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CLASSIFICATION OF OVARIAN CYSTS USING ARTIFICIAL NEURAL NETWORK

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Abstract - *Ovarian cyst is one among the common problem in women. The aim of this research is to classify Ovarian cysts using ANN (Artificial Neural Networking).The ovarian cysts are generally classified into Follicular cyst, Corpus luteum cyst, Hemorrhagic cyst, Dermoid cyst, endometriosis cysts, Polycystic-appearing ovary, but the proposed work here focuses on the Classification of Follicular and Dermoid cysts which is common and fertitility affecting cysts in women. For achieving these aim, database images of ovarian cysts has been collected from Hospitals, Doctors and Internet. Initial pre-processing involves noise removal of the image, resizing followed by lab color space conversion by taking luminenance component, feature extracting and finally classifying using ANN classifier.*

Key Words*: *Ovary, Cyst, Artificial Neural Network, weights, synopses, Back Propagation Algorithm

1.INTRODUCTION

Medical Imaging is a boon given by science and technology to Homo sapiens. While on the one hand medical diagnostics has advanced jump, on the other hand elevation in image processing, pattern recognition and machine intelligence techniques has boosted the medical imaging field. With this improvement it is now possible to make diagnostics much easier. An easy and correct diagnosis forwards deserved treatment and thereby adds chances of full recovery, while lessening the ache and discomfort of patients[2]. Modern approaches are cost effective. Some of the successful applications of the image processing techniques are in the area of medical imaging. This study has been taken up to classify the ovarian cysts which is familiar in women nowadays.

An abnormal enlargement or fluid-filled sac within the ovary is termed as an Ovarian Cysts. Usually they do not create any symptoms. But they may cause fertility problems, abdominal pain, bleeding, vomiting, weight gain and other physiological disorders. Not all types, majority of cysts are harmless. Ovarian cysts problems in woman are interconnected with their ovulation period. The ovarian cysts are classified into Follicular cyst, Corpus luteum cyst, Hemorrhagic cyst, Dermoid cyst, Polycystic-appearing ovary but the proposed work here focuses on the classification of Follicular cysts and Dermoid cysts. Polycystic ovary is very common in youngsters and other cysts are considered to occur in woman around 40-60 age. It is not mandatory but rarely cysts may have a chance of developing ovarian cancer. Proper treatment for the cyst problems begins by pelvic examinations.

1.1 RELATED WORKS

Devesh D. Nawgaje [1] proposed Genetic Algorithm for Ovarian Cancer segmentation. Imaging plays an important role in the diagnosis and treatment of ovarian cancer. An accurate segmentation is critical, especially when the ovarian tumor morphological changes remain subtle, irregular and difficult to assess by clinical examination. Traditionally, segmentation is performed manually in clinical environment that is operator dependent and very tedious and time consuming labor intensive work. In this paper genetic algorithm for selecting the optimal threshold in image segmentation is proposed. The complete algorithm is implemented using Digital Signal Processor TMS320C6713 which decreases the run time greatly.

Malini Suvarna, B.S Sivakumar, U.C.Niranjan. [2] "Classification Method of Skin Burn Images", International Journal of Computer Science and Information Technology vol. (5), No. 1, pp 109-118, Feb. 2013.Research is to develop

an automated method of determining the severity of skin burn wounds and to classify of skin burn images using different classifiers.

Marcus Stoetzer, [3] presented Advances in assessing the volume of odontogenic cysts and tumors in the mandible: a retrospective clinical trial', Head & Face Medicine 2013, 9:14.To compare two methods of creating three-dimensional representations of mandibular cysts and tumors on the basis of computed tomography (CT) and cone beam computed tomography (CBCT) data. A total of 71 patients with acquired jaw cysts took part in this retrospective clinical study. CT and CBCT scans were obtained from all patients and saved in the Digital Imaging and Communications in Medicine (DICOM) format. Data were analyzed twice with iPlan software. Analysis was performed manually and using an interpolarization algorithm.

Endometriosis [4] "A Guide for Patients American society Reproductive medicine". Published by the American Society for Reproductive Medicine under the direction of the Patient Education Committee and the Publications Committee. This booklet is in no way intended to replace, dictate or fully define evaluation and treatment by a qualified physician. It is intended solely as an aid for patients seeking general information on issues in reproductive medicine.

