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# A segmentation method and classification of diagnosis for thyroid nodules

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***Abstract:*** ***Heterogeneous features of thyroid nodules in ultrasound images is very difficult task when radiologists and physicians manually draw a complete shape of nodule, size and shape, image or distinguish what type of nodule is exist. Segmentation and classification is important methods for medical image processing. Ultrasound imaging is the best way to prediction of which type of thyroid is there. In this paper, uses the groups Benign (non-cancerous) and Malignant (cancerous) Thyroid Nodules images were used. The texture feature method like GLCM are very useful for classifying texture of images and these features are used to train the classifiers such as SVM, KNN and Bayesian. The experimental result shows the performance of the classifiers and shows the best predictive value and positively identify the percentage of the non-cancerous or cancerous people and shows the best performance accuracy using the SVM classifier as compare to the KNN and Bayesian classifier.***

***Keywords-*** *Thyroid Ultrasound (US) images, Feature extraction, GLCM, RBAC, SVM, KNN and Bayesian.*

## I. Introduction

In modern medicine, various medical images – ultrasound, CT, Scintigraphy, SPECT, MR, PET, X-rays etc play an important role in process of disease diagnosing and treating and have become major evidence to ensure disease [12]. Ultrasonography is the most well accepted imaging modality for the diagnosis and follow-up of thyroid disorder. The advantages of using ultrasonic imaging include its mobility and low cost as well as the ability to measure the dimension of the gland check for the presence of masses or cysts and evaluate the structure and echogenicity of the parenchyma [8]. US is the most sensitive imaging test available for the examination of the thyroid gland, to detect thyroid lesions, accurately calculate their dimensions, and identify the internal structure. A thyroid ultrasound examination provides an objective and precise method for detection of a change in the size of the nodule, used to evaluate the US features, which include size, echogenicity (hypo echoic or hyper echoic), and composition (cystic, solid, or mixed), as well as presence or absence of coarse or, a halo and irregular margins[1]. Segmentation plays an important role in medical imaging to obtain the location of the object of interest as well as to detect the area, volume or the analysis of dynamic behaviour of anatomical structure over time [11]. Thus by segmentation process the affected or the region of interest can be separated from other tissues. To detect the abnormality of thyroid gland, first the location and size of the gland must be segmented. A segmentation algorithm based on localized based [4] method that is basically to select the small region of the thyroid nodule or to segment the local area of the images and to segment the nodule which is gives the information of which type of nodule exist benign and malignant. In digital image processing techniques offer the opportunity for texture description. The thyroid nodule can be characterized by texture description and quantifying properties [8]. The thyroid texture characterization based on statistical parameter could provide an objective diagnostic tool and contribute to the use of computer assisted application in thyroid disorders. The most famous feature extraction technique are presented based on (GLCM) next, and famous classification method SVM classifier, KNN classifier and Bayesian classifier. In this project work, we proposed to develop a computer aided diagnosis system of thyroid ultrasound images [2]. In this module, firstly thyroid gland region are segmented from the nodular (noncancerous) region in the normal thyroid nodule images and nodular (with cancerous) region in the abnormal thyroid nodule images. Then the segmented thyroid ultrasound images were use the features extraction techniques and also used SVM, KNN and Bayesian classifier. From this module classified result, the results obtained from the performance measures such as accuracy are calculated.

The rest of this paper is organized as follows. Methodology in section II introduces a description of the main components of the proposed scheme. Then in section III result and discussion performance Evaluation study on real US thyroid data is presented, demonstrating the effective accuracy. Finally in the last section IV the conclusion of this study is summarized.

## II. Proposed Methodology

**A. Database:**
Total 13 Number of thyroid images were used where total 8 cancerous and 5 non-cancerous images was selected in database. These thyroid images provided by internet (Thyroid Images Wilmington Endocrinology PA, Gallery- category-thyroid Ultrasound Images). The format of images was used in JPEG.

**B. Software and computer used for analysis:** We used MATLAB version 7.7.0 (R2008b) and used image processing Toolbox) For our analysis and used a computer with Intel® Core™i3-350M Processor 2.26 GHz CPU and 3 Gigabyte of memory.

**C. Data pre-processing:** Ultrasound images contain speckle noise and to remove the noise various filters are used and also used histogram equalization produce visual differences and enhanced the contrast between images .The various modules of proposed work are classification of thyroid images and segmentation of thyroid nodular images.

