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Thyroid Cancer Detection for Myanmar: Review and Recommendation

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ABSTRACT

Thyroid cancer is common cancer nowadays in most of the people irrespective of country, gender and regions, and so as in Myanmar. This paper brings significant work on thyroid cancer detection using image processing and segmentation methods so that appropriate work can be carried out for the benefit of people of Myanmar. The critical study of important papers gives challenges in existing work on cancer detection using several methods but there is not robust method for thyroid cancer detection. So, we attempt to suggest a robust set of methods for addressing this problem for Myanmar since there is very limited work on detection of cancer in the country.

KEYWORDS: *Thyroid cancer, detection, image processing, segmentation, computer-aided diagnosis (CAD), cancerous tissues, benign and malignant*

1. INTRODUCTION AND BACKGROUND

In the field of medical science and applications, there are many challenges such as diagnosis of a disease with correct detection and analysis of symptoms, for example in cancer detection it is very difficult to detect exact portion of cancerous area in an image. Patel et al (2014) in their book discussed in details about CAD system for analysis and better diagnosis of various types of diseases such as breast cancer, lung cancer, thyroid cancer etc. [1]. There have been numerous research contributions in the field of medical image analysis using some CAD system even used in assessment of cognitive ability of human brain in [2] (Sinha et al. (2018)).

Devanand et al. (2017, 2018) implemented the image segmentation method using wavelet transform for ultrasound images. The research also introduced about the application of wavelet based method for thyroid cancer detection [3, 4, 5]. Patel et al. (2016, 2015, 2014, 2013, 2012, 2011) experimented on several contributions on breast cancer detection using mammograms with the help of adaptive thresholding method and gray level clustering methods [6, 7, 8, 9,10,11, 12, 13]. Sinha (2015) suggested fuzzy based medical image analysis with improved performance and results [14]. Kailash et al. (2013) implemented clustering method for MRI image segmentation for brain tumor detection [15]. Abhishek et al. (2012) used PCG signals for heart disease detection using wavelet segmentation method [16]. Patel et al. (2010, 2011, 2014, 2015) in their early detection of breast cancer using k-means, region growing, histogram method, mass growing method achieved good results for breast cancer detection [17.18,19,20,21,22]. Bhesaj et al (2011) worked on MRI images and neural network was used for classification of images [23]. Sinha et al. (2008) studied a fundamental background on how to analyze the x-ray images with the help of image processing tools [24].

Therefore, we can see that lot of work has been done in the field of cancer detection of various types such as breast cancer, lung cancer, brain tumor cancer etc. However, the work on thyroid is not much reported. This chapter presents significant contributions in the area of thyroid cancer detection.

2. THROID CANCER AND CAD

Thyroid cancer can be detected using a CAD system whose typical flow diagram can be seen in Fig. 1 which includes various stages of image processing tasks used for pre-processing, segmentation, post processing etc. The preprocessing is applied to remove any noise signal from ultrasound images, then subjected to segmentation method for extracting regions of interest where cancer is likely to be affected. Feature extraction of segmented areas will help in classifying and detecting of cancer nodules inside the image.

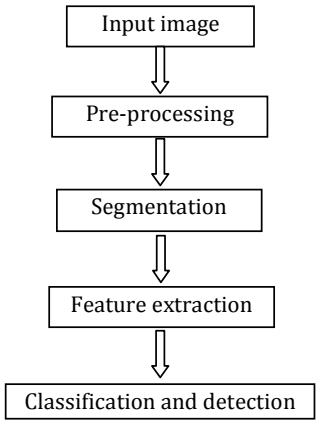

Fig. 1.1: Typical CAD system for Thyroid cancer detection.

3. RELATED RESAERCH

We have studied many research papers on different CAD systems used for thyroid cancer detection and major contributions and challenges of few important work are discussed here.

