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SEGMENTATION OF PANCREATIC CYSTS AND ROI EXTRACTION FROM PANCREATIC CT IMAGES USING MACHINE LEARNING

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ABSTRACT
Segmentation of Pancreas with high accuracy in computerized tomography (CT) results is considered to be a basic issue in both medical image processing and computer-aided diagnosis (CAD). Pancreas segmentation is considered as a difficult task due to its uncertainity in location and in analysis of organs, while it takes very minute division of the entire abdominal CT scans. Because of the accelerated development of the CAD system and therefore the serious need for antiseptic treatments, pancreas segmentation with high accuracy of results is demanded. A new approach is used in this paper, for automated pancreas segmentation of CT images using inter-/intra-slice circumstancial instruction with preprocessing, segmentation, feature extraction, classification.

KEYWORDS:
Artificial Neural Network, Classification CT images, Pancreatic cysts, Preprocessing, Segmentation.

1. INTRODUCTION

Pancreatic cancer is a deadly disease that is still being un-noticed by the people due to lack of awareness about the cancer. Unlike
Other cancers, pancreatic cancer does not show any kind of symptoms initially. Patients who are prone to cancer and have diabetes issues, it may not be sure that what had caused the cancer, either the precancerous cells or the sugar level in the patient. Also, study reports show that people aged over 50 and have an onset of diabetes have the risk of pancreatic cancer.

I. LITERATURE SURVEY

This section depicts the prior works processed in pancreatic cancer and segmentation of pancreas. Researchers have applied the traditional techniques of CT, PET, MRI scan images in the identification of pancreatic cancer [1], which helps us in the detection on the later stages only. Barbara J. Kenner and Vay Liang W. Go used screening and bio marker techniques to identify cancer at the early stages [3], and the social program for early detection by Hiroki Sakamoto, Satoshi Harada, Nobu Nishioka, used clinical detection of finding the disease using ultrasonography[4], The author in [7] studied that Pancreatic cancer detection can be also performed by transactional image processing techniques and by using multiple pointers Computerized scanning technique. Khandaker A. Al Mamun, Nicole McFarlane [2] proposed a system by integrating present time sound detecting tools for artificial pancreas using piezoelectric sensor.

Rita J. Miller studied the earlier detection of cancer by using quantitative ultrasound methods[6], Andrew McGuigan described the cancer related to pancreas as an result of diagnosis and epidemiology. [5], Authors in [8],[9] studied on the deep supervison techniques on pancreatitis and pancreatic cancer detection by using computing techniques.

2. PROPOSED SYSTEM

The existing system for pancreatic detection is CT scan, MRI scan and PET/CT scan.

By using methods like preprocessing and segmentation to segment the ROI of pancreas of diabetes patients, we can detect the cancer cells only to a certain extent, which is not accurate enough to treat the patient whether the cancer is malignant or not. The proposed system we are using the same as the existing system such as preprocessing, segmentation, Feature extraction and classification. The pixels of the images are sharpened after the preprocessing technique-median filter.

3. SYSTEM ARCHITECTURE

SYMPTOMS

a. Pain in upper abdomen
b. Drastic weight loss
c. Jaundice
d. Hyperglycemia
e. Prolonged fever

Steps involved in segmentation and ROI extraction of pancreatic tumor in diabetes patients are shown in figure 1.