Jyothi R Tegnoor [5] "Automated Ovarian Classification in Digital Ultrasound Images using SVM" paper points light for classification of Ovarian digital ultrasound images using SVM classifier.

1.2 METHODOLOGY

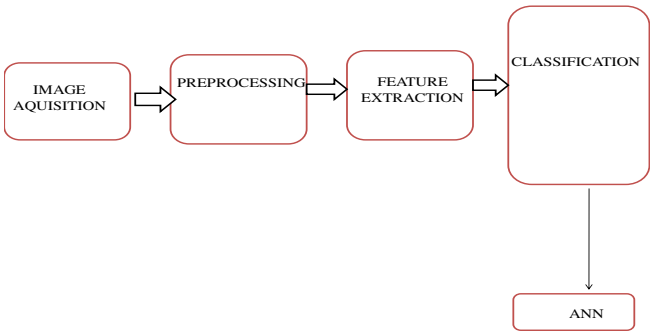


Fig 1. Overview of the Research

When a women meets with a cysts problem Usually Doctors examines the scanned report of an ovarian cyst patient and distinguishes between cancerous and non-cancerous cells, but the proposed work here focuses on automating this process. A digital camera is used to capture the cyst images of the patient and the software developed would analyse the image.

Initial pre-processing involves noise removal of the image followed by the contrast enhancement in lab colour space by taking luminenance component classification using ANN classifier by taking the two chrominance values in lab representation. Figure.1 shows the over view of the methodology employed in the research.

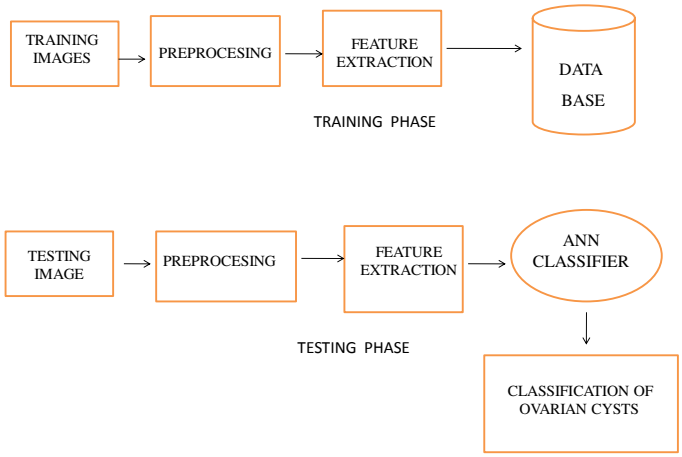


Fig.2. Represents the Training and Testing Phase Of ANN Classifier

The proposed system will also serves as a good teaching and research tool for students of health care. The system would also serve as an aid in the follow up of gynecological treatments. The proposed system is built and optimized to use very little computational resources, power and faster algorithms

The proposed work has two sessions they are Training Phase and Testing Phase. In Training Phase certain set of ovarian cysts images are given and trained .Then pre-processing process occurs proceeded by Feature Extraction and will be saved and stored in Feature data base. In Testing Phase certain set of ovarian cysts images are given and tested to find out the type of Ovarian Cyst classified as shown in Fig 2.

1.Image Acquisition: Collection of photographic images from the hospital. First step is to acquire scanned images of ovarian cancer patients.

2.Pre-processing: Pre-processing involves 3 steps:

Resizing: The images acquired from various data bases would not be of uniform size and format, depending on the device used for capturing the image. Therefore these images were compressed into a uniform size of 90×90 pixels with the help of bilinear interpolation using Matlab image processing toolbox.

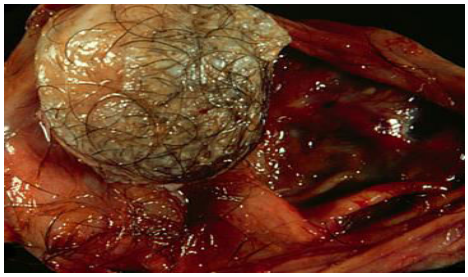


Fig 3 .Shows Original image(167×224)

