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NEURAL NETWORKS BASED KIDNEY IMAGE CLASSIFICATION

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ABSTRACT: Ultrasonography is considered to be safest technique in medical imaging and hence is used extensively. Due to the presence of speckle noise and other constraints, establishing the general segmentation scheme for different classes of kidney in ultrasound image is a challenging task. This research aims at classification of medical ultrasound images of kidney as normal and abnormal kidney images In this work, the wiener filter is used to reduce the noise present in the image The gray-level co-occurrence matrix (GLCM) is used for examining the texture. It is used to find texture properties of an image by calculating the frequency of occurrence of pixel pairs with specific values and in a specified spatial relationship.
KEYWORDS: Speckle Noise, Pixel, Texture, Ultrasound

I. INTRODUCTION

The ultrasound (US) imaging uses the faster and more accurate procedures in medical diagnosis. It has several virtues like noninvasive, non-radioactive and inexpensive. US has wide spread applications as a primary diagnostic aid of soft tissue organs and carotid artery . In recent years, the potential use of computer-aided diagnosis in the field of medical image processing in general and kidney images in particular has been the interesting area for rigorous research. But, the quality of the US image depends on combination of many factors originating from the imaging system and the knowledge level or experience of the operator. The US image may contain speckle noise due to loss of proper contact or air gap between transducer and body part. The speckle noise can also be formed during beam forming process or signal processing. Using this texture model, the texture similarities of areas around the segmenting curve are measured, in the inside and outside regions, respectively.

The database consist of 25 US kidney images. It is very necessary to remove the speckle noise from the US kidney image without loss of pixel information from the original image. The wiener filter is used to reduce the noise present in the image. Wiener filter inverts the blurring and removes the additive noise simultaneously by performing an optimal trade off between inverse filtering and noise smoothing. Wiener filtering is also a linear estimation of the original image.

$$W(f_1,f_2) = \frac{H^*(f_1,f_2)\, S_{xx}(f_1,f_2)}{|H(f_1,f_2)|^2\, S_{xx}(f_1,f_2)+S_{\eta\eta}(f_1,f_2)}$$

Where S_{xx} (f_1, f2), $S_{\eta\eta}$ (f_1, f2) are respectively power spectra of the original image and the additive noise, and H (f_1, f2) is the blurring filter. The GLCM functions are used for finding texture properties of an image by calculating the frequency of occurrence of pixel pairs with specific values and in a specified spatial relationship.

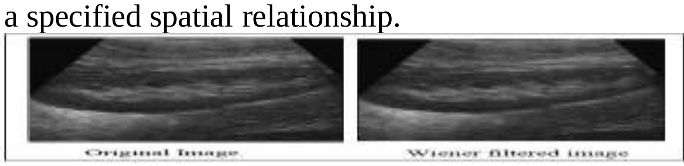

Figure 1: Filtered Image

The feature extraction algorithm for the US kidney image is given below.

1. Input the US kidney image.
2. Obtain the Region of Interest(ROI) of kidney
3. Apply log transform to cropped image.
4. Perform despeckling of log transformed image
5. Perform histogram equalization on despeckled image (P).
6. Find the run length features namely, Mean, Variance, Range, Energy, Homogeneity, Maximum Probability, Inverse Difference Moment (IDM).
7. Store the values obtained to in 5 as a feature vector.
8. Find gray-level co-occurrence matrices in four directions (0°, 45°,90°,135°)
9. For each matrix calculate contrast, correlation, energy and homogeneity separately
10. Store the combined feature vector by using the feature sets in 5 and 8

Back Propagation networks are fully connected, layered, feed forward networks, in which activations flow from the input layer through the hidden layer(s) and then to the output layer. The US kidney classification algorithm is given below.

Input: *1. US Kidney Image Data set (D) 2. Learning Rate (l) 3. Network and a multilayer FFN*
Output: *A trained neural network*

Initialize all weights and biases in network
While terminating condition is not satisfied {
For each training tuple **X** in D { Propagate the inputs forward
For each input layer unit j { O j = I j
For each hidden or output layer unit j { $I_j = \sum_i W_{ij} O_i + \theta_j$ $O_j = \frac{1}{1+e^{-1}j}$
Back propagate the errors; For each unit j in the output layer
$Err_j = O_j - O_j T_j - O_j$
For each unit j in the hidden layers, from the last to the first hidden layer
$Err_j = - \sum_k Err_j O_j O_j Err\ w_{jkk}$
For each weight w_{ij} in network { $\Delta w_{ij}=(l)Err_jO_i$; $w_{ij} = w_{ij} + \Delta w_{ij}$
For each bias θ j in network { $\Delta\theta_j = (I)\ Err_j$; $\theta j = \theta_j + \Delta\theta_j$
} }

III. RESULT AND DISCUSSION

We have tested the proposed work with the US kidney images . The research work is implemented on Intel core i3 processor using Dotnet2012.The performance analysis exploits statistical measures, to compute the accuracy of the kidney classification. We got a better accuracy of 96%.

IV. CONCLUSION

An efficient ultrasound kidney image classification system using BPN classifiers is presented. Texture features are extracted and put in a training database. An efficient method gray-level co-occurrence matrix (GLCM) is applied for analyzing the texture. We achieved a better accuracy of 96%. The results are encouraging and promising.

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