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An Artificial Neural Network Based Vessel Detection On The Optic Disc Using Retinal Photographs

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Abstract: Diabetic retinopathy caused by complications of diabetes, which can eventually lead to blindness. It affects up to 80% of all patients who have had diabetes for 10 years or more. Despite of these statistics, research indicates that at least 90% of new cases could be reduced if there was proper and vigilant treatment and monitoring of the eyes. The longer a person has diabetes, higher the chances of developing diabetic retinopathy .The aim of the project is to detect abnormal vessels in the optic disc of human eye and also prevent from the eye related disease by measuring the features (shape, position, orientation, brightness, contrast) and applying segmentation by replacing the values of the feature measurements the vessels are detected. The existing system uses support vector machine (SVM) to categorize each segment as normal or abnormal. The SVM is used to analyze data and recognize patterns but it cannot detect the vessels automatically, accuracy is not clear and the prediction of disease needs better knowledge. The proposed system uses neural network algorithm for training the features and prediction of disease that is accurate and faster and can find the disease based on ranking its features. .

Key terms: neural network.

I. INTRODUCTION

Medical imaging is the technique and process used to create images of the human body or parts and function thereof for clinical purposes (medical procedures seeking to reveal, diagnose, or examine disease) or medical science (including the study of normal anatomy and physiology). Although imaging of removed organs and tissues can be performed for medical reasons, such procedures are not usually referred to as medical imaging, but rather are a part of pathology. As a discipline and in its widest sense, it is part of biological imaging and incorporates radiology (in the wider sense), nuclear medicine, investigative radiological sciences, endoscopy, (medical) thermograph, medical photography, and microscopy (e.g. For human pathological investigations). Measurement and recording techniques which are not primarily designed to produce images, such as electroencephalography , magneto encephalography, electrocardiography , and others, but which produce data susceptible to be represented as maps (i.e., containing positional information), can be seen as forms of medical imaging

Image processing methods stems from two principal application areas: improvement of pictorial information for human interpretation and processing of image data for storage, transmission and representation for autonomous machine perception. In general, image processing is any form of signal processing for which the input is an image, such as photograph or video frame the output may be either an image or set of characteristics or parameters related to the image. An image may be defined as a two-dimensional function, f(x, y), where x and y are spatial (plane) coordinates, and the amplitude of f at any pair of coordinates (x, y) is called the intensity or gray level of the image at that point. When x, y and the intensity values of f are all finite, discrete quantities, we call the image a digital image. The field of digital image processing refers to processing digital images by means of digital computer. Digital image is composed of a finite number of elements, each of which has a particular location and value. These elements are called picture elements, image elements and pixels

Vision is the most advanced of our senses, so it is not surprising that images play the single most important role in human perception. However, unlike humans, who are limited to the visual band of the electromagnetic spectrum, imaging machines cover almost the entire spectrum, ranging from gamma to radio waves. They can operate on images generated by sources that humans are not accustomed to associating with images. These include ultrasound, electron microscopy, and computer-generated images. Thus, digital image processing encompasses a wide and varied field of applications

II. RELATED WORKS

an automatically grading of veins in digitized ocular fundus images which is described by rough silhouette of the vein[6]. To perform the automated grading they performed the following steps initially Vein is extracted, thinning is applied to the image centrelines, diameter is measured, and Fourier analysis is performed on the sampled version. The categories as normal, definite, advanced are generated automatically. The automatic detection of lesions in retinal images by colour properties was proposed [4], by inserting the property intersection points on the optic disk. Thus optic disk was tracked by combining blood vessels and colour properties. The enlargement of fovea a vascular zone which results to the loss of capillaries was taken [3] .To analyze the fovea a vascular zone, the system optimizes, by using a Gaussian bayes classifier to determine the accuracy of diabetic retinography in progression stages.

The Segmentation of the retinal vasculature[9] Which was the first step towards auto screening for diabetic retinopathy? Retinal vasculature segmentation approach developed by combining the two dimensional continuous wavelet transform and supervised pixel classification. [2]The Micro aneurysms, the first clinical sign of diabetic retinopath were used to indicate the severity of the disease. This paper investigates a set of optimally adjusted morphological operators used for micro aneurysm detection on non-dilated pupil and low-contrast retinal images. The automated method to locate the blood vessels in images of the ocular fundus[1] tool should prove useful to eye care specialists for the purpose of patient screening, treatment evaluation, and clinical study. In this paper they proposed the hand-labelled ground truth segmentations of 20 images which reduces false positives as much as 15 times over basic thresholding of a matched filter response. By applying threshold the small groups of isolated pixels are correctly labelled and the evaluations are perfect still the improvement in MFR is possible by analyzing signal to noise ratio in a good frequency. The development of a nationwide eye screening program for the detection of diabetic retinopathy has generated much interest in automated screening tools.

B.