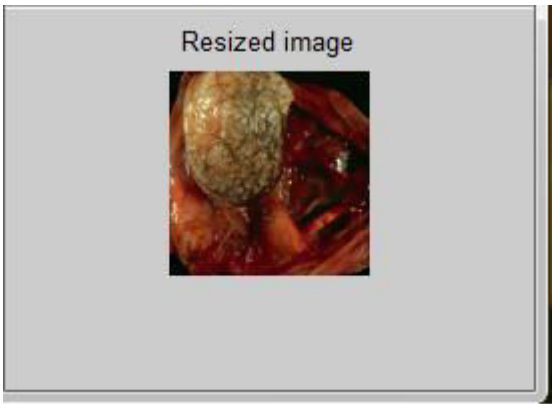


Fig 4. Resized Image(90×90)

RGB space to L*a*b: The main reason for converting an image from RGB to L*a*b space is that an object can appear in varying colors depending on the intensity and color illuminating it. Therefore classifying the images based on their appearance may leads to miss- classification.

Fig 5. Shows the result of an image being converted from RGB to L*a*b color space.

Contrast enhancement: Contrast enhancement is the sharpening or focussing the image feature such as edges or boundaries, contrast to make a graphic display useful for analysis. Contrast Enhancement of the image is to be done for the proper classification of cysts images of different types.

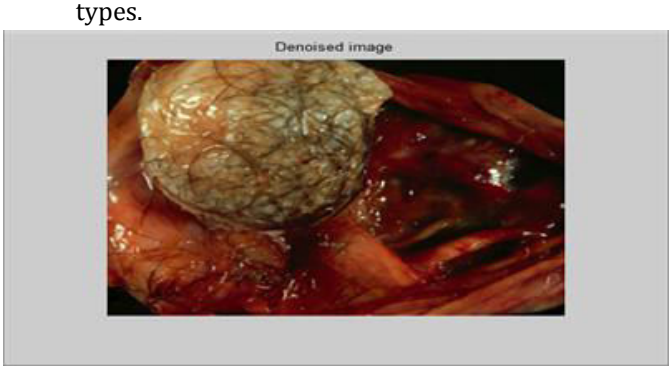


Fig 6. Contrast enhancement

3.Feature Extraction: In this work we are going to extract the features such as Mean, Skewness, Kurtosis, and Standard deviation.

4. Classification of ovarian cancer stages: Classifier algorithms implemented in this research work is ANN network.

MATRIX LABORATORY (MATLAB) is a program where one can utilize a high-level programming language to perform numerical computation. One can perform image enhancement, image deblurring, feature detection, noise reduction, image segmentation, geometric transformations, and image registration. In this research work the image enhancement, feature detection and image resizing tools of MATLAB 13 are used[2]

2. CLASSIFICATION USING ANN

The human brain is a large neural network consisting of processing elements which respond to external stimuli and process information dynamically[2]. An Artificial Neural Network (ANN) is a mathematical model based on the functioning of the brain or the biological networks. The artificial neurons are interconnected and respond to stimulus as per prior training. Neural Networks are large networks of simple processing elements or nodes which process information dynamically in response to external inputs. During the learning phase, in most cases, a neural network is an adaptive system that changes structure. Neural networks are used to model the relations between inputs and outputs or to find patterns in data.

The interconnections between the neurons in the different layers of the system are referred by the word network in the term 'artificial neural network'. The interconnections are known as synopses. The input neurons of the first layer send data via synapses to all the neurons till the last layer of output neurons. The synapses store parameters called "weights" that operate on data in calculations.

An ANN is typically defined by 3 parameters[2]

1. The inter connection pattern between different layers of neurons
2. The learning process for updating the weights of inter connections
3. The activation function that converts neurons weighted input to output activation

ANN's ability to be used as an arbitrary function approximation mechanism that 'learns' from observed data is probably the greatest advantage of ANN.

ANN Training Using Back Propagation

The back propagation algorithm is a generalization of the least mean square algorithm that modifies network weights to minimize mean square error between the desired and actual output of the network. Back propagation is a specific technique for implementing gradient descent in weight space in multi layer feed forward network**.** The back propagation process consists of the following steps.

1. Initialize weights in the network
2. Apply an input (stimulus) vector to the network.
3. Feed forward or propagate the input vector to determine all output units.
4. Compare unit response in the output layer with the target response.
5. Compute and propagate the error sensitivity measure backward through the network
6. Minimize the overall error at each stage through unit weight adjustments.

The inputs to the ANN are the five quantitative features which are Mean of A and B, Skewness, Kurtosis and Standard deviation. The outputs of the ANN are the two neurons due to the two type of cyst classifications which we are used in this research work. The output neuron which has the highest value is said to be the type of the cyst classification ie if the output is 1 it refers to Dermoid and if it is 2 it refers to Follicular Cysts. The advantages of back propagation algorithm are, it is simple and its speed is also reasonable.