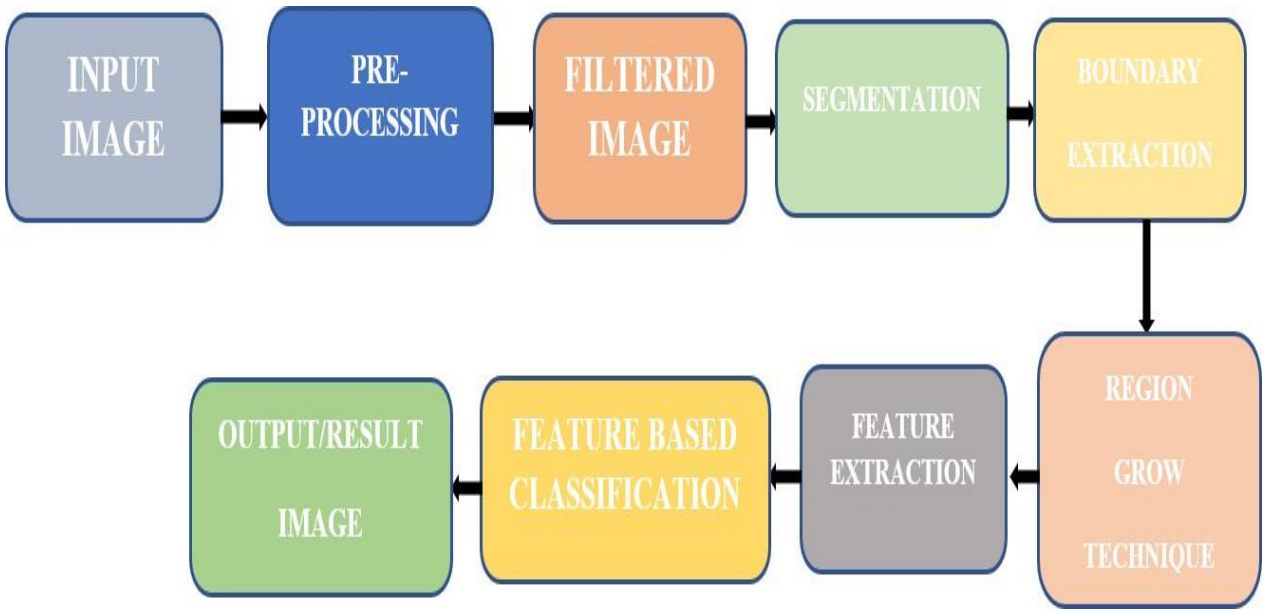


Fig1. Architecture Diagram for Pancreatic Tumor segmentation and ROI extraction

4. REQUIREMENTS GATHERING

The basic requirements needed for the system to be built are CT scan images or PET/CT scan images of the pancreas of the diabetes patients.

5. STUDY ON PANCREAS

Pancreas is an long, narrow organ located behind the belly. The widest part of the organ is called the head which is located on the right side. The first division of the small intestine lies on the curve of duodenum.

6. ALGORITHMS USED:

a. Preprocessing- Median filter
b. Segmentation – Kmeans
c. Feature extraction- Gray level co- occurrence matrix(GLCM)
d. Classification-Artificial Neural Networks

A. PRE-PROCESSING

Pre-processing suppresses the unwanted distortion or the non-regularities present in the image in which further processing is done. From various labs, the input inages are gathered. To figure out the exact region the colored or 3D images are converted into gray. Presence of distortions is identified using Poisson technique added to the scanned material. In certain images the noise quality cannot be changed according to previous studies.

MEDIAN FILTER:

The median filter helps in removing the unwanted noise in the CT image. All unwanted distortion is removed from the input image and the output is free from noise.

The noisy image can be modelled as X(a, b) = Y(a, b) + □(a, b)
where Y(a, b) is the original image pixel ('true' value of pixel), η(a, b) is the noise perturbation and X(a, b) is the resultant distorted pixel, with corrdinates a, b.
The amount of noise is signal- dependent, that's n(i) is larger when u(i) is larger.
Step 1 : Calculate Vector Median as total of distances from one point to every other point .
Step 2 : Select pixel with least distance as vector median of that window.
Step 3 : Replace noise pixel with vector median

B.SEGMENTATION

Segmentation is the operation of extracting the portion which is affected. The accurate sector of tumor in the scanned image is found by the means of segmentation. This is done by using the K-Means Clustering algorithm. The required portion is segmented using the color-based segmentation algorithm. Difficulties may occur due to some differences in the structure and color.

K-MEANS CLUSTERING:

Pattern recognition, feature extraction, and compression of the image is usually done after the Kmeans clustering. Image segmentation the classification of a picture**.**To calculate k-means clustering At random cluster centers K points are selected. Objects are assigned to the closest center compatible with the Euclidean distance. Mean of all objects is calculated at the centroid. Repeat the steps till an equivalent pixels are allocated to every cluster in forthcoming laps.

K number of clusters are choosen.