Three colour normalization algorithms [10] applied for reducing the background colour variation between subjects. Methods were tested using a set of colour retinal fundus camera images containing four different lesions which are important in the screening context distribution of chromaticity values for each lesion type from each image was plotted. Real-time medical image quality is a critical requirement in a number of healthcare environments.over10% to 15% of images are rejected from studies due to image quality, in [7] they proposed a methodology for evaluating a digital image in real-time, by providing real-time feedback, the corrective actions were taken. The technique was equally effective on uncompressed and compressed (JPEG) images. the detection of vessel-like patterns in a noisy environment[5]. To define vessel-like patterns, segmentation will be performed. The Mathematical Morphology was very well adapted. A specific Gaussian-like profile whose curvature varies smoothly along the vessel is segmented**.** the Variable and feature selection[10] This has become the focus of much research in areas of application. The datasets with tens or hundreds of thousands of variables are available in the relevant areas. The selecting of the appropriate features on the input space of thousand variables is the challenging task. By designing a linear predictor (eg: svm) it selects the variable.

.III. PROPOSED METHOD

A. Architecture

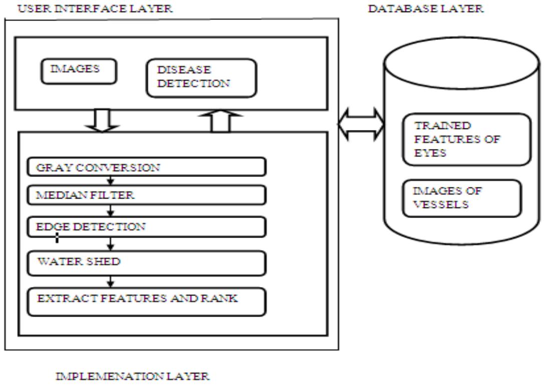


Fig.1 Proposed architecture diagram

As per fig 1 the images are selected and trained by using the grayscale, median filter, edge detection, watershed process. When a new input image is executed the above processes are done and by comparing the new image and input image the features are extracted and ranked as per the values.

IV. STEPS FOR VESSEL DETECTION

Following steps are involved in vessel detection:

A. Image Selection

The image is selected and converted into gray scale, where image is converted into black and white shade and median filter process is applied to remove noise. The filtered image will be the outcome of the first module

B. Detect the vessel)

The detection of vessel is the detected by using the edge detection and watershed process. The edge detection process segments the image and detects each and every part of the segment in the image, the sharp edges are detected. Watershed transform is a morphological region-based segmentation operation. It divides an image into regions based on a topographic map of the image grey level. The dividing lines between hypothetical topographical catchments areas are known as the watershed lines.

C. Segmentation and extraction

The segmentation and extraction process are the used to extract the features of the processed image. In this process the vessel image undergoes all the previous processes such as gray scale, median filter, edge detection, watershed process. By applying the process the features are segmented and extracted

D. Feature selection and training

The features are selected and trained in this session, where the input image is processed and by applying the K-fold cross validation, the original sample is randomly partitioned into *k* subsamples. Of the *k* subsamples, a single subsample is retained as the validation data for testing the model, and the remaining $k-1$ subsamples are used as training data. The cross-validation process is then repeated *k* times (the *folds*), with each of the *k* subsamples used exactly once as the validation data. The Wilcox rank test is used to rank the features and show the severity of the disease

E. Disease detection)

Finally the disease detection, where the vessel image which undergoes k fold validation extracts the features of the input image. This processed input image shows the severity of the disease by ranking the features. Other pathologies are also indicated clearly with their values

V. EXPERIMENTAL RESULTS

All algorithms in this section were implemented in jsp. For back end SQL server was used. A collection of 12 images are collected and the algorithm were used in it. Examination of the algorithm performances was done. The screen shots are

