Detection of Kidney Stones Using Neural Networks and their Composition

Saddat Sajad Bisati, Vignesh Muralidharan, C.Vijayakumaran

Computer Science and Engineering, SRM Institute of Science and Technology, Kattankulathur Campus, Chennai, Tamil Nadu
Computer Science and Engineering, SRM Institute of Science and Technology, Kattankulathur Campus, Chennai, Tamil Nadu
Computer Science and Engineering, SRM Institute of Science and Technology, Kattankulathur Campus, Chennai, Tamil Nadu

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Abstract - This study explored the event of a semi-automated program that uses image processing techniques and geometry principles to define the boundary, and segmentation of the kidney area, and to reinforce urinary calculus detection. It marks the detected kidney stones and provided an output that identifies the dimensions and site of the kidney supported pixel count. The program was tested on standard KUB CT scan slides were divided into two groups supported the presence and absence of kidney stones in the hospital records. Of these, the program generated six inconsistent results which were attributed to the poor quality of the first CT scans. Results showed that the program has high accuracy, which suggests the program's potential in diagnostic efficiency for urinary calculus detection.

Key Words: Optical coherence picturing, Discrete Wavelet Transform, Neural networks, Grey Level Co-occurrence Matrix, Correlation Coefficient

1. INTRODUCTION

Optical coherence picturing (OCT) [1] may be an old modality for non-invasive assessment of diseases. As a result, OCT image analysis is changing into more and more necessary. Texture analysis has been actively investigated for tissue characterization. The potential of texture analysis has been incontestable in various medical specialty applications, together with Gregorian calendar month imaging of skin, bladder, eye, atherosclerotic plaque, esophagus, and breast. In general, texture analysis techniques are classified into 3 groups: applied math technologies, spectral technologies, and structural technology. The selection of best methodology for texture analysis could vary wishing on the precise medical specialty applications.

OCT [2] and its useful extension (Doppler Gregorian calendar month and optical small roentgenography, OMAG) are used for imaging excretory organ microanatomy and microcirculation. Gregorian calendar month will resolve excretory organ corpuscles and uriniferoustubules. The morphological changes in these structures area unit related to ischemia-reperfusion injury. Automatic algorithmic rule for image analysis algorithmic rule has been developed antecedently for quantifying spatially- resolved cannular diameter as an attainable biomarker for indicating viability of the transplant excretory organ. In these previous studies, the cannular lumens were segmental out from cross-sectional Gregorian calendar month pictures of excretory organ

microstructure supported Associate in nursing empirically-determined intensity threshold. However, as Gregorian calendar month intensity is attenuated with depth, segmentation of deeper cannular lumens supported one mounted threshold becomes difficult. Components incorporating the applicable criteria that follows.

2. RELATED WORKS

Speckle noise reduction and segmentation of urinary organ regions from ultrasound image

Ultrasound imaging plays an important role in medical field to estimate urinary organ size, position, look and helps to sight structural abnormalities further because the presence of cysts, stones, cancer, non-heritable anomalies, swelling, blockage of water flow etc. however presence of speckle noise and low distinction in ultrasound pictures, detection of urinary organ could be a tough further as difficult task. During this paper we tend to develop and implement a system, which might section human urinary organ from ultrasound pictures, usable throughout surgical operations like punctures. First, we tend to take input image and perform restoration on it image. Then we tend to scale back speckle noise and sleek resultant image victimization Dennis Gabor filter. Bar chart effort is employed to boost the image quality. For this study, 2 segmentation techniques were chosen to be compared carries with it cell segmentation and region based mostly segmentation. For higher result we tend to use region based mostly segmentation to extract urinary organ regions. Finally, we tend to perform refinement and crop the divided urinary organ region from the first image.

Feature Extraction of Urinary Organ Ultrasound Pictures supported intensity bar chart and grey level co-occurrence matrix

This study proposes associate degree approach of feature extraction of urinary organ ultrasound pictures supported 5 intensity bar chart options and nineteen grey level co-occurrence matrix (GLCM) options. Urinary organ ultrasound pictures were divided into four totally different groups; traditional (NR), microorganism infection (BI), cystic unwellness (CD) and urinary organ stones (KS). Before feature extraction, the photographs were at first preprocessed for conserving pixels of interest before feature extraction. Preprocessing techniques as well as region of interest cropping, contour detection, image rotation and background removal, are applied. Check result shows that kurtosis, mean, skewness, cluster shades and cluster prominence dominate

over different parameters. When social control, Kansas cluster has highest price of kurtosis (1.000) and lowest price of cluster shades (0.238) and means (0.649) whereas NR cluster has highest price of mean (1.000), imbalance (1.000), and cluster shades (1.000) and cluster prominence (1.000). CD cluster has very cheap price of imbalance (0.625) and metallic element has very cheap price of kurtosis (0.542). This shows that these options are often wont to classify urinary organ ultrasound pictures into {different totally different completely} teams for making info of urinary organ ultrasound pictures with different pathologies.