1. The centroids and K points are seleceted randomly.
2. Each data points are assigned to the closest centroid that forms K clusters.
3. A new centroid is placed and computed on every cluster.
4. Reallocate every datum to the latest proximity centroid. If any reallocation happened, the move to step 4, else the system is organized.

$J=\sum_{j=1}^{k}.\sum_{i=1}^{n}.\| x_i^{(j)} - c_j \|$--------(1)

gclms=graycomatrix(circuitBoard,'Offset',offs ets0);

4. Derive statistics from the GLCMs using the graycoprops function. The example calculates the contrast and correlation.

stats = graycoprops(glcms,'Contrast Correlation');

5. Plot correlation as a function of offset.

figure, plot([stats.Correlation]); title('Texture Correlation as a function of offset'); xlabel('Horizontal Offset') ylabel('Correlation')

C. FEATURE EXTRACTION

The relevant shape and information is retrieved using feature extraction. Dimensionality reduction is a special form of feature extraction in pattern understanding and image refining.

GCLM:

A pair of pixels with specific value is calculated in an image to characterize the texture and through a spatial relationship occurs during a picture generating the GLCM, then taking out the statistical data from a matrix. Provides a sum of squared elements within GLCM.

1. The grayscale image is displayed. The process is as such the colored image is converted to a grayscale.

2. Offsets of varying directions and distances are defined. The offset contains different sizes and structures of objects that are arranged in various directions. The instance states a group of offsets which are horizontal in direction that only differs in distance.
offsets0 = [zeros (40, 1) (1:40)'];

3. GLCM needs to be created. Offsets specifying graycomatrix function is to be called.

D.CLASSIFICATION

To explain the further levels of disease, classification is used on an extracted image. The region which is healthy and rich in the image is classified using ANN.

Artificial Neural Network:

Artificial Neural Network can be used for classification, regression or clustering. Stages of image processing are divided into preprocessing, feature extraction and classification. In the later stage it can be applied. Input to ANN should be features and output should be classes.

6. Experimental Results:

Fig 1: Image preprocessing in grayscale image

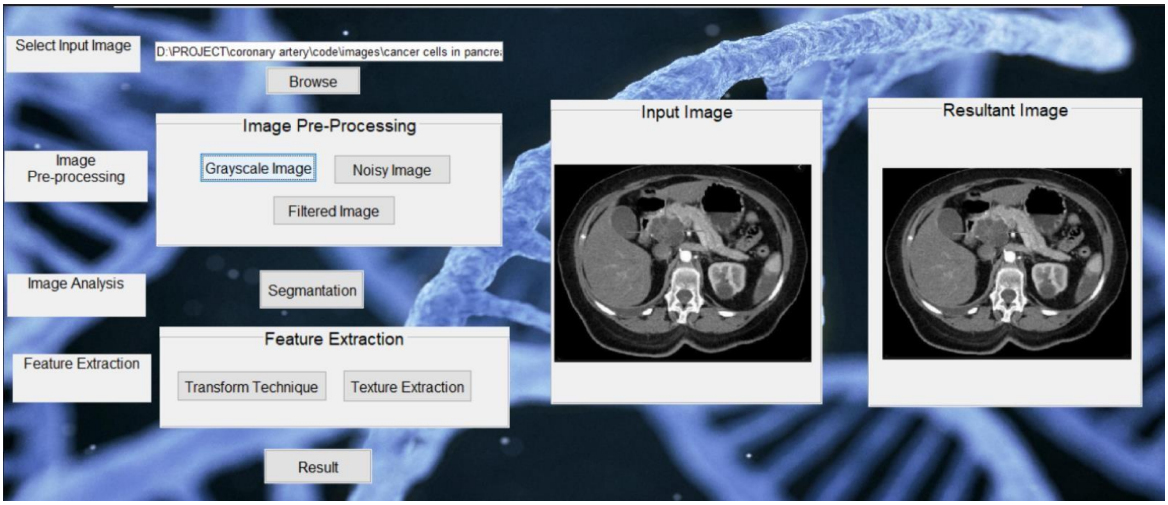


Fig 2: Input image of cancer cells in pancreas preprocessed with Grayscale technique