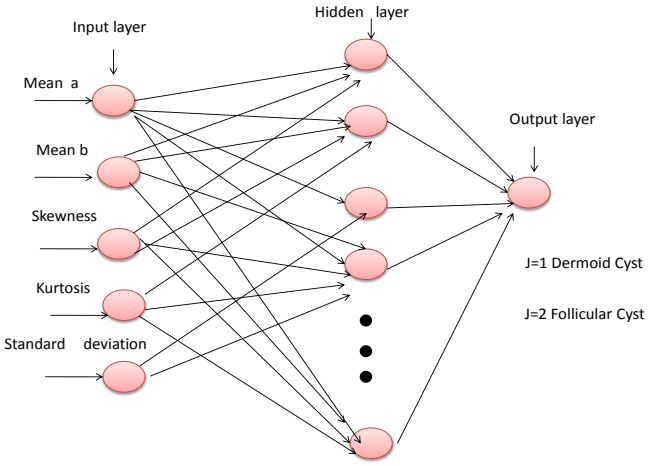


Fig 7.Architecture Of Artificial Neural Networking for Dermoid & Follicular Cysts Classification.

In a feed forward Neural Network, the learning algorithm has two stages. Initially, a training input feature is presented to the input layer of the network [2]. The network propagates the input feature from layer to layer until the output class is produced at the output layer. If this class is dissimilar from the pre-labeled class of the input feature, an error is obtained. Back propagation learning involves propagation of the error, backwards from the output layer to the input layer in order to update the weights in the input and hidden layers. The equation 1is for the weights updating in the network.

$$w_{ij}^{k+1} = w_{ij}^{k} + \beta \frac{\partial E}{\partial W_{ij}} \qquad \text{----------1}$$

Where E **= [N(y) –G(y)]** for the output layer of ANN

Where K is the iteration number, β is the learning rate, N(y) are ANN outputs and G(y) is the output due to training input data.

In this research few ANNs were tried for the classification of the cyst images. The ANNs differed in terms of the number of hidden layers and number of neurons in hidden layers. The number of hidden layers varied from one to three and number of neurons varied from three to fifty. The back propagation neural network which gave best classification results has one hidden layers, one output layer and one input layer[2].

The network parameters chosen are

- Learning Rate β = 0.005
- Number of Hidden Layers = 1
- Number of Neurons in the 1st Hidden Layer =50
- Number of Input Neurons = 5(corresponding to features Mean of A and B, skewness, kurtosis and standard deviation
- Number of Output Neurons = 2 (corresponding to 2 types of cyst classification)

The log sigmoid function is used in all the neurons. The equation for the output of the ANN is given in equation 2

$$N(y) = \sum_j \sum_i \sum_x f_s(x) w_{xi} w_{ij} w_{jo} \qquad \text{--------2}$$

x=1, 2,3,4,5 (Features) (inputs)
y=1, 2 (types) (outputs)

