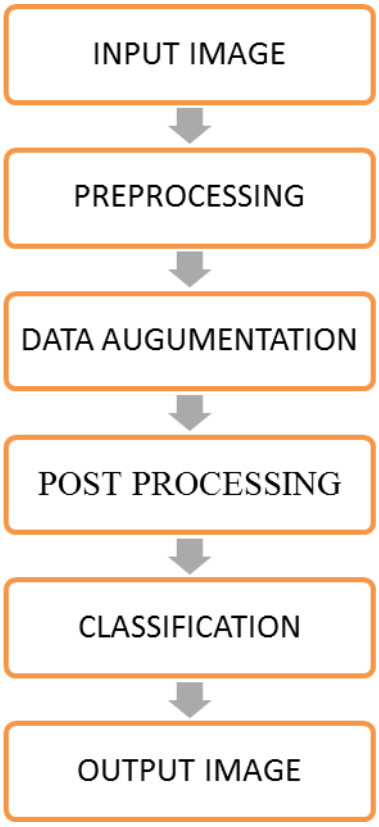


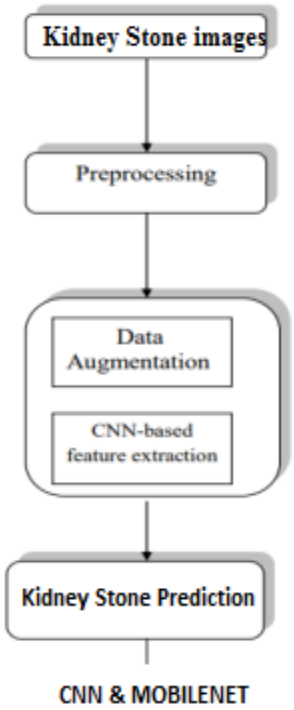
Fig 1: Architecture

A model for a data system that is far-reaching, including the origins of knowledge and utilitarian sections. In terms of requirements, this model highlights a calculated framework that perceives screening systems and their data structures to be staged periodically after some time, screening modalities, accessible information, level of computerization, equipment and programming, and levels of human and financial resources. The primary CNN principle is to automatically segment and create pixel masks for each image object.

It consists of several layers in sequence, including convolutional, non-linear and pooling layers, followed by one or more layers that are convolutional and totally connected. Input to a convolutional network takes the raw pixel values of an image.

In this paper, a image classification methods for diagnosis of cervical cancer on architecture Convolutional neural network (CNN)is proposed for classifying the cervical cancer .The proposed method consists of four major steps: pre-processing, Data sampling, feature extraction and classifier.

One of the easiest approaches of solving the data problem is Convolutional Neural Networks (CNN). It is a common method used which includes TensorFlow, Keras and many other common Frameworks it can be just done through Numpy library as well. Filters are used for feature extraction. Each selected filters must have different functions in order to give the correct prediction class. Pooling layers are added to reduce the parameters and convolutions are used to remove the features. Further the output layer is fully interconnected where the input is taken from the other layers and are flattened and are sent to the output to know number of classes.



Deep learning is also a subset of machine learning, which is essentially a three-layer neural network. These neural networks attempt to mimic the function of the human brain, however, they fall short of its capabilities, allowing it to "learn" from enormous volumes of data. While a single-layer neural network may still make approximate predictions, additional hidden layers can help to optimize and tune for accuracy.

The term "computerized axial tomography scanner," or CT, refers to an electronic radioactivity image process in which a narrow beam of x-rays is directed at a patient and rapidly alternated around the frame, carrying signals that are processed by each machine's calculating to encourage cross-divided countenances—or "slices"—of the corpse. These slices are referred to as tomographic figures because they include more detailed information than standard x-indications. One sort of the following slice is created for one machine's computation; they'll be digitally "shapely"

together to form a three-spatial accurate likeness the patient admits for smooth labeling and section of basic buildings as well as any cancers or anomalies.

