A Review on Segmentation Algorithms of Oral Cancer Detection

Shilpa Harnale1
Research scholor, CSE Dept
GNDEC, Bidar

Dr. Dhananjay Maktedar2
HOD, CSE Dept, ,
GNDEC, Bidar

***Abstract*: Oral cancer is one of the complex diseases in the world. The rate of the death is increasing all over the world due to this type of malignancy. Early diagnosis of malignancy is essential to avoid risk of disease. Earlier detection of oral lesions aids surgeons to provide proper treatment to save lives. An oral tumor can be Malignant or benign. Benign tumor of the mouth is growth that does not spread (metastasize) to other parts of the body, malignant tumors are cancerous and they rapidly grows and metastasize to other parts of the body. Oral cancer detection and segmentation is one of the most challenging and time consuming task in medical image processing. This research is focused towards the comparative study of earlier proposed segmentation techniques discussed in the literature.**

Keywords: Oral cancer, Medical Image Processing, preprocessing, Segmentation

I. INTRODUCTION:

Oral cancer constitutes 3rd common malignancy in developing countries. Dental technology offers improved solution to traditional dental problems and helps detecting oral problems at an early stage. Oral cancer is also known as mouth cancer ,it may arise as a primary lesion originating in any of the tissues in the mouth, there are several types of oral cancer ,but around 90% are squamous cell carcinomas, originating in the tissues that line the mouth and lips. oral or mouth cancer most commonly involves the tongue, it may also occur on the floor of the mouth, cheek lining ,gums, lips or hard and soft palate(roof of the mouth).most oral cancers look very similar under the microscope and called as squamous cell carcinomas, but less commonly other types of oral cancer occur such as melanoma.

Oral tumors are mainly classified as Benign and Malignant. Benign tumor of the mouth is growth that does not spread (metastasize) to other parts of the body, it is not cancerous and life threatening, where as malignant tumors are cancerous and they rapidly grows and metastasize to other parts of the body.
There are several image processing technique such as histogram equalization, image segmentation, image enhancement, morphological operation, feature extraction and classification.

II. LITERATURE REVIEW:

Nurtanio et al. [1], presented a segmentation system for cyst or tumor cases from dental X-ray images.In preprocessing, the colored images are transformed into gray images, and then apply Gaussian filter to smooth images then segmentation using the active contour models (snake) provides a