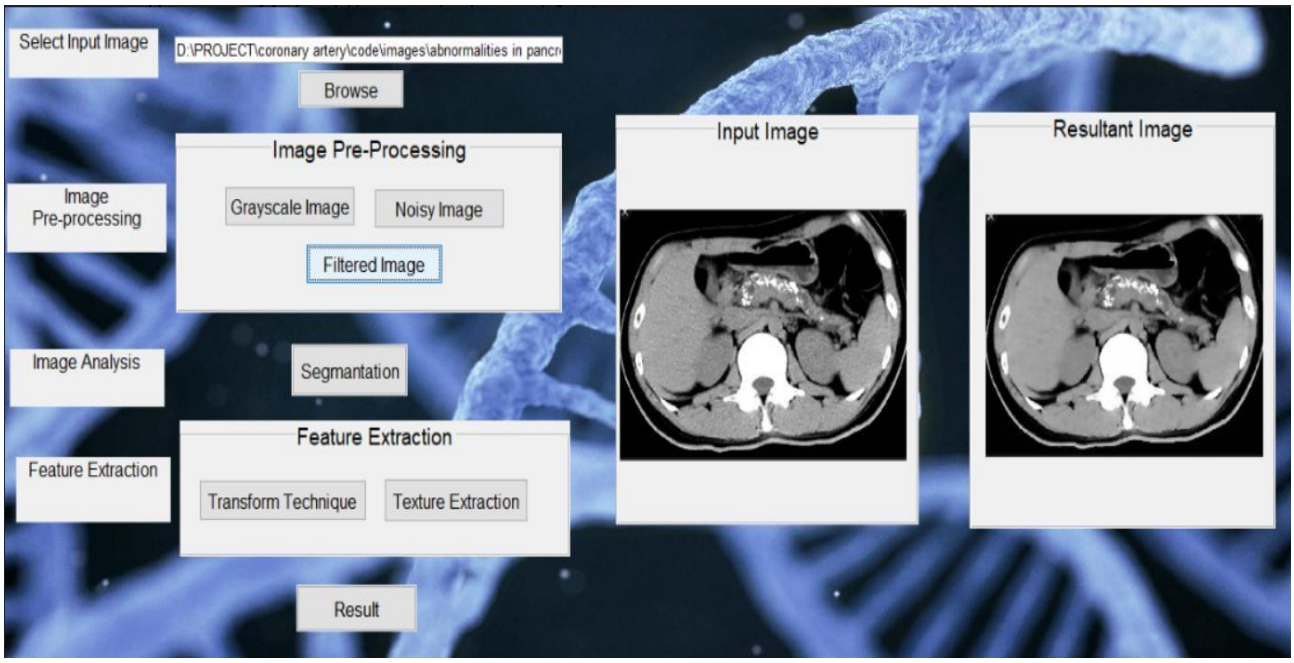


Fig 3: Filtered image with median filter

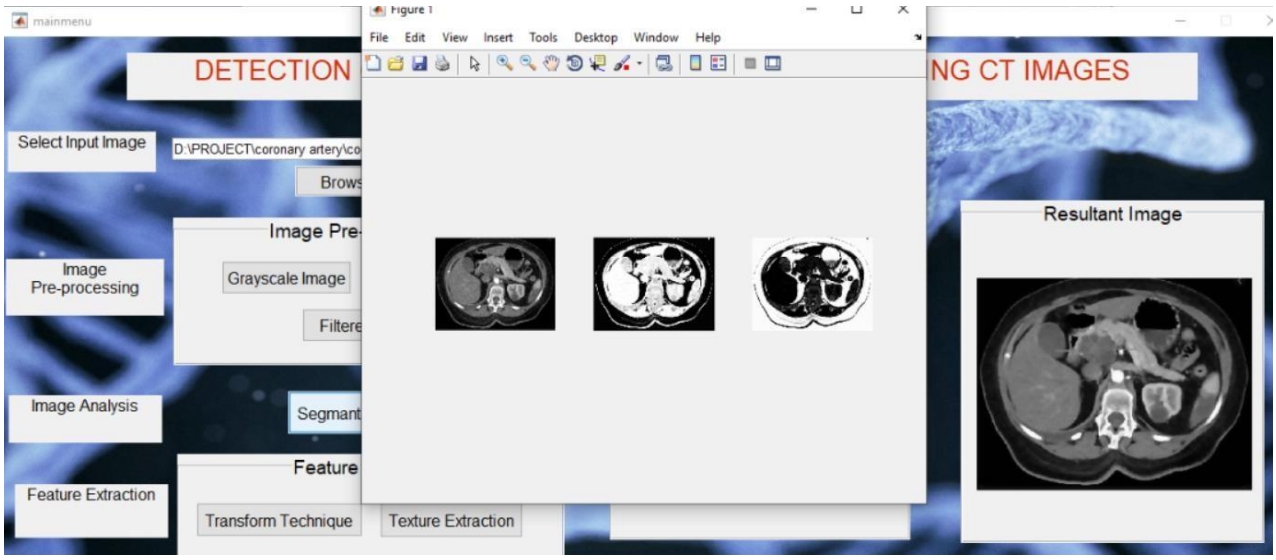


Fig 4: Input images of