Detection and Characterization of Tumors Victimization Segmentation supported HSOM, Riffle Packet Feature areas and ANN

The method to section somebody's brain of MRI image is planned within which growth detection and characterization area unit thought-about victimization HSOM and riffle packets feature areas. within the initial part, the MRI brain image is no heritable from patient's info, in this film object and noise area unit removed, and hierarchical Self Organizing Map (HSOM) is applied for image segmentation. The HSOM is that the extension of the traditional self-organizing map won't to classify the image row by row. During this lowest level of weight vector, a high price of growth pixels and computation speed is achieved by the HSOM with vector division. Within the second part, the feature of the MRI image is extracted initial. Victimization the ANN and riffle packets we tend to verify the abnormal spectra and sort of abnormality. The MRI analysis results were correct ninety-seven of the time once classifying the spectra of the clinical MRI knowledge into traditional tissue, tumor, and radiation mortification. They were correct seventy-two and eighty three of the time once determined growth varieties victimization the clinical and simulated MRI knowledge, severally.

Analysis of Ultrasound Urinary Organ Pictures Victimization Content Descriptive Multiple options for Disorder Identification and ANN Based Mostly Classification

The objective of this work is to produce a group of most important content descriptive feature parameters to spot and classify the urinary organ disorders with ultrasound scan. The ultrasound pictures area unit at first pre-processed to preserve the pixels of interest before feature extraction. In total twenty-eight options area unit extracted, the analysis of options price shows that thirteen options area unit extremely vital in discrimination. This resultant feature vector is employed to coach the multilayer back propagation network. The network is tested with the unknown samples. The end result of multi-layer back propagation network is verified with doctors and this confirms classification potency ofninety.47%, 86.66%, and 85.71% for the categories thought-about severally. The study shows that feature extraction when pre-processing followed by ANN based mostly classification considerably enhance objective identification and provides the likelihood of developing computer-aided identification system

Sensitivity of Feed Forward Neural Networks to Weight Errors

An analysis is created of the sensitivity of feed forward stratified networks of Adeline parts (threshold logic units) to weight errors. Associate degree approximation springs that express the chance of error for associate degree output vegetative cell of an oversized network (a network with several neurons per layer) as a performance of the share amendment within the weights. As would be expected, the chance of error will increase with the amount of layers within the network and with the share amendment within the weights. The chance of error is basically freelance of the amount of weights per vegetative cell and of the amount of neurons per layer, as long as these numbers area unit massive (on the order of one hundred or more)

3. PROPOSED WORK

- ➢ DWT
- ➢ Feature Extraction
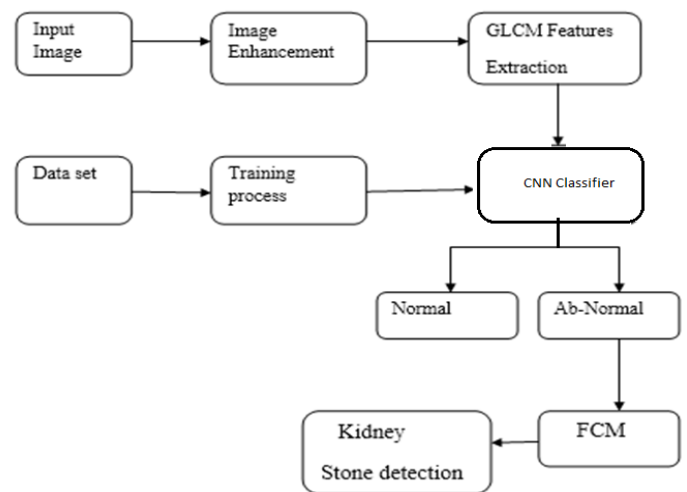- ➢ CNN Classifier
- ➢ K-means Clustering.

Figure 1. Block Diagram

➢ DWT: The Discrete Wavelet Transform (DWT) is a signal processing tool. It is utilized for signal coding, to address a discrete sign in a more repetitive structure, regularly as a preconditioning for information pressure.

➢ Feature Extraction: is a piece of the dimensional decrease measure, in which, an underlying arrangement of the crude information is separated and diminished to more sensible gatherings. So when you need to handle it will be simpler. The main trait of these enormous informational collections is that they have countless factors. These factors require a ton of figuring assets to deal with them. So Feature extraction assists with getting the best element from those huge informational collections by select and join factors into highlights, hence, adequately diminishing the measure of information. These highlights are not difficult to measure, yet ready to portray the genuine informational collection with the precision and inventiveness.