**D. Texture analysis and feature extraction:** Use Gray-co-matrix and extract features from that. GLCM calculates the probability of a pixel with the gray-level value *i* occurring in a specific spatial relationship to pixel with the value *j*. The number of gray levels in the image determines the size of the GLCM [9]. Although there is a function in Matlab Image Processing toolbox that computes parameters Contrast, Correlation, Energy, solidity and Homogeneity, the paper by Haralick suggests the tabulation form where few more parameters that are also computed here [7]. It is easy to add new features based on the GLCM using this code. And also calculate the new formulas which is helps to extract the US features and also helpful to disguising the benign and malignant nodules. Features were calculated using correlation, entropy, variance and homogeneity etc.

**E. Segmentation:** Use the segmentation based algorithm localized based active contour (region based) [4] method that is basically to segment the local area of the images and to segment the nodule which is give the information of which type nodule exist benign and malignant. The proper procedure of segmentation algorithm the thyroid benign image are segmented with-

Iteration = 500

Mask = m (30:70, 50:170) = 1

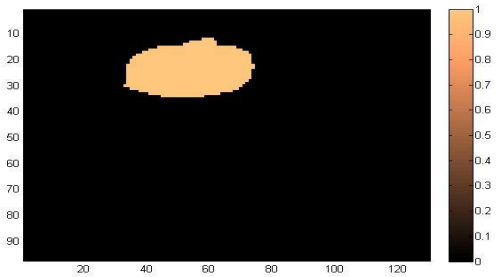


**Fig 1** segmented graph

Thyroid lobes are segmented into left and right lobes using region based active contour. RBAC effectively segments the thyroid gland in US images [4]. RBAC algorithm provides robustness against initial curve placement and insensitivity to image noise. The images are inverted to remove noise from the image. .

**F: Classifiers:** The most famous classification methods like support vector, nearest neighbour and Bayesian classifiers used for this work. These all classifiers gives the prediction percentage of presence of disease in the images.

**G: performance measure:** Quantitative measurement of classification accuracy is calculated in term of true positive (TP), true negative (TN), false positive (FP), false negative (FN) with respect to the ground truth.

## III. Result

**Total no. of 13 images was used**. Where 8 images were malignant (cancerous) and 5 images were benign (non-cancerous). And total 13 features were extracted with the help of GLCM. Result shown that the SVM classifier was used these 13 texture features and distinguishing the malignant cancerous nodule and benign noncancerous nodules with up to 84.62%.