pancreas with enlargement

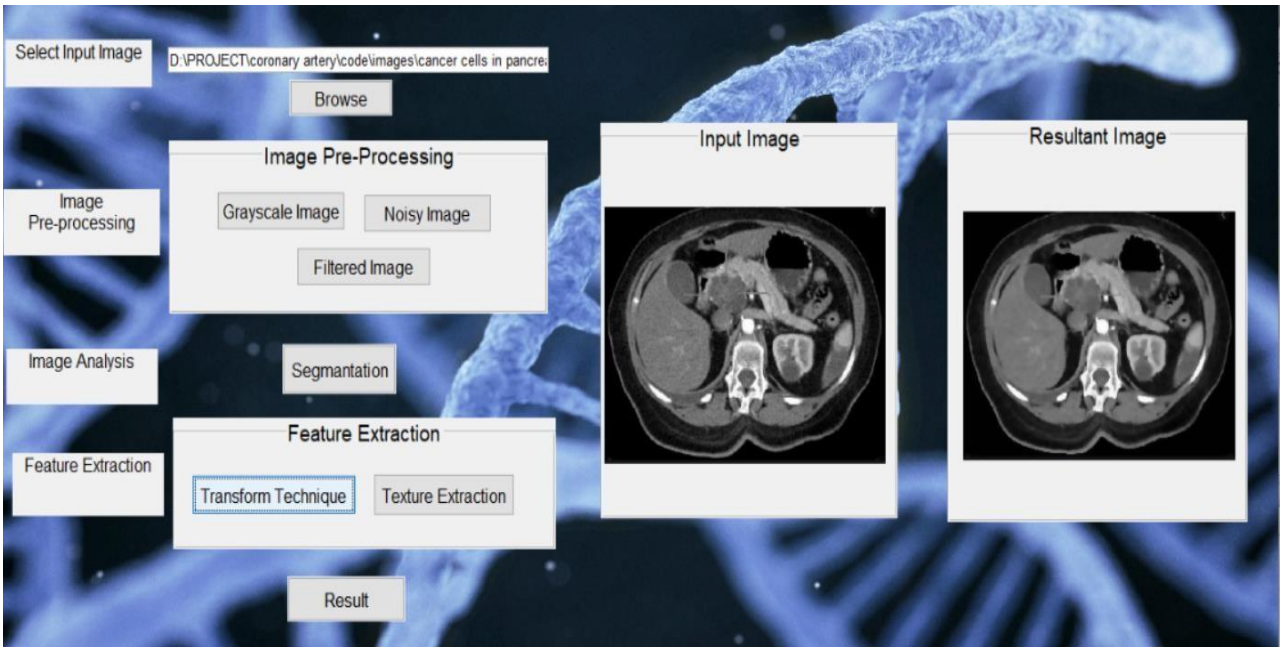


Fig 5 : Feature extraction done on the input image

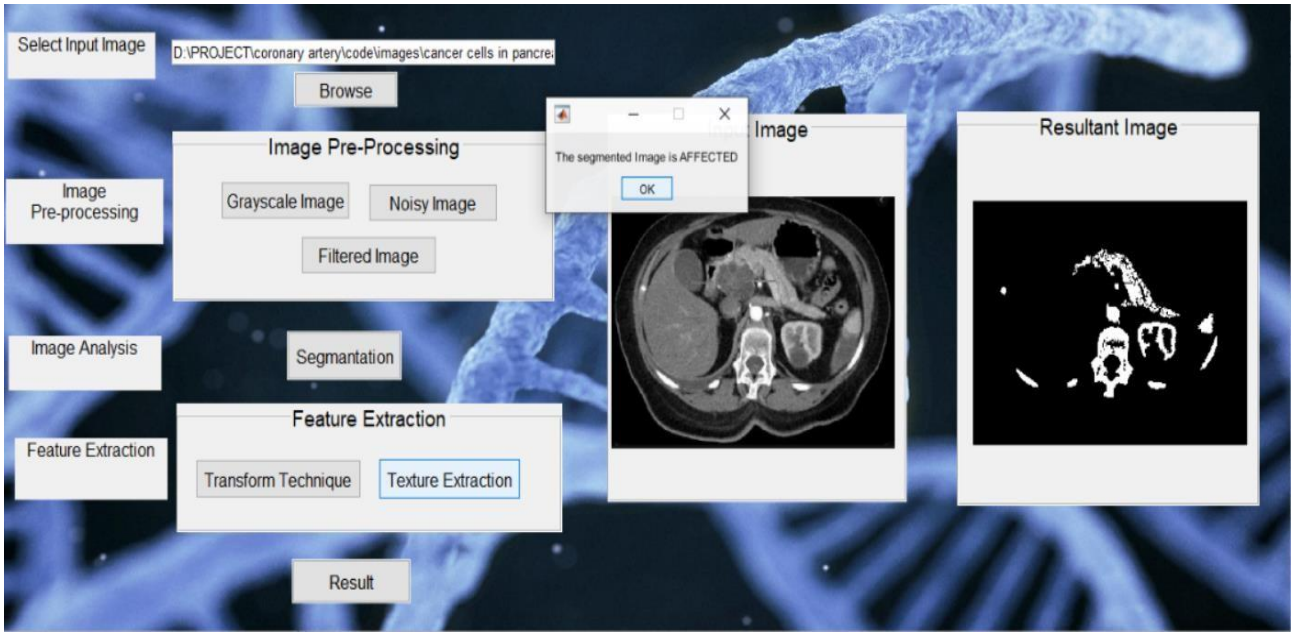