➢ CNN Classifier: Neural networks are predictive models loosely based on the action of biological neurons.
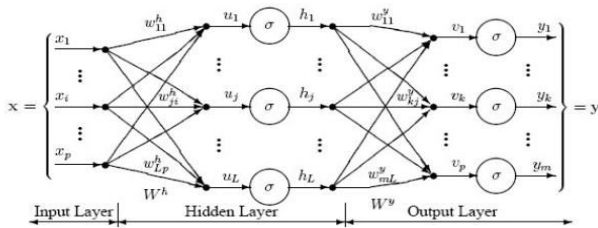

Figure 2. CNN Layer Diagram

➢ K-means clustering: Clustering is employed to prepare knowledge for economical retrieval. One in all the issues in cluster is that the identification of clusters in given knowledge. A preferred technique for cluster relies on K- means that such the info is divided into K clusters. During this methodology, the quantity of clusters is predefined and therefore the technique is very addicted to the initial identification of components that represent the clusters well. An outsized space of analysis in cluster has targeted on rising the cluster method such the clusters aren't addicted to the initial identification of cluster illustration**.**

4. Implementation

Image pre-processing: is that the term for operations on pictures at very cheap level of abstraction. These operations don't increase image data content however they decrease the entropy. The aim of pre-processing is associate improvement of the image knowledge that suppresses unwanted distortions or enhances some image options relevant for more process and analysis task.

A distinct rippling Transform: counseled process algorithmic rule to rework image knowledge to rippling constant knowledge. A DWT employing a 9-tap filter to get low-pass rippling coefficients and a 7-tap filter to get high-pass rippling coefficients. 2 completely different specific 9/7 distinct rippling Transforms square measure recommended: 9/7 Float DWT for lossy compression and 9/7 number DWT for lossless compression. It's an area transformation from time and frequency domain. It decomposes the image into completely different sub band pictures. LL, LH, HL, and HH. Multi Resolution Analysis is designed to grant poor time resolution and frequency resolution at high frequencies. Good frequency resolution and time resolution at low frequencies. Sensible for signal having high frequency parts for brief durations a high-frequency sub band contains the sting data of input image. LL sub band contains the clear data concerning the image. Enhancing the looks of the image with facilitate of this sub bands data for retrieval method. The rippling rework is computed on an individual basis {for completely different for various} segments of the time-domain signal at different frequencies.

GLCM: texture options square measure extracted victimization grey Level Co-occurrence Matrix (GLCM).Texture options calculated victimization GLCM square measure distinction, Correlation, Entropy, Energy.

$$E = \sum_{x} \sum_{y} p(x, y)^2$$

Where p(x, y) is the GLCM

Contrast Equation:

$$I = \sum \sum (x - y)^2 p(x, y)$$

Correlation Coefficient: It is used to measure the joint probability occurrence of the specified pixel pairs.

Correlation: sum (sum ((x- μx) (y-μy) p(x, y)/σ x σ y))

Homogeneity: It is used to measure the closeness of the distribution of elements in the GLCM to the GLCM diagonal.

Homogeneity = sum (sum (p(x, y)/ (1 + [x-y])))

K-means clustering: Clustering is employed to prepare knowledge for economical retrieval. One in all the issues in cluster is that the identification of clusters in given knowledge. A preferred technique for cluster relies on K- means that such the info is divided into K clusters. During this methodology, the quantity of clusters is predefined and therefore the technique is very addicted to the initial identification of components that represent the clusters well. An outsized space of analysis in cluster has targeted on rising the cluster method such the clusters aren't addicted to the initial identification of cluster illustration

5. RESULTS DISCUSSION

After implementing, the kidney stones were detected successfully with composition. Accuracy of the model differs as we change the test dataset.
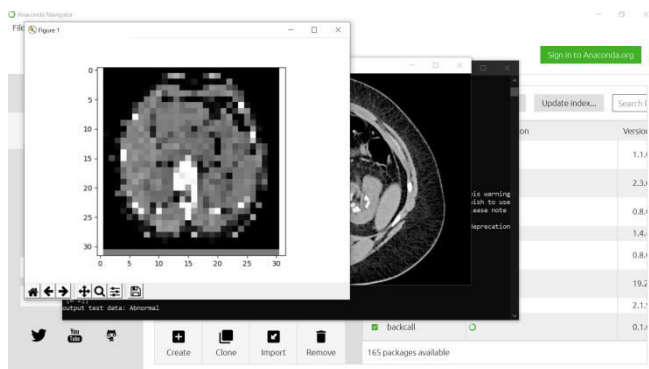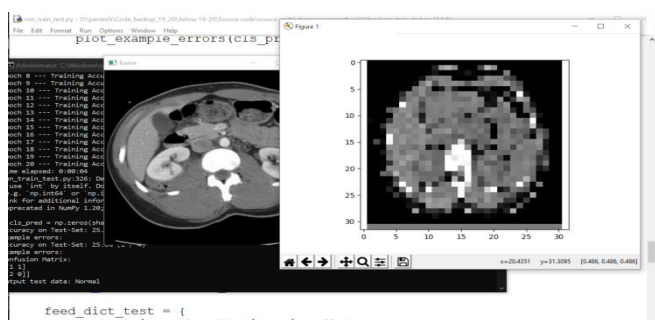

Fig. 3 Output 1

Fig. 4 Output 2 with prediction

3. CONCLUSIONS

In this project we were able to detect kidney stones using different segmentation techniques with neural networks. Results showed that the program has high accuracy, which suggests the program's potential in diagnostic efficiency for kidney stone detection.

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