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Analysis of Image Featuers for Efficient Classification of Thyroid Diseases

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Abstract: In current scenario thyroid disorders has become common among the general public/ population. The thyroid gland is positioned in the anterior part of the neck region between the vertebrae T1 and C5 and the lobes of this gland are held together by Isthmus. Computer based system a technique is used for intelligent categorization of these diseases and it is very useful in diseases and diagnostics management. The purpose of the study was to classify the various thyroid types by quantifying the histological image features of Ultrasound images. Six image features were characterized in thyroid tissues, which includes, entropy, mean, brightness, hue, energy and standard deviation oh brightness. To analysis the features statistical stepwise selection and multiple discriminate analyses were used. A new approach which classifies these thyroid diseases is done on the basis of segmentation method. To sort these kinds of diseases some of the techniques used are image enhancement processing to avoid noise and gray level compensation for segmentation.

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I. Introduction

Due to the risk of Malignancy and hyper function these diseases are common nowadays. The testing is based on a non-invasive method which provides more meaningful and fast Information based on the characteristics and structure of thyroid diseases. The merits of this system are, Minimum capturing time period, Non ionizing un harmful radiation, More accurate. Sonogram images contain speckle noise, echo artifacts makes the task of diagnosing very difficult. Interpretation of image is usually performed by the skilled person using subjective knowledge. The Most suitable technique is used to segregate these diseases, contribute to the innovative ideas diagnostically thereby reducing false detection. Image segmentation using active contour method relies on initial contour deformation of boundaries in an image such a technique is based on basic filtering

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and edge locating operators. Ultrasound images contain non relevant edges due to the presence of noise. Such noise should be removed using an appropriate filter namely Gaussian filter.

The filtering techniques introduce non linearity's in the image due to smoothing of boundaries under considerations

II. THEORETICAL BACKGROUND

A. SEGMENTATION AND CLASSIFICATION OF THYROID DISEASES

Sonogram images are affected by low visual quality. Methods are required to increase the visual qualities of ultrasound images in order to locate the region of interest. The enhancement technique is done to reduce speckles. Median filter with adaptation is used for filtering. Suspected portion of thyroid present subcutaneously and the region is placed in the middle between the bright and dark region of the image.

Adaptive median filter Removes the speckle noise and enhance the portion of interest in the sonogram images. This type of filtering is performed using a convolution mask with variable weight adjustment to give well defined image. This is further improved by dilation and erosion morphological operators.

B) Gray-level Fixation

Segmentation results will be affected if the variance is too large. The intensity of the suspected thyroid region is identified by the fixation technique.

III. STATISTICAL PIXEL-LEVEL FEATURE

The nature of the image is identified from the shape of the histogram, plot of pixel intensity values versus the number of pixels at that value.

Sonogram image characteristics are analyzed based on the six pixel-level. The statistical pixel-level features include, *Standard Deviation of Brightness* (SDB), *mean of Brightness*, *Entropy*, *mean of Hue, and Energy* of the selected image areas

Quantitative information is obtained based on the pixels with in a segmented region.

The statistical stepwise selection was enforced to exclude insignificant features. The features are classified based on the multiple discriminate analyses. The first- order probability of the histogram $P(g)$, is defined as

$$P(g) = \frac{N(g)}{M} \text{ --------------- (1)}$$

$N(g)$-Gray level numerical value of the pixel

M - Total number of pixels in the image

$P(g)$ -Probability distribution

The mean, hue, standard deviation, energy and entropy features are obtained based on histogram probability.

The mean or average value, describes the brightness of the image. Low mean value indicates darkness of the image and High mean value indicates brightness of the image. L denotes intensity levels ranges from 0 to L- 1.

$$\bar{g} = \sum_{g=0}^{L-1} gP(g) = \sum_r \sum_c \frac{I(r,c)}{M} \text{ ------------(2)}$$

Standard deviation represents the Variation of contrast in the image. It is given as

$$\sigma_g = \sqrt{\sum_{g=0}^{L-1} (g-\bar{g})^2 P(g)} \text{ ------------------------(3)}$$

Skewness evaluates asymmetricity with respect to mean and intensity level distribution.

$$\text{SKEW} = \frac{1}{\sigma_g^3} \sum_{g=0}^{L-1} (g-\bar{g})^3 P(g) \text{ ----------(4)}$$

The skew results in positive if the end portion of the hist values spreads to the right if positive and negative if it spreads to the left. Efficient method for Measuring skew using mode, mean and standard deviation is yet an efficient way to measure skew. Peak value is the Mode

$$\text{SKEW}' = \frac{\bar{g} - mode}{\sigma_g} \text{ -------------------------(5)}$$

The energy of an image describes the level of distribution of intensity throughout the image

$$\text{ENERGY} = \sum_{g=0}^{L-1} [P(g)]^2 \text{ ----------------- (6)}$$

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The energy will be maximum for an image with non varying intensity values, and rises to the smaller when the value of pixels oriented across many intensity ranges. This compresses the data when the value is of very large.