Jagadessh et al. (2017) implemented detection of thyroid cancer with the help of image processing methods. The methods used for detection include pre-processing, segmentation and classification. Nearest neighborhood method for preprocessing, edge detection for segmentation and neural network for classification, were implemented. The detection of cancer was done on the basis of malignant tissues present in the throat image taken in the form of ultrasound images. This work is a good attempt in the field of thyroid cancer detection but the number of images, size of database and calculation of accuracy were not discussed properly [25].

Luying et al. (2018) implemented and obtained experimental results for thyroid detection using 342 samples of ultrasound images of 342 patients. More number of malignant tissues were detected and therefore the cancer detection is implemented with good accuracy and sensitivity. This paper has compared clinical analysis with the results obtained by radiologists. It has been observed that the results are matching between clinical practice and radiologists' observation and diagnosis. However, the images which are considered in this paper are only static images, and not the moving images. The research needs to be modified for video images or real tie images of patients suffering from thyroid. Moreover, time complexity and number of stages have not been appropriately explained and calculated in the work [26].

Gopinath et al. (2013) employed support vector machine (SVM) for thyroid cancer analysis and texture features were used in this work. Statistical parameters were used to evaluate the performance of the method operated on morphological operations and their results. The accuracy of classification could be further improved from 96% [27]. Priti et al. (2016) used [28] artificial neural network (ANN); Malathi et al. (2017) implemented hybrid system using neural network as well as fuzzy logic, as neuro-fuzzy system to detect thyroid abnormalities [29]; Sathya Priya et al. (2018) suggested another hybrid method based on SVM for cancer detection of thyroid patients [30]. In all such works, there is no any robust method that can be used for all types of images having any difficulties in the image.

Mossoud et al. (2018) designed a CAD system for thyroid cancer detection using hill climbing method of soft computing techniques by which sensitivity, accuracy and other parameters were calculated. But, real time clinical data and validation of result were not done [31]. Polepogu et al. (2016) implemented a CAD for the disease and machine learning approach was used but the area and other values were not determined therefore improvement could be d further obtained [32]. If the area of malignant nodule is calculated, it would be good work. Sonali et al. (2012) used segmentation tools with the help of MATLAB and compared for different modalities of images such as CT, MRI, ultrasound. Further improvement is possible by using adaptive tools for segmentation of thyroid images [33]. Estryious et al. (2010) studied thyroid nodule detection for moving ultrasound images that can be applied for real time data [34]. Yu Yan et al. (2019) used fractal dimension differentiation for comparing malignant and benign nodules of thyroid images [35]. One more similar work [36] is reported in David et al. (2019).

There are several others focusing on thyroid cancer but analysis of methods and performance evaluation were not done properly. The major problem which is reported based on literature survey on this topic is that the research on thyroid cancer detection using CAD system has to be done extensively by the native researchers in Myanmar so that the people of Myanmar can get benefit. Moreover, collaboration with some cancer research center, or diagnostic center and at least a practicing physician can be involved for obtaining better results and appropriate validation of CAD based results with clinical data.

4. COMPARISON AND RECOMMENDATION

This piece of study reported several contributions om thyroid cancer detection using various types of methods. There is research on thyroid by limited number of researchers and very less amount of work has been done for Myanmar context. So, we recommend the following:

- Much focused research on thyroid cancer is needed
- Suitable image de-noising as preprocessing method needs to be developed
- Databases for real time images of patients suffering from thyroid, need to be created
- A framework of segmentation methods can be implemented for better and improved results for classification
- Robust method of classification needs to be found and implemented over real time data
- Neuro-fuzzy system as a hybrid method to be used
- The features play important role in assessment of performance and therefore robust set of statistical features such as area, size, SNR (signal to noise ratio), CNR (contrast to noise ratio) should be also included.

Based on extensive research survey, we compared few important papers in terms of methods; the year of contribution and their major findings. This is reported in a Table 1.1. The comparative study includes major research on thyroid cancer from 2012 to 2019 which means that our focus is to find out the latest impact of thyroid cancer detection so that we can make plan for future research required in this important field of medical science. Fractal method was used that involved important statistical parameters. Support vector machine methods are also used

and few other features are calculated for classification of cancer. Hill climbing method and artificial neural network (ANN) based methods were used that also involved same parameters as sensitivity, specificity, accuracy etc.