STEP 1: TO TRAIN THE IMAGE SELECT IMAGE PREPROCESSING

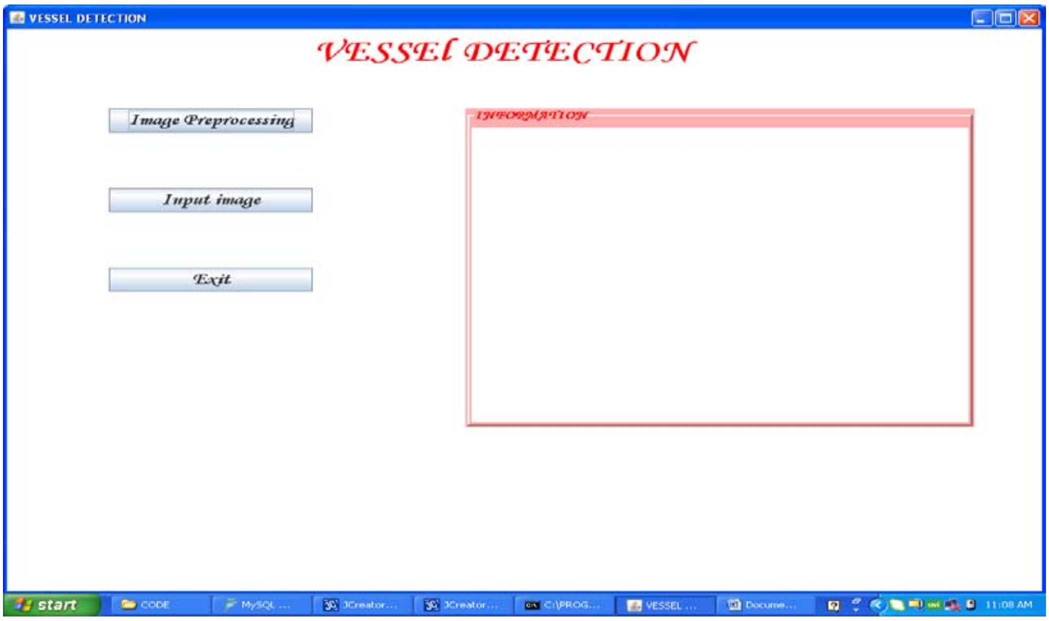


Fig 2 User Interface

STEP 2: BROWSE THE INPUT IMAGE

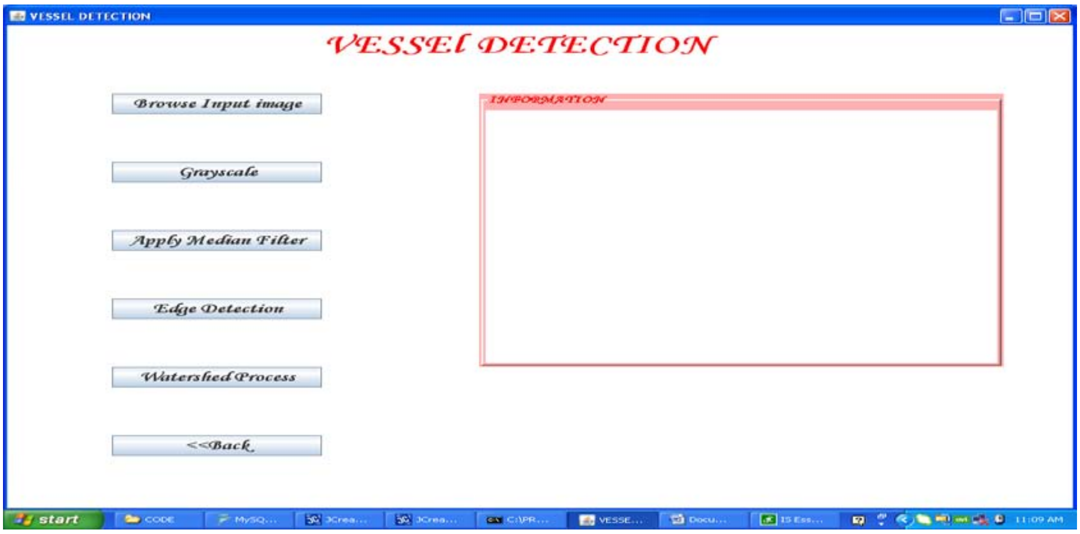


Fig 3 Image Preprocessing