Fig 6: Texture extraction shows the affected area in the pancreas

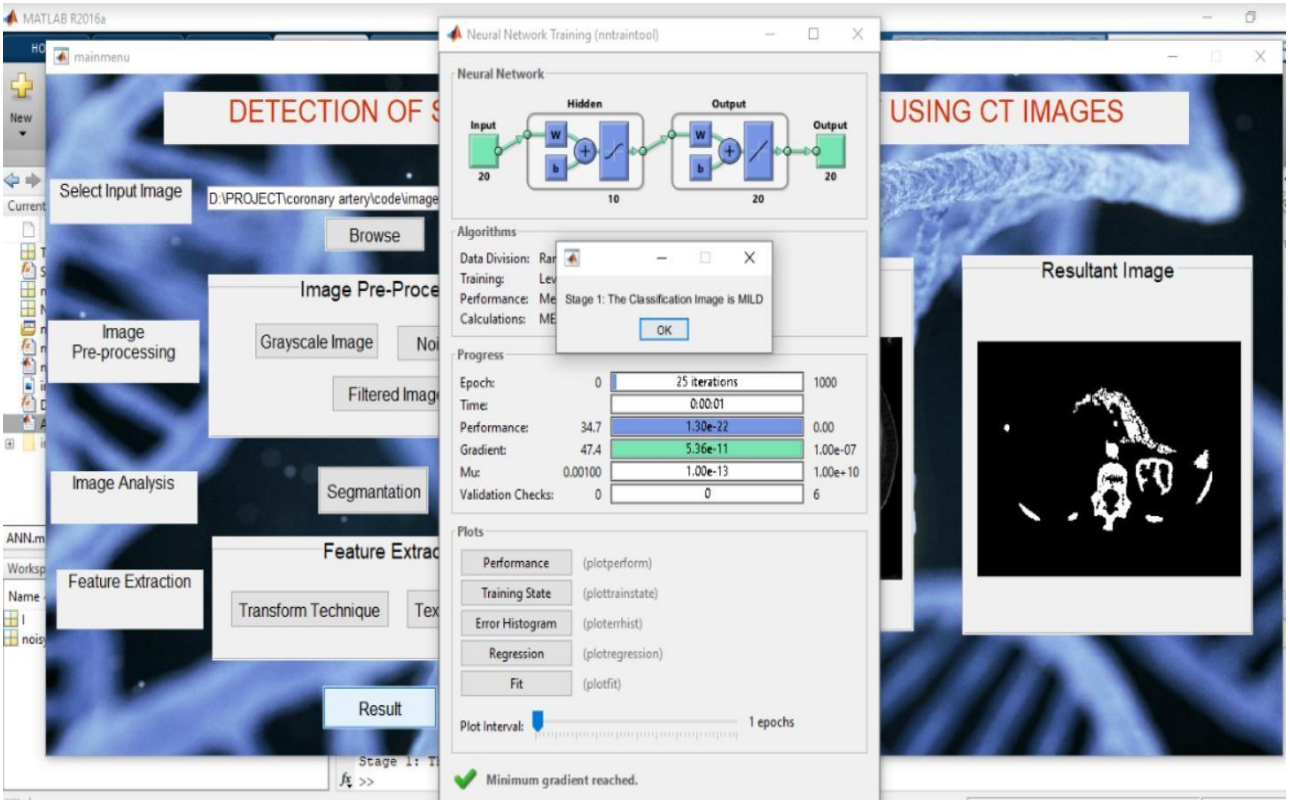


Fig 7: Neural network training