W_{xi}, W_{ij}, W_{jo}= ANN weights f_x (x) are the input features

3. RESULTS

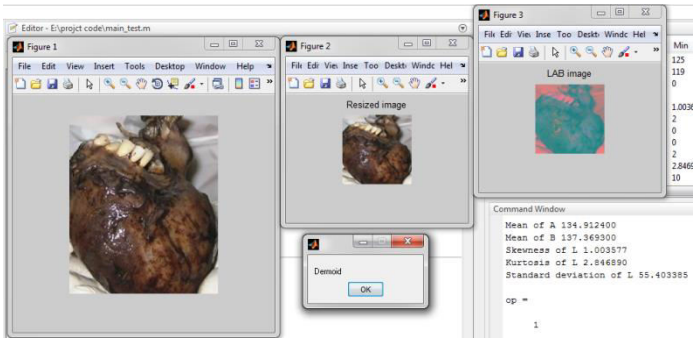


Fig 8. Classification of Dermoid Cyst if Output is 1

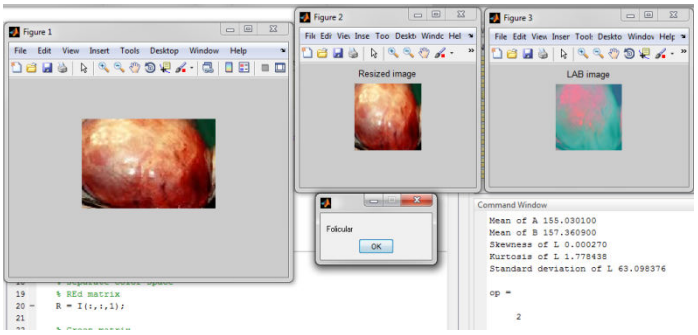
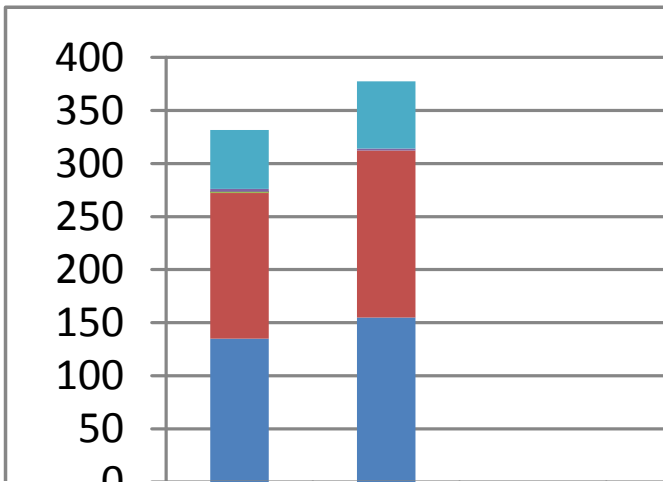


Fig 9. Classification of Follicular Cyst if Output is 2

The efficiency of Dermoid Cyst in this research work is 80% and Follicular Cyst is 70%.Therefore we can conclude that classification of Dermoid cyst is more efficient than Follicular Cysts using ANN classifier.



Graph -1: Graph based on Features extracted

The above graph shows the effectiveness of the each features extracted. Mean of the cysts is having a noticeable classifying feature than others.

4. CONCLUSIONS

The proposed research attempts to find an automated solution for classifying cyst images as Dermoid and Follicular. The design and development of such a classifier is clinically very significant particularly, when it is used in remote areas and under emergencies. The research work reported here began with collection of images from a hospital, acquired through highly resolute digital camera. Ethical clearance was taken during the data acquisition both from the hospital and the patient. A data base of 20 images was built which contained both types of cysts images. ANN is

inspired by the biological information processing of human brain. The computational model of the ANN contains neurons which are nonlinear computational elements. The parameters of ANN are learnt during the training phase from the training data. Training phase is iterative and ANN parameter design is based on back propagation algorithm (BPA).

The experimented cyst image classification with many configurations of ANN differed in number of neurons and hidden layers. The computational cost of the training phase is proportional to the number of neurons in the ANN. The testing phase also involves significant computation as the input data has to pass through all the interconnections and neurons multiplying with weights on their way to give the classifier output. ANN is the most computationally intensive method. However, with its massive interconnection of weights and nonlinear neural model, it gives the best classifier performance. The classification results of ANN are 80% for dermoid cyst images and 70% for Follicular images for the network containing one hidden layers having 50 neurons hidden layer.ANN method gave the best result in terms of features and efficiency. Non-linearity associated with the neurons.Computation ANN training is higher, as the iterations continue until the specified minimum error is reached.

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REFERENCES

[1] Devesh D. Nawgaje and Rajendra D. Kanphade "Hardware Implementation of Genetic Algorithm for Ovarian Cancer Image Segmentation", International Journal of Soft Computingand Engineering (IJSCE) January 2013 ISSN: 2231-2307, Volume-2, Issue-6,

[2] Malini Suvarna, B.S Sivakumar, U.C.Niranjan. "Classification Method of Skin Burn Images", International Journal of Computer Science and Information Technology vol. (5), No. 1, pp 109-118, Feb. 2013.

[3] Marcus Stoetzer and Franziska Nickel "Advances in assessing the volume of odontogenic cysts and tumors in the mandible: a retrospective clinical trial", Head & Face Medicine 2013, 9:14

[4] R. Nicole Endometriosis : "A Guide for Patients American society Reproductive medicine".

[5] Jyothi R Tegnoor "Automated Ovarian Classification in Digital Ultrasound Images using SVM"