STEP 3: SELECT THE IMAGE

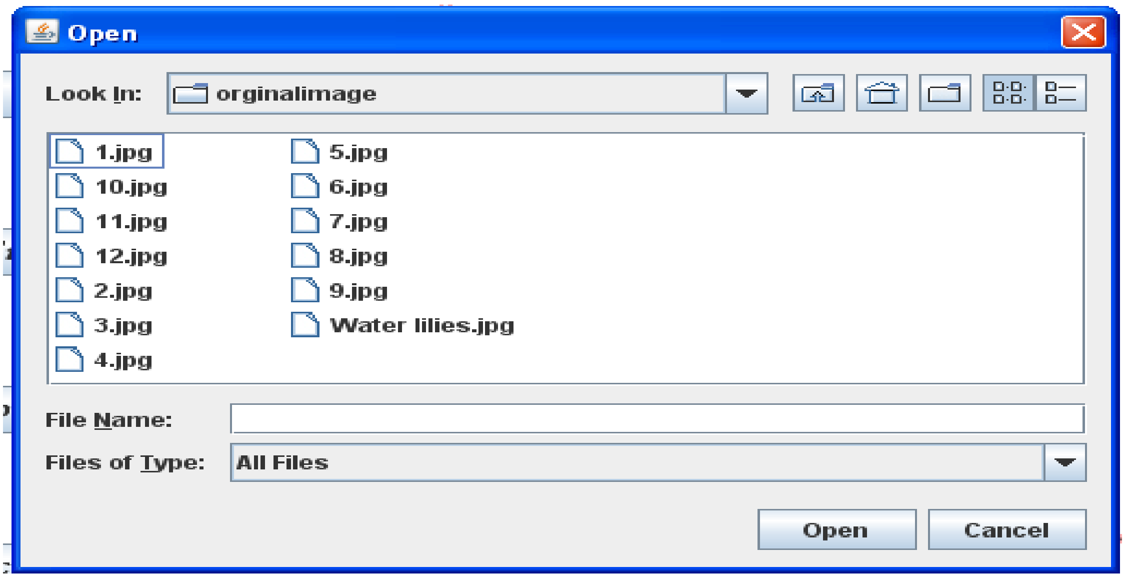


Fig 4 Image Selection

STEP 4: THE SELECTED IMAGE

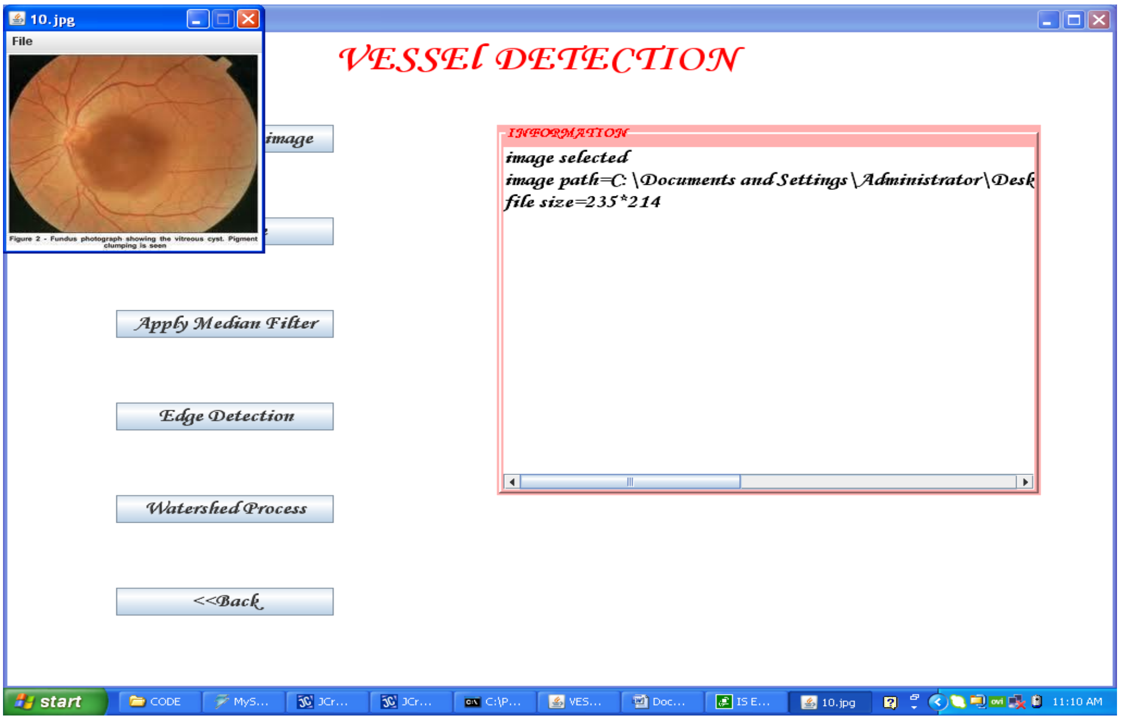


Fig 5 Training Session