shows the stage and intensity of the classification of the image

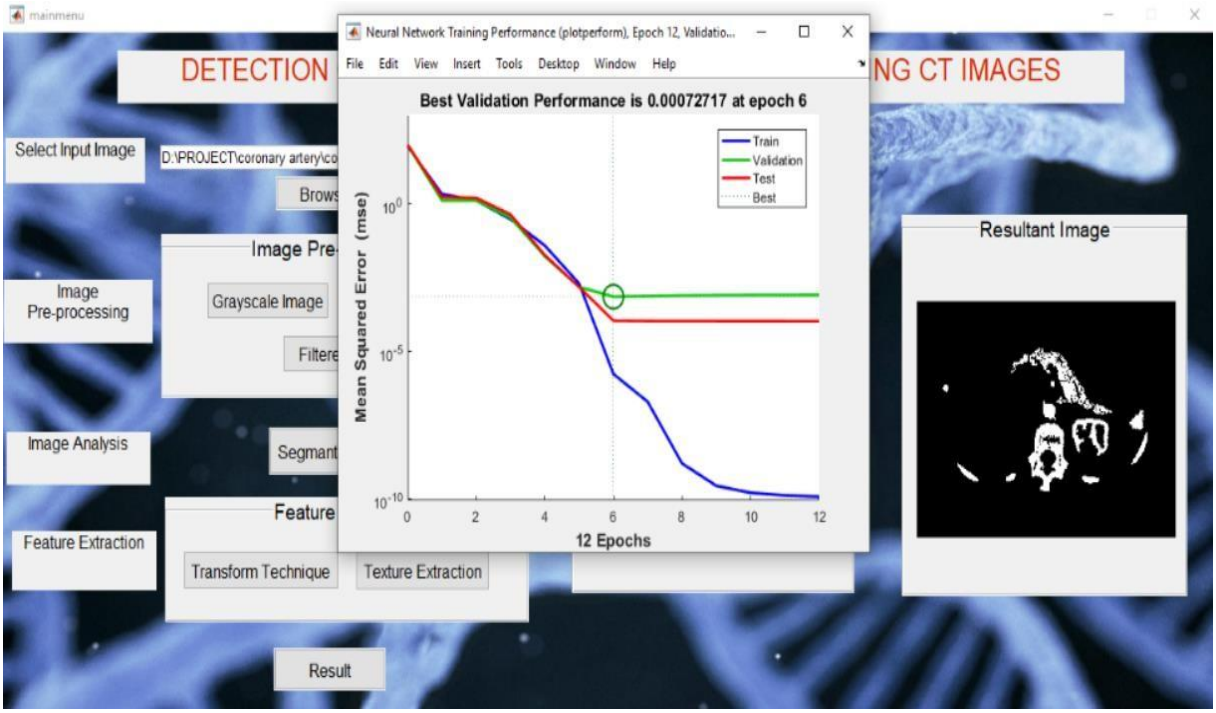
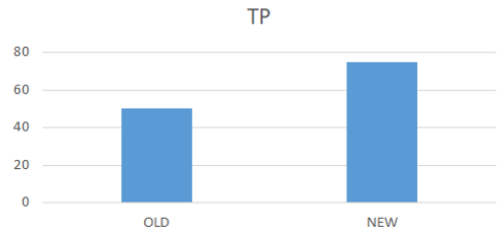