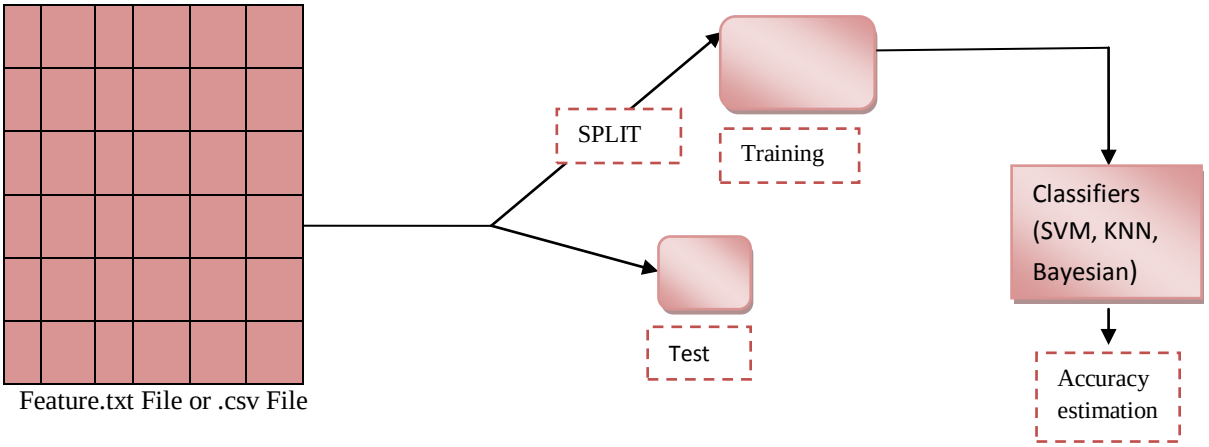


**Fig 2** Train and test

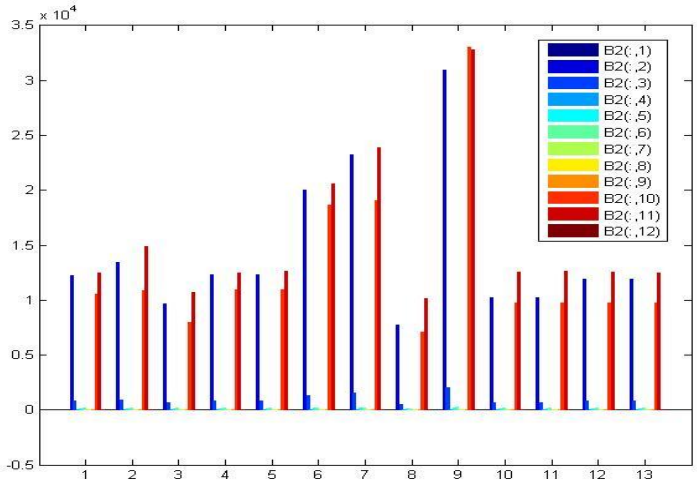


**Fig 3** feature.txt file bar graph

| Selected features | SVM | KNN | Bayesian |
|---|---|---|---|
| **TP** | 8 | 6 | 0 |
| **TN** | 3 | 0 | 5 |
| **FN** | 2 | 2 | 8 |
| **FP** | 0 | 5 | 0 |

**Table 1** shows the TP, TN, FN, FP of classifiers

| Classifiers | ACCURACY |
|---|---|
| **SVM** | 84.62% |
| **KNN** | 46.15% |
| **Bayesian** | 38.46% |

**Table 2** shows the per cent of accuracy using classification methods

According to the table 2 SVM shows the best classification accuracy as compare to the others. Fig 4 shows the bar chart. Representing the performance accuracy of Bayesian, KNN, and SVM.

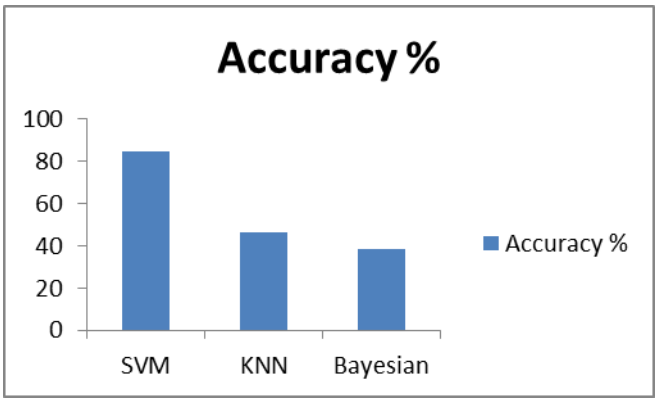


**Fig 4** Accuracy of classifiers

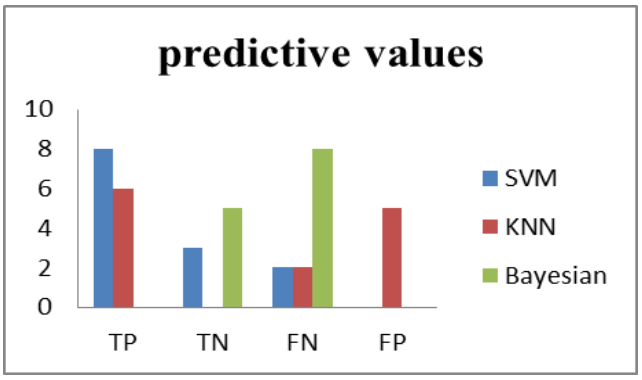


**Fig 5** predictive value graph

From the analysis, it is evident that the classification performance of SVM is higher as compare to KNN and Bayesian

## IV. Conclusion

Medical images are a widely used tool for clinical diagnosis, although it is time consuming for physicians to manually segment the thyroid nodule. This work proposed the method of classification of thyroid using the Bayesian, KNN and SVM [6], segmentation of thyroid nodules. From the experimental results, it is concluded that SVM gives the better classification accuracy than KNN and Bayesian. Our resulting SVM performance accuracy is about 84.62% was obtain. SVM is best classifier method. The utilization of new and more efficient classifiers could improve the accuracy performance thyroid. The features served as input into all classifiers in this study has proven to possess high discriminatory attributes [11] however the generation of more feature may enhance the evaluation procedure accuracy. Future work this work is really efficient platform for researchers and scientist. In this work it can be easily to detect and analysis the kind of problem is occurred

(diseases or not) and what are the risk factor? This software platform can be Evolvement of the proposed time effective scheme, cost effective for application in an integrated real time system for the assessment of the thyroid carcinoma.

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