Luying et al. (2017) researched on thyroid with great impact using deep learning that employs convolutional neural network (CNN) where additional parameters such as NPV (negative predictive value) and PPV (positive predictive value). In neuro-fuzzy based hybrid method, all these good parameters were estimated in addition to time required for detection (see Malathi et. Al., 2017).

This comparative analysis has included all scope of CAD based research on thyroid cancer but exact cancer stage has not been calculated in any paper. So, the research on breast cancer carried out in several contributions from [1] to [24] are based on involvement of real time data, a radiologist and validation of results that includes opinion of radiologists also. In the breast cancer detection, cancer stage determination was achieved particular. Therefore, the recommendation for implementing thyroid research in Myanmar is as follows:

- Using gray level clustering and adaptive threshold based methods in adaptive manner
- Employing deep neural network so that exact classification can provide the cancer stage also.

TABLE1.1: Comparative analysis of existing research work on thyroid cancer detection.

Contributor	Method used	Major findings
Yu Yan et al. (2019)	Fractal Dimension	Specificity-86.9%; Sensitivity-64.9%; Accuracy- 98%
Sathya Priya et al.(2018)	ILBP-SVM	Accuracy, Precision, Recall, F-measure were suggested but not calculated for data used
Massoud et al. (2018)	Hill Climbing	Specificity-99.7%; Sensitivity-80%; Accuracy- 98.96%; F Score-83.4%
Jagadeesh et al. (2017)	ANN	The data over which ANN used is limited
Luying et al. (2017)	CNN	Specificity-48.5%; Sensitivity-96.7%; Accuracy- 82.2%; PPV-81.3%; NPV-86.2%
Malathi et al. (2017)	Co-active Adaptive Neuro-Fuzzy Inference System (CANFIS)	Specificity-99.24%; Sensitivity-99.2%; Accuracy- 99.08%; PPV-77.3%; NPV-99.07%; Detection time-0.35 ms
Priti et al. (2016)	ANN	Accuracy-70%
Gopinath et al. (2013)	Support Vector Machine (SVM)	Specificity-100%; Sensitivity-95%; Accuracy- 96.7%
Eystratios et al. (2010)	SVM and k-Nearest Neighbors	Accuracy-95%

5. CONCLUSIONS

This paper presents careful study about main research work on thyroid and other cancer detection in order to find out which method works well. Other cancer determination methods were also studied because suitable CAD system can be suggested for thyroid cancer detection for people of Myanmar. Numerous papers on thyroid suggests that deep neural network (CNN) and neuro-fuzzy methods are optimal methods and these concepts can be implemented with gray level clustering and adaptive thresholding method so that exact cancer determination can be obtained. This research may prove an important work for contribution towards the society and people of Myanmar. Future work suggests implementing the methods which are recommended on real time database created in Myanmar with the help of a radiologist and a hospital.

REFERENCES

[1] B. C. Patel and G. R. Sinha, Medical Image Processing: Concepts and Applications, Prentice Hall of India, 2014.

[2] G. R. Sinha, K. Srujan Raju, Rajkumar Patra, Daw Win Aye and Daw Thuzar Khin, "Research Studies on Human Cognitive Ability", International Journal of Intelligent Defense Support Systems, 5(4), pp. 298-304, 2018.

[3] Devanand Bhonsle, Vivek Chandra and G R Sinha, "Speckle noise removal from Ultrasound images using Combined bivariate shrinkage and enhanced total Variation techniques", International Journal of Pure and Applied Mathematics, 118(18), pp. 1109-1132, 2018.

[4] Devanand Bhonsle, V K Chandra and G. R. Sinha, "An Optimized Framework Using Adaptive Wavelet Thresholding and Total Variation Technique for De-noising Medical Images", Jour of Adv Research in Dynamical & Control Systems, 10(09), pp. 953-965, Special Issue, 2018.