STEP 5: APPLY GRAYSCALE CONVERSION

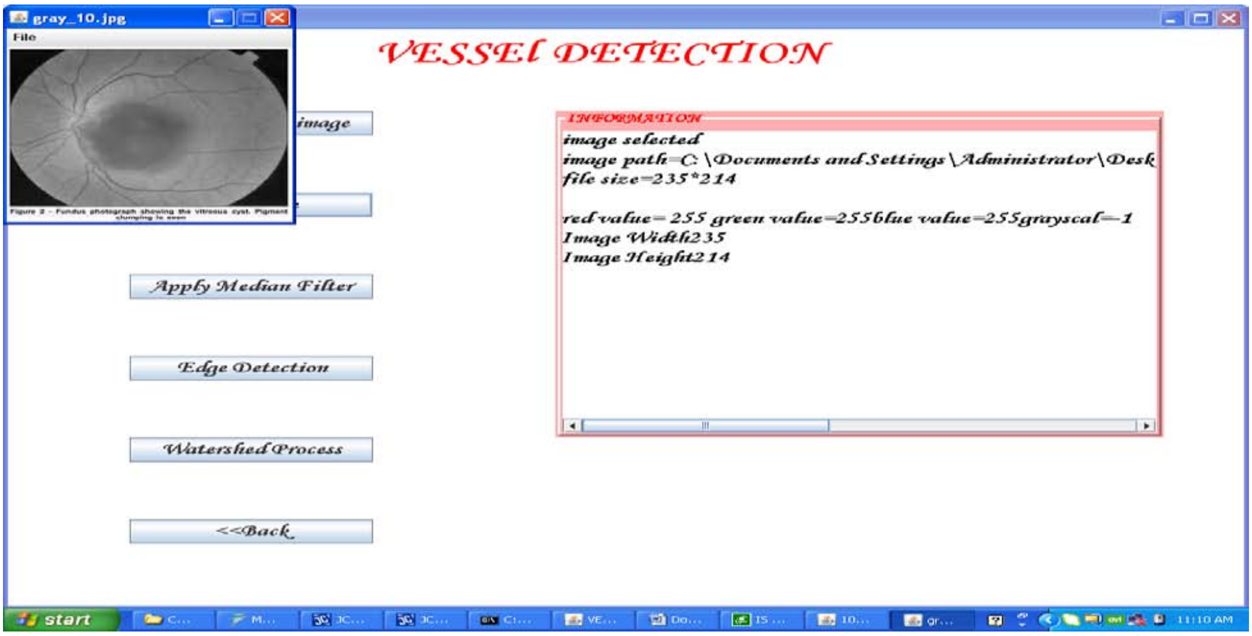


Fig 6 Gray Scale

STEP 6: APPLY MEDIAN FILTER

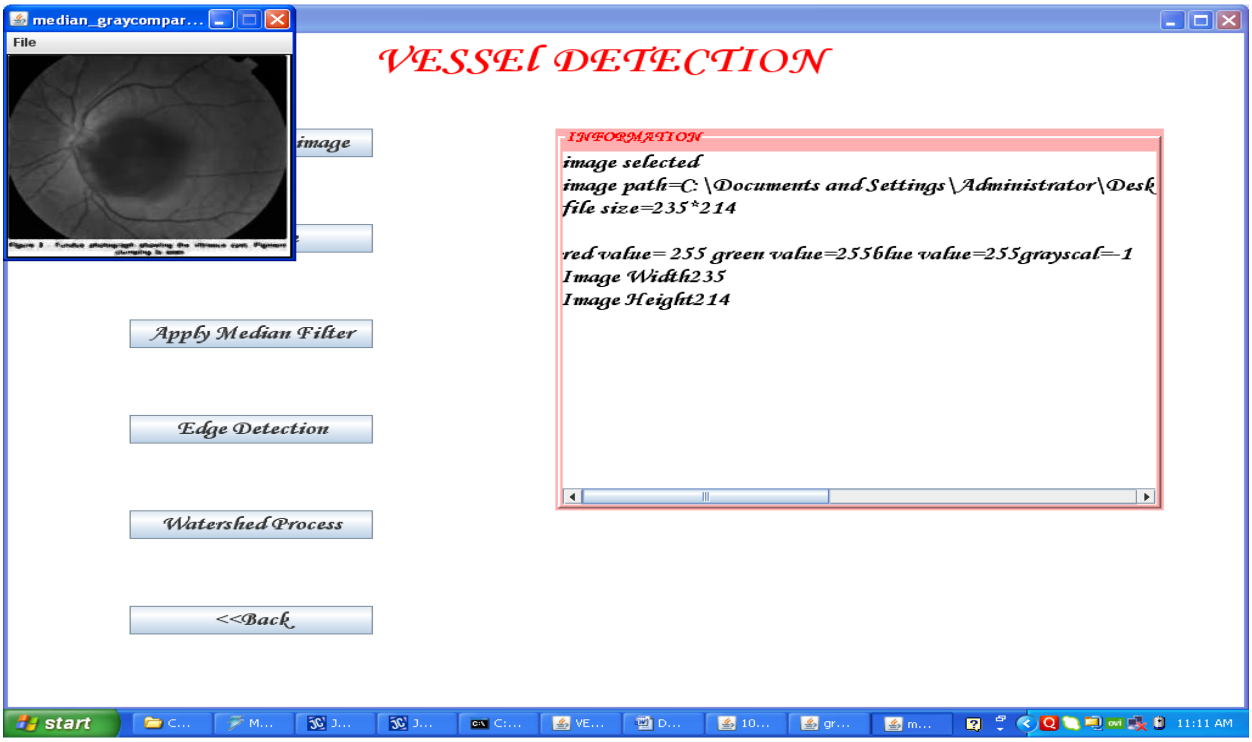


Fig 7 Median Filter

STEP 7: APPLY EDGE DETECTION