The entropy is a measure of energy and it defines the bits necessary for coding. It is defined as

$$\text{ENTROPY} = -\sum_{g=0}^{L-1} P(g)\log_2\,[P(g)] \text{ ---- (7)}$$

Entropy is very high for an image with more intensity values, and for complex image. This value varies inversely with the energy.

IV. PROPOSED SYSTEM

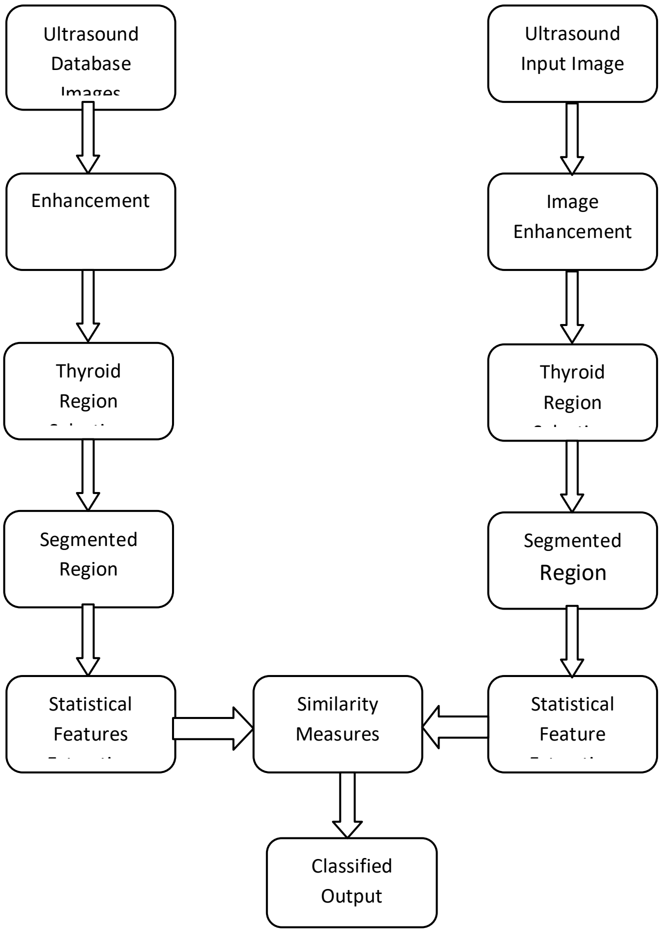


Fig.1.Block diagram of the Process

V. EXPERIMENTAL RESULTS

The ultra sound images of two thyroid dieseases (goiter ,carcinoma) are segmented and the statistical pixel-level features are calculated using MAT LAB for the above mentioned diseases. The results are shown in the graph.

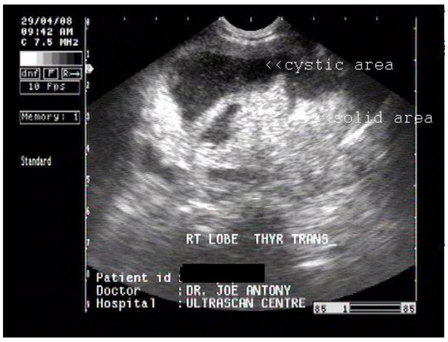
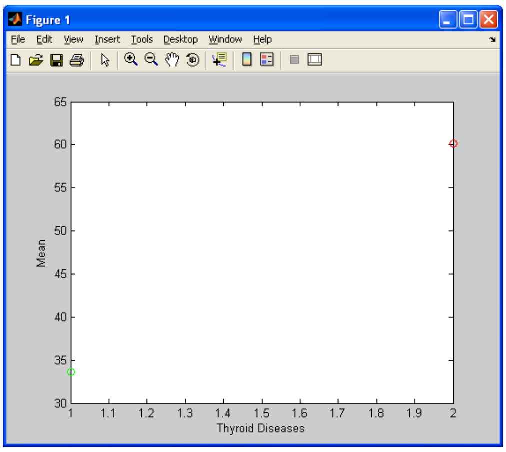


Fig.2.1 The ultra sound image of carcinoma

Fig.2.2 The ultra sound image of goiter

MAT LAB RESULTS OF STATISTICAL PIXEL-LEVEL FEATURES FOR GOITER AND CARCINOMA



(a)

