A SURVEY ON KIDNEY STONE DETECTION USING IMAGE PROCESSING AND DEEP LEARNING

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Abstract – *As result of our current life style kidney stone has become a common health issue. There are inaccuracies in the classification of kidney stone due to the presence of noise. Also, quick and correct diagnosis of kidney stone is essential which is observed to be lacking in the currently followed practices.*

It's difficult to obtain results for large dataset using human inspection, this is where an automated kidney stone classification is implemented. The automated system uses image processing and deep learning method. The MIR and CT scan images of the proposed methodology of nephrolithiasis is preprocessed. The extraction of the key features is done using gray level concurrent matrix. The conversion of RGB format of image into gray format is essential. The color information of the image is now reduced and converted into a single dimensional from 3 dimensional with similar patterns.

***Key Words*: Image processing, convolution neural network, Deep learning, Machine learning, Python, CT scans.**

1. INTRODUCTION

The Kidney Stone issue can be seeing rising dramatically throughout the world. Shape of kidneys are like bean shaped. They are located on both side of spine behind bellies and below the ribs. Size of kidney is around size of a largest fist. Filtration of the blood is the primary function of kidneys. They maintain balance of bodily fluids by removing waste materials from it. Also, they keep electrolytes in their sufficient levels. When blood comes into kidney the work of kidney starts like removing waste and adjusting level of salt, water and minerals if it is needed. Then this filtered blood goes into body back and the waste goes into pelvis and then removed from body in the form of urine funnel shaped structure that drains down a tube known as ureter to the bladder.

Each and every kidney stone having around ten percent tiny filters. They are known as nephrons. If blood stops flowing through kidney part it could be die and that can lead to a kidney failure. Formation of a stone in kidney leads to blockage of urine congenital anomalies cysts. Various types of kidney stones namely viz renal calculi stone, struvite stones, stage horn was analysed. A commendable contribution of various researcher in the discipline of nephrolithiasis detection via means of occurring numerous algorithms to locate the kidney stone is seen. Use of neural network for the classification of urinary calculus has shown great potential.

1.1 Problem Statement

Failure of Kidney can be a life changing. So that the initial detection of kidney stone is important. Kidney stones must first be identified to ensure successful surgical operations.[3]

1.2 Objective

The main objective of this project is to efficiently detect kidney stone problems with the help of image, and to improve the detection rate in terms of accuracy as well as sensitivity.

2. LITERATURE SURVEY

For this topic, many research papers have been published and many researchers have work upon it, in order to design Kidney stone detection using image processing and deep learning few of the following are discussed here. Literature survey is an information review. Which will help us in understanding and exploring concept of basis learnings So it will help us in better understanding the topics based on early information available. Literature survey is often done to connect our work with the relation of existing data.

Sr. No	Papers	Algorithm used	Accuracy	Software	Data sets or Input Parameters
1.	kidney stone detection with CT images using neural network	Fuzzy C-Mean (FCM) Clustering Algorithm	98.8%	Yes	Data set CT images
2.	Kidney Stone Analysis Using Digital Image Processing	Image Processing	92.57%	Yes	Data set
3.	Analysis and Implementation of Kidney Stone Detection by Reaction Diffusion Level Set Segmentation Using Xilinx System Generator on FPGAs	ANN	98.8%	Yes	CT scans images through datasets
4.	Urinary Stone Detection on CT Images Using Deep Convolutional Neural Networks	CNN	92%	Yes	Dataset collected from various hospitals
5.	Kidney Stone Detection Using Image Processing and Neural Networks	Fuzzy C Mean (FCM) Clustering Algorithm	98.8%	Yes	CT scans images

3. SOFTWARE REQUIRMENTS

3.1 PYTHON

In this project we use Python language for coding. It is High level and free open-source language.

Specifications: -

- High level
- Interpreted
- Easy to Code
- Interpreted and Portable language
- GUI programming support
- Inbuild Library support

3.2 VS CODE IDE: -

VS code also known as Visual Studio Code it is an IDE made by Microsoft used for development operations like task running, debugging. It's aim to provide tools that developer needs for a quick code-build-debug cycle that developers can write and test code at the same time.