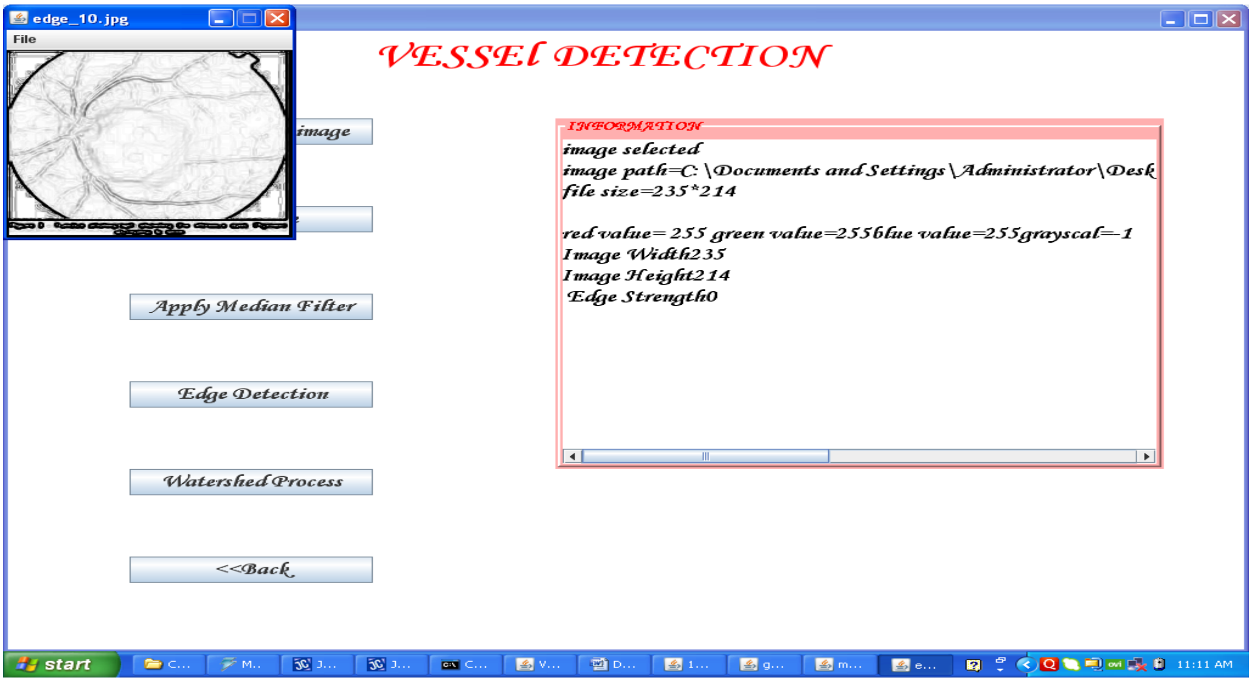


Fig 8 Edge Detection

STEP 8: APPLY WATERSHED PROCESS

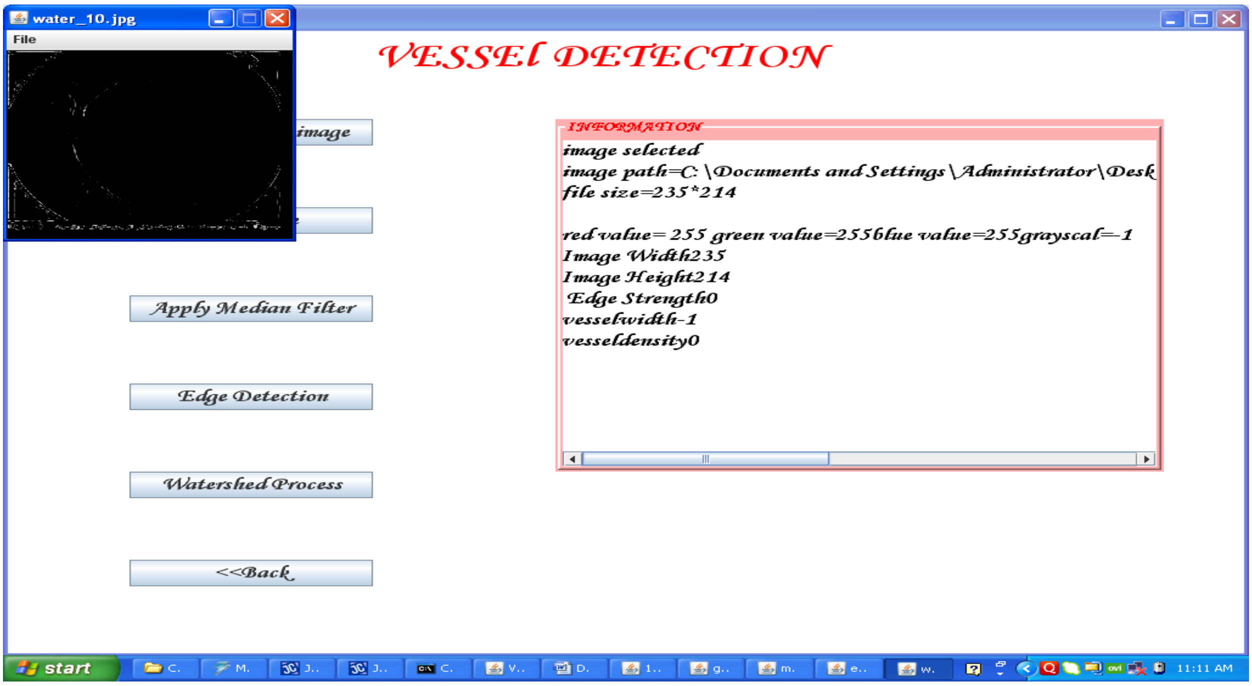


Fig 9 Watershed

STEP 9: BROWSE A NEW INPUT IMAGE