[5] Devanand Bhonsle, Vivek Chandra and G R Sinha, "Noise Removal from Medical Images Using Shrinkage Based Enhanced Total Variation Technique", Journal of Advanced Research in Dynamical & Control Systems, 13, pp. 549-560, 2017.

[6] Bhagwati Charan Patel and G. R. Sinha, "Detection of masses in mammographic breast cancer images using Modified Histogram based Adaptive Thresholding (MHAT) method", International Journal of Biomedical Engineering and Technology, 2016.

[7] Bhagwati Charan Patel and G R Sinha, "Gray level clustering and contrast enhancement (GLC–CE) of mammographic breast cancer images", CSI Transactions of Springer, 2(4), p. 279–286, January 2015.

[8] Bhagwati Charan Patel and G. R. Sinha, "Abnormality Detection and Classification in Computer-aided Diagnosis (CAD) of Breast Cancer Images", Journal of Medical Imaging and Health Informatics, 4(6), pp. 881-885, 2014.

[9] Bhagwati Charan Patel and G. R. Sinha, "Mass segmentation and Feature extraction of Mammographic Images of Breast cancer in Computer-

aided diagnosis (CAD) System", CSVTU Journal of Research, 6, pp. 67-74, 2013.

[10] Bhagwati Charan Patel and G. R. Sinha, "Comparative Performance Evaluation of segmentation methods in Breast Cancer Images", International Journal of Machine Intelligence (ISSN: 0975 – 2927), 3(3), pp. 130-133, 2011.

[11] Bhagwati Charan Patel and G.R.Sinha, "An adaptive K-means clustering algorithm for breast image segmentation", International Journal of Computer Application, New York USA, 10(4), pp. 35-38, November 2010.

[12] Bhagwati Charan Patel and G R Sinha, "Efficient Detection of Suspected areas in Mammographic Breast Cancer Images", i-manager's Journal on Pattern Recognition, 01(04), pp. 01-10, December 2014-February 2015.

[13] Bhagwati Charan Patel and G R Sinha, "Energy and Region based Detection and Segmentation of Breast Cancer Mammographic Images", International Journal of Image, Graphics and Signal Processing, 6, pp. 44-51, 2012.

[14] G.R.Sinha, A Chapter on Fuzzy based Medical Image Processing, A volume in the Advances in Medical Technologies and Clinical Practice (AMTCP) Book Series, pp. 45-61, IGI Global Publishers, USA, IGI Global Copyright 2015.

[15] Kailash Sinha and G. R. Sinha, "Segmentation of brain MRI images for tumor detection by optimizing c-means clustering algorithm", i-manager's Journal on Instrumentation and Control Engineering, 1(3), pp. 14-21, 2013.

[16] Abhishek Misal, G R Sinha, R M Potdar and M K Kowar, "Comparison of wavelet transforms for denoising and analysis of PCG signal", i-manager's Journal on Communication Engineering and Systems, 1(1), pp. 49-53, 2012.

[17] Bhagwati Charan Patel, G. R. Sinha and Kavita Thakur, "Early detection of breast cancer using a modified topological derivative based method", International Journal of Pure and Applied Science and Technology, 7(1), pp. 75-80, 2011.

[18] Bhagwati Charan Patel and G. R. Sinha, "Mammographic image analysis method for Early detection of Breast cancer", i-manager's Journal on Future Engineering and Technology, 7(1), pp. 10-16, 2011.

[19] Bhagwati Charan Patel and G.R.Sinha, "Structural analysis of tissue in contiguous micro calcifications in mammograms for breast cancer identification", i-manager's Journal on Future Engineering and Technology, 6(2), pp. 20-27, 2011.

[20] Bhagwati Charan Patel and G.R.Sinha, "Early detection of breast cancer using self-similar fractal method", International Journal of Computer Application, New York USA, 10(4), pp. 39-43, November 2010.

[21] Bhagwati Charan Patel and G. R. Sinha, "Reliable Computer-Aided Diagnosis System Using Region Based Segmentation of Mammographic Breast Cancer Images", Mathematics and Computers in Science and Engineering Series, Proceedings of the 17th International Conference on Mathematical Methods, Computational Techniques and Intelligent Systems Mathematics and Computers in Science and Engineering Series, Mathematical Methods and Systems in Science and Engineering, Tenerife, Spain, ISBN: 978-1-61804-281-1, p. 131-142, January 10-12, 2015.