○ Red = Goiter

○ Green = Carcinoma

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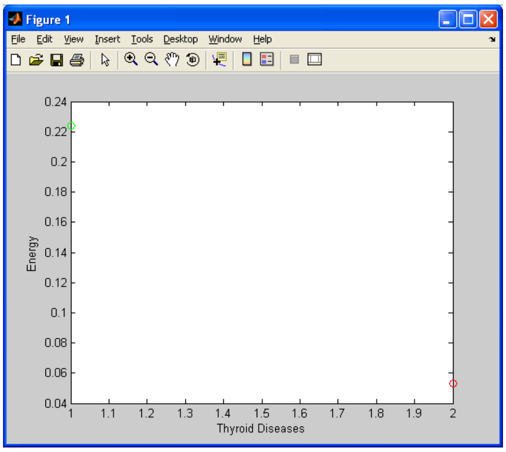
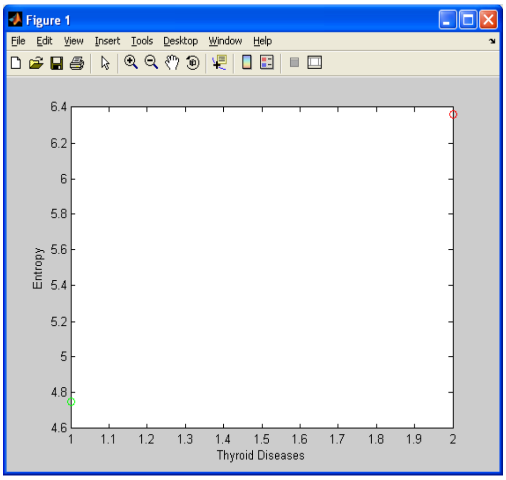


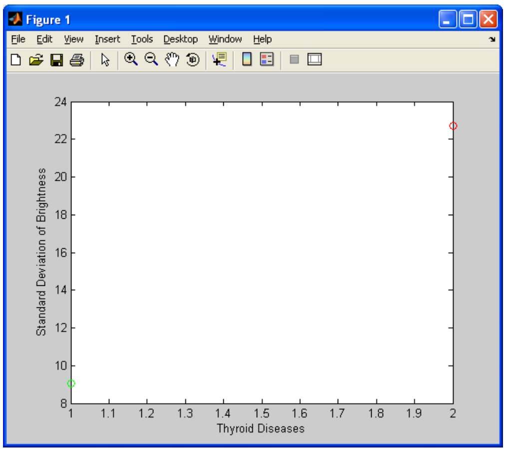
○ Red = Goiter
○ Green = Carcinoma

(b)



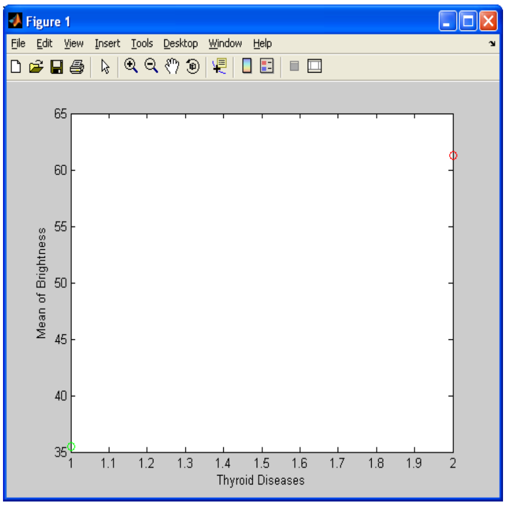
○ Red = Goiter
○ Green = Carcinoma

(c)



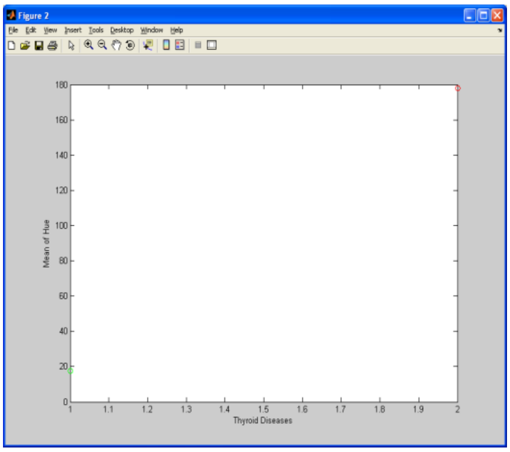
○ Red = Goiter
○ Green = Carcinoma

(d)



○ Red = Goiter
○ Green = Carcinoma

(e)



○ Red = Goiter
○ Green = Carcinoma

(f)

Fig. 3. The plots of six image features a. Mean, b. Energy, c. Mean Brightness, d. Entropy, e. Mean hue, f. Std.dev of Brightness, for two typical kinds of tissues

VI. CONCLUSION AND FUTUER WORKS

In this paper, two ultrasound thyroid images (carcinoma, goiter) were processed, filtered, segmented and classified based on the image features. The gray level compensation technique proposed in this paper, classify and segment the ultra sound image. Obtained results shows the good measures of the proposed system. In future, more advanced algorithm is designed to improve the performance of system. The

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information provided from this paper will provide a reliable means of suggestions for clinical analysis of thyroid diseases

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