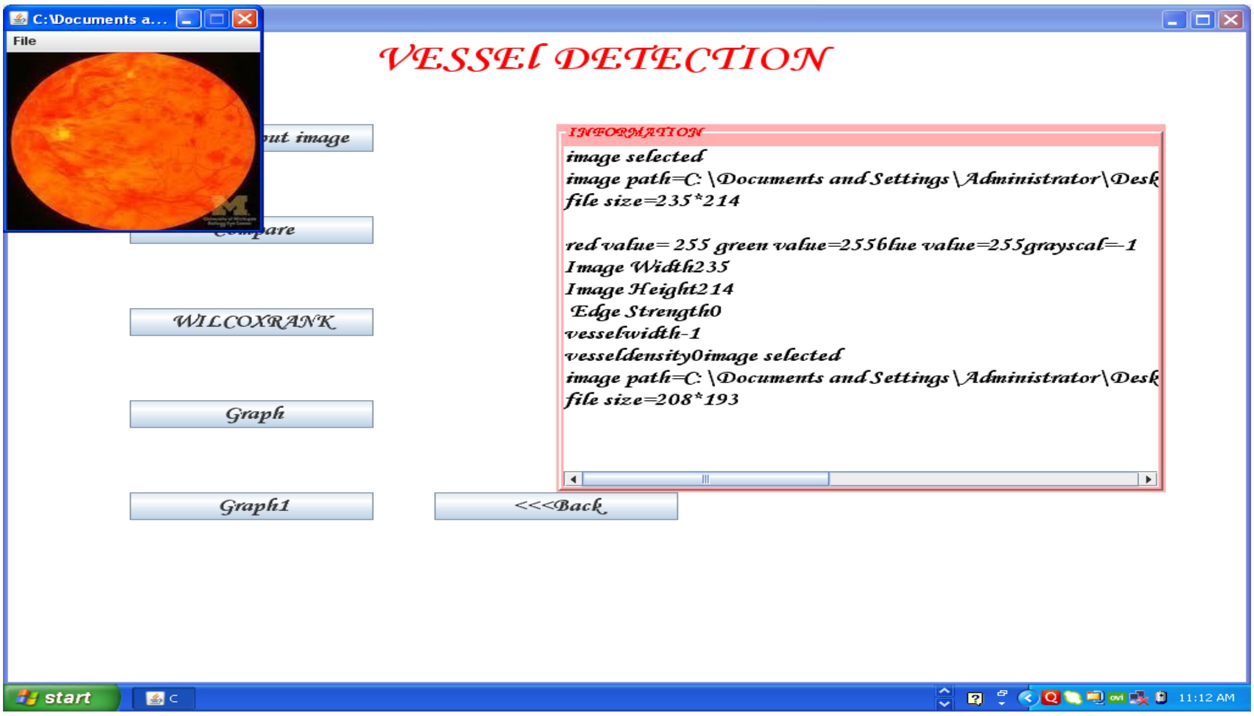


Fig 10 Input Image

STEP 10: APPLYING THE GRAYSCALE, MEDIAN FILTER, EDGE DETECTION, WATERSHED PROCESS.

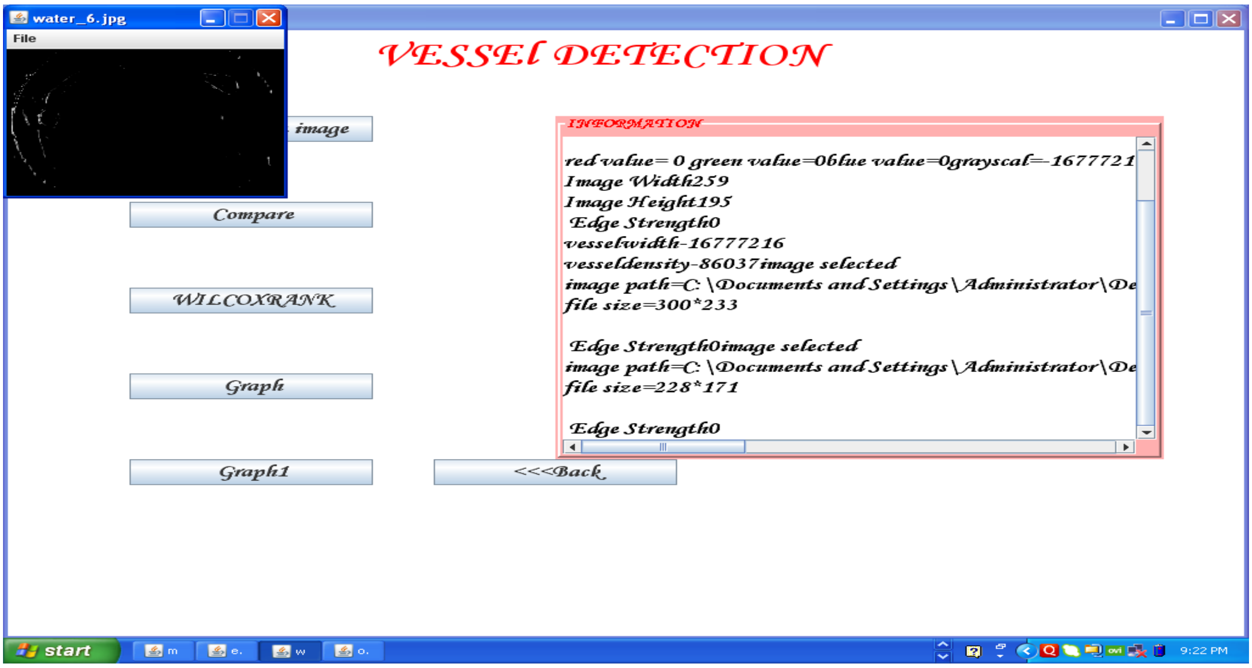
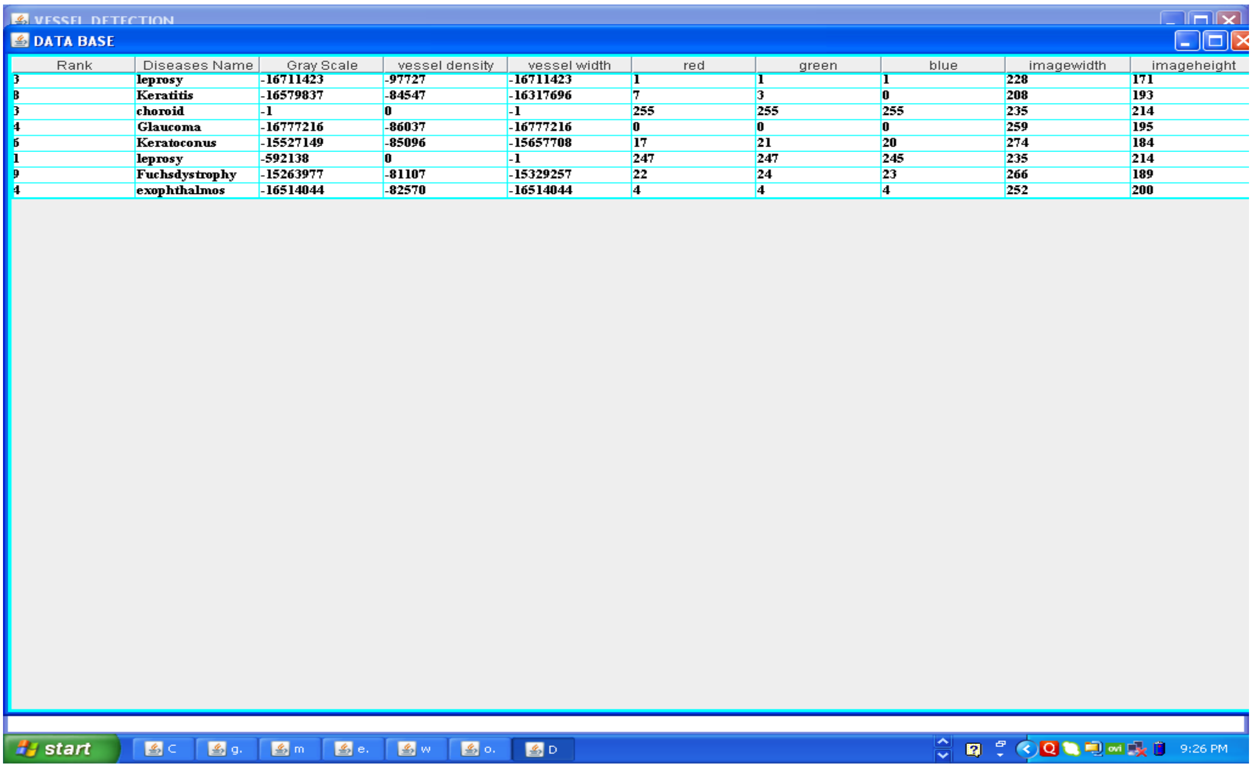