A CT scanner employs power-driven radioactivity beginning that spins around the circular gap of a donut-shaped form called a base, as opposed to traditional radioactivity, which uses a tough and rapid radioactivity tube. During a CT scan, the patient lies on a bed that travels about the stage gradually, while a television set rotates around the patient, firing thin x-ray beams through the frame. CT scanners utilize different mathematical radioactivity detectors that are directly opposite the radioactivity beginning, as a recommendation of corrective film. As soon as the x-rays leave the subject, they are elevated by detectors and relayed to a computer. Image slices can be spread independently or shapedly together for a single piece to create a 3D perfect replica of the patient that reveals the frame, means, and tissues, as well as some anomalies that the doctor is troubled to notice.

CT scans of the kidneys can provide more precise information about the kidneys than typical kidney, ureter, and bladder (KUB) X-rays, allowing doctors to better diagnose kidney injuries and disorders. CT scans of the kidneys are effective for detecting tumors or other lesions, obstructive diseases such as kidney stones, congenital malformations, polycystic uropathy, and accumulation of fluid around the kidneys, and thus the location of abscesses, when one or both kidneys are examined.

IV. RESULTS AND DISCUSSION

The system has been trained with 156 kidneys CT scanpictures where 78 images affected with stone and theremaining 78 images are healthy. The system recorded 154images as correct detection and 2 as false recognitions out of156. By observing the data sets; the resulting accuracy is98.71%. There are 2 false-positive cases and zero falseacceptances.

TABLE I. Result Analysis

Terms	Proposed
Total Testing Class	156
True Positive	76
True Negative	78
False Positive	2
False Negative	0

Here, the system attained 76 true positive that means; these76 images are truly affected by stone and the systempositively identified as malignant but 2 of them are ignoredby the system by considered as influenced kidney but theyactually don't have stone i.e. false positive. There are 78True negative that means the system predicted no, and theydon't have any stone. So, as per the total no. of correctpredictions; the accuracy is calculated as 98.71% which is abit superior to the existing systems.

TABLE. II Result Comparison

Terms	M.Edhayadharshini[6]	Proposed
Accuracy	93.65%	98.71%
Sensitivity	97.35%	100%
Specificity	94.85%	97.5%

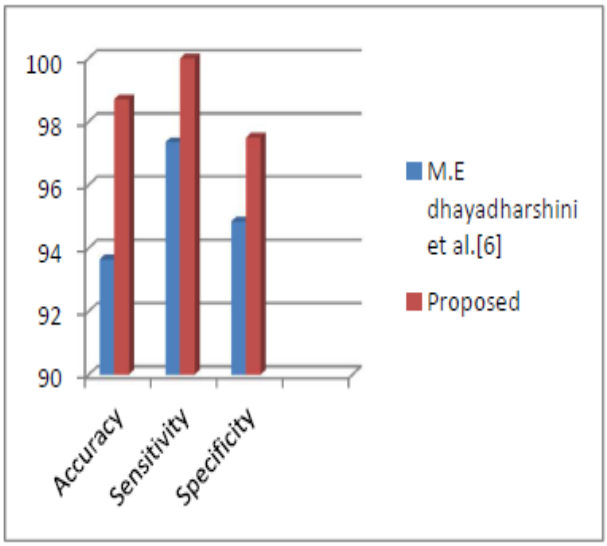


Fig.2 Result Comparison Graph

V. FUTURE SCOPE AND CONCLUSION

The proposed work is advantageous for recognizing kidneystones from CT scan pictures with less processing instant andachieves great accuracy. Firstly, the input image is enhancedby the histogram equalization approach and then applies theEmbossing technique for better visibility of lowdisproportion and also improves edges directionally withconvolution kernel after that we apply SVM for betterclassification. Finally, the system achieved the desiredconsequences successfully. The System obtained 98.71%accuracy by system trained with 156 CT scan samples that

affected by stone as well as healthful kidney. The systemaccuracy has been calculated on the basis of TP, TN, FP,FNparameters. Automatic identification is now trending inmedical science which legitimately helpful for saving humanhealth and wealth also. Accuracy is a tremendously crucialparameter in the medical field so in the future othertechniques and filter may helpful for accuracy enhancementand detecting multiple stone in kidney.

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