Fig 8: Best validation perfomance

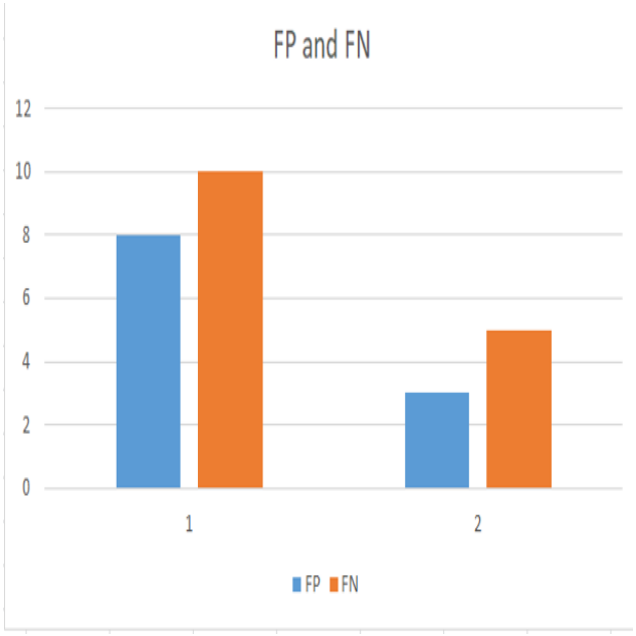
7. PERFOMANCE ANALYSIS

	OLD	NEW
TP	50	75
FP	8	3
FN	10	5

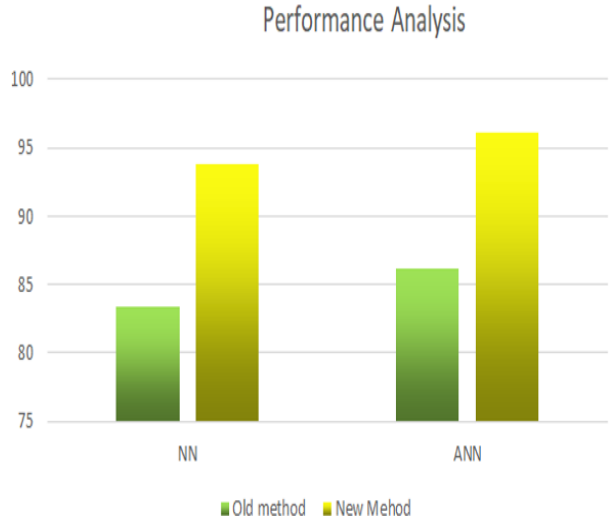
	NN	ANN
OLD METHOD	83.3333333	86.02689655
NEW METHOD	93.75	96.15384615



Graph 1: Comparison of accuracy of the combination of kmeans and segmentation and combination method using NN and ANN respectively.



Graph 2: False positive and False negative of cases of analysis using the combination of algorithms and also using NN and ANN



Graph 3: Overall performance analysis graph between combination of algorithms by k-means segmentaion and by using NN and ANN

The performance analysis reports helps us in figuring out that the combination of various algorithms like Kmeans, feature extraction using GLCM and segmentaion and classification using ANN provides better results with increased efficiency. The combination of these modalities helps us in better classification of the pancreatic cysts.

8. CONCLUSION

The K-means clustering algorithm were used to improve the efficiency of the existing system and provide better results and accuracy in detection and segmentation of the pancreatic cancer.

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