Specifications: -

- Lightning-fast source code editor
- Syntax highlighting
- Auto indentation
- Snippets

3.3 CNN ALGORITHM: -

A CNN algorithm also known as Convolutional Neural Network is a Deep learning algorithm. That take the input images and assign importance to various aspects so be able to differentiate one from another. A CNN has multiple hidden layers that help to extract information from an image.

The four layers of CNN are:

1. Convolution layer
2. Relu layer
3. Pooling layer
4. Fully connected layer

3.4 Machine Learning: -

Machine learning allow user to feed an algorithm with an large amount of data and have the computer analyze and make data-driven recommendations and decisions based on only the input data, for example -An algorithm would be trained with pictures of dogs and other things, all labelled by humans, and the machine would learn ways to identify pictures of dogs on its own.

Types of machine learning algorithms:

• Supervised

• Unsupervised

Supervised machine learning is the most common and easy type.

Machine learning algorithms are utilized during a good kind of applications, like in medicine, email filtering, speech recognition, and computer vision, where it's difficult or unfeasible to develop conventional algorithms to perform the needed tasks.

3.5 Image Processing: -

It is may be a method to convert a picture into digital form and perform some operations thereon, so as to urge an enhanced image or to extract some useful information from it. Morphological image processing removes the imperfections from the binary images because binary regions produced by simple thresholding it can be distorted by the noise. It helps in smoothing the image using opening as well as closing operations.

Morphological operations can be extended to grayscale images. It consists of non-linear operations associated with the structure of features of a picture. It depends on related ordering of pixels but on their numerical values. This technique analyzes an image using a small template known as structuring element and this element is placed on different possible locations in the image and is compared with the corresponding neighborhood pixels. A small matrix structuring element is with 0 and 1 values.
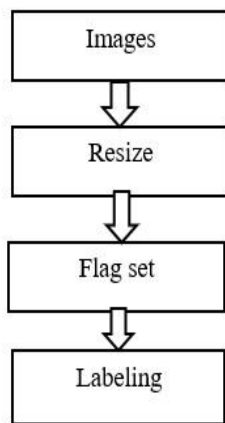
Fig 3.5 Image Processing

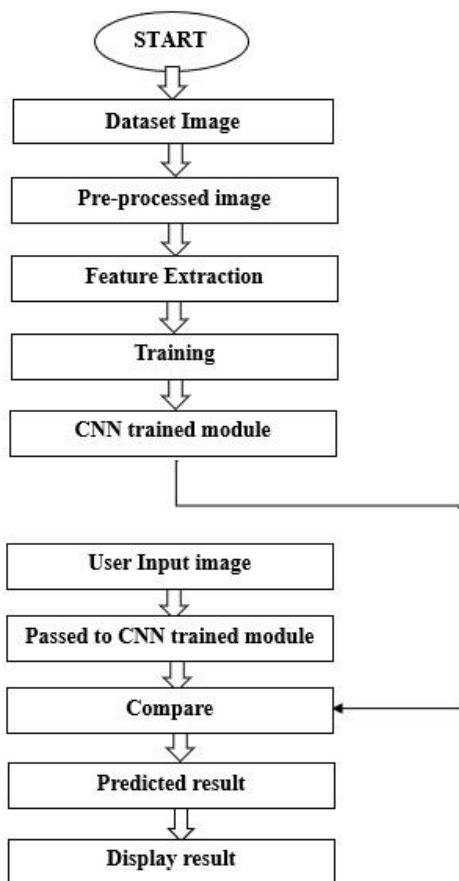## 4. DESIGN AND IMPLEMENTATION

4.1 FLOW CHART:

Fig.4.1 Flow chart

Fig.4.1 shows flow chart of we can see the work flow of our project system. Firstly, CNN training is done with the help of Machine learning and Deep learning by doing processing in dataset. So, for that dataset of stone and no stone both images are passed and after passing the data arrangement