[22] Bhagwati Charan Patel and G. R. Sinha, "Mammography Feature Analysis and Mass detection in Breast Cancer Images", International Conference on Electronic Systems Signal Processing and Computing Technologies(ICESC-2014), Abstr p. 44, 11 January, 2014, Shri Ramdev College of Engineering and Management Nagpur, India.

[23] Bheshaj Kumar, G. R. Sinha and Kavita Thakur, "Quality assessment of compressed MR medical images using general regression neural network", International Journal of Pure and Applied Science and Technology, 7(2), pp. 158-169, 2011.

[24] G.R.Sinha, Kavita Thakur and M. K. Kowar, "Radiographic image Enhancement: Spatial Domain Methods and their Performance Evaluation", i-manager's Journal on Future Engineering & Technology, 3(2), pp. 41-46, 2008.

[25] Jagadessh Sharaf and Kalpana, Thyroid Cancer Detection using Image Processing, International Journal of Research and Scientific Innovation (IJRSI), IV(VIII):75-77, 2017.

[26] Luying Gaom Ruyu Liu, Yuxin Jiang, Wenfeng Song, Ying Wang, Jia Liu, Juanjuan Wang, Dongqian Wu, Shuai Li, Aimin Hao and Bo Zhang, Computer-aided system for diagnosing thyroid nodules on ultrasound: A comparison with radiologist-based clinical assessments, Head & Neck, 40:778–783, 2018.

[27] B Gopinath and N Shanthi, Support Vector Machine Based Diagnostic System for Thyroid Cancer using Statistical Texture Features, Asian Pacific Journal of Cancer Prevention, 14:97-102, 2013.

[28] Priti S. Dhatgude and S. M. Handore, Detection of Thyroid Nodule In Ultrasound Images Using Artificial Neural Network, International Journal of Advanced Computational Engineering and Networking ISSN:2320-2106, 4:61-65, 2016.

[29] Malathi M. and Srinivasan S. Detection and Diagnosis of Tumor Regions in Thyroid Images using CANFIS Classifier, 39: 41-48, 2017.

[30] S. Sathya priya and D. Anitha, Thyroid Ultrasound Image Classification Using Improved LBP with Hybrid Support Vector Machine, International Journal of Pure and Applied Mathematics, 119:3445-3457, 2018.

[31] Massoud Sokouti, Mohsen Sokouti, and Babak Sokouti, Computer Aided Diagnosis of Thyroid Cancer Using Image Processing Techniques, International Journal of Computer Science and Network Security (IJCSNS), 18:1-8, 2018.

[32] Polepogu Rajesh and Kunduru Umamaheswari, Thyroid Disorder Detection Using Image Segmentation

in Medical Images, International Journal of Scientific Development and Research (IJSDR), 1:215-225, 2016.

[33] Sonali Bhadoria, Preeti Aggarwal, C. G. Dethe and Renu Vig, Comparison of Segmentation Tools for Multiple Modalities in Medical Imaging, Journal of Advances in Information Technology, 3:197-205, 2012.

[34] Eystratios G. Keramidas, Dimitris Maroulis and Dimitris K. Iakovidis, TND: A Thyroid Nodule Detection System for Analysis of Ultrasound Images and Videos, Springer, 2010.

[35] Yu Yan, Wei Zhu , Yi-yun Wu and Dong Zhang, Fractal Dimension Differentiation between Benign and Malignant Thyroid Nodules from Ultrasonography, www.mdpi.com/journal/applsci, 2019.

[36] David Dov, Shahar Kovalsky, Jonathan Cohen, Danielle Range, Ricardo Henao, and Lawrence Carin, Thyroid Cancer Malignancy Prediction from Whole Slide Cytopathology Images, https://arxiv.org/pdf/1904.00839.pdf.