Fig 11 Comparing The Features

STEP 11: WILCOX RANK



DATA BASE

Rank	Diseases Name	Gray Scale	vessel density	vessel width	red	green	blue	imagewidth	imageheight
3	leprosy	-16711423	-97727	-16711423	1	1	1	228	171
8	Keratitis	-16579837	-84547	-16317696	7	3	0	208	193
3	choroid	-1	0	-1	255	255	255	235	214
4	Glaucoma	-16777216	-86037	-16777216	0	0	0	259	195
6	Keratoconus	-15527149	-85096	-15657708	17	21	20	274	184
1	leprosy	-592138	0	-1	247	247	245	235	214
9	Fuchsdystrophy	-15263977	-81107	-15329257	22	24	23	266	189
4	exophthalmos	-16514044	-82570	-16514044	4	4	4	252	200

Fig 12 Wilcox Rank

VI. PERFORMANCE EVALUVATION

The performance evaluation in the project is done for the purpose of existing vs proposed and features and vessel detected .

A. Neural Network vs. SVM

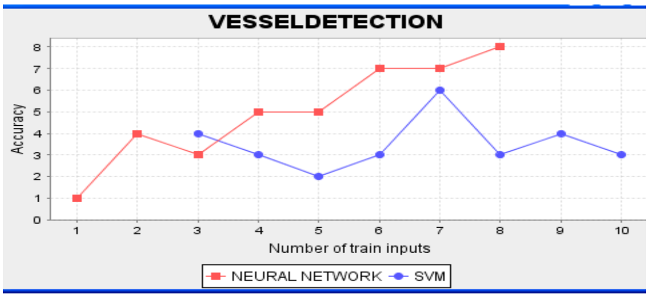


Fig 13 Cost analysis

B. **vessel detection**

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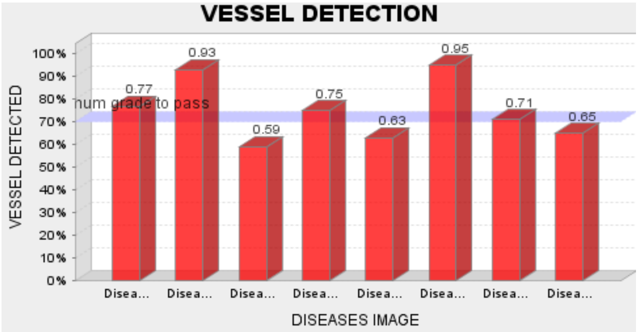

Fig.14 Execution Time

VII. CONCLUSION

The proposed work have been implemented a neural network to detect disease and find the severity of the patient. The training and new processed image, there details about the feature extraction all are saved in database for future work. The images of different environment are tested and check whether the vessel is detected automatically. The work that has been implemented are neural network where the vessels are detected automatically. The neural network is interconnected with neurons and produces the result efficiently. The snake edge detection is used to detect sharp edges and can be initialized across boundaries. A watershed is a basin-like landform defined by highpoints and ridgelines that descend into lower elevations and stream valleys. All these techniques enhances the project and produces a good vessel detection system

VIII. ACKNOWLEDGEMENT

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