on data is done and arrange dataset is passed for image processing. Here resizing images, setting flag to images and labelling images these operations are done. These processed images are then sent for training. Using CNN algorithm, we train the data. Here 3 layers of CNN are used and feature extraction of images is done. So, after doing these all operations these all is store in one trained module. In trained module one input is from user input image is coming and this image is compared with training did on dataset. And according to comparison predicted result is generated whether stone is present or not and finally output is display.
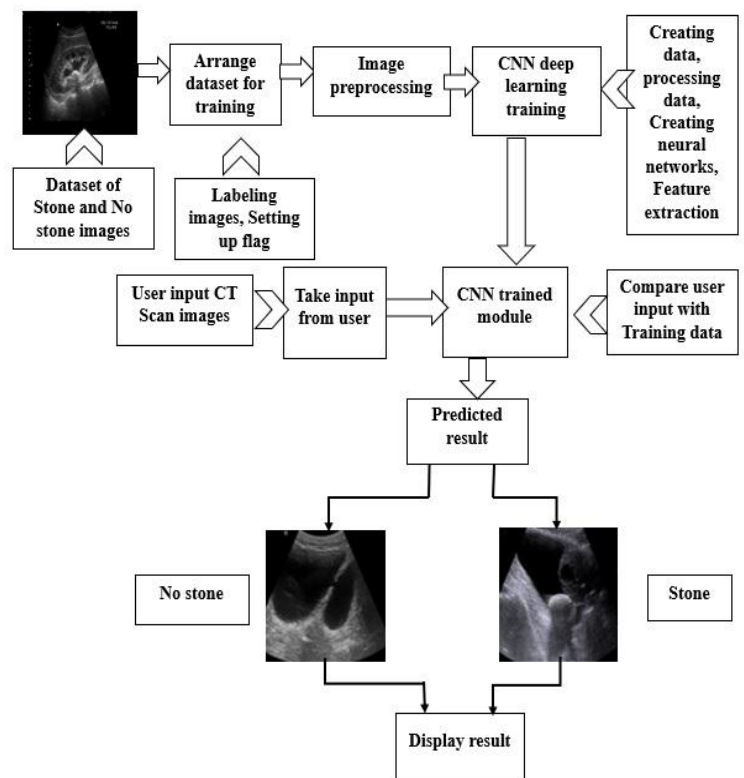
4.2 BLOCK DIAGRAM:

Fig.4.2. Block Diagram

The following block diagram Fig.4.2 shows implementation of kidney stone detection. Which contains CNN algorithm for training. The following diagram shows flow of signal. The main function of CNN algorithm is to take an input image and to analyze visual images by processing data with grid-like topology. Image processing block is used to process images in given dataset like labeling images, resizing the images setting flag to images, feature extraction etc. like operations are done in this block. Coding is done in Python language. The main function of CNN training is to create neural network and creating dataset for training and testing. In CNN trained module comparison is done and result is predicted and accordingly result is display.

5. OUTPUT:
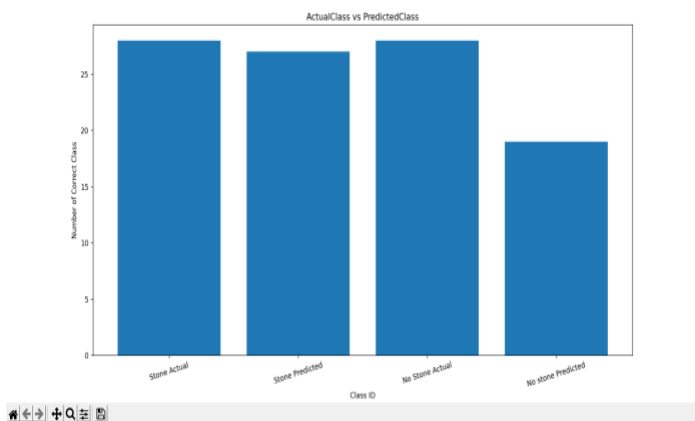
6. CONCLUSIONS

Detecting the presence of kidney stones using the proposed methodology has been done by preprocessing the ultrasound image. It was followed by segmentation and finally morphological analysis of the resulting image was performed.

The final image helped in the detection of the exact location of the stone. Moving further the edge detection method was performed which identified the shape and structure of the formed stones.

7. FUTURE SCOPE

• In future work, the proposed method might be designed for real time implementation via interfacing it with the scanning machines.

• In future, the system will be designed for real time application by placing biomedical sensors in the abdomen region to capture kidney portion. The captured kidney image is to be proposed algorithm to process and detect stone on

FPGA using hardware description language (HDL). The identified urinary calculus within the image is displayed with color for straightforward identification and visibility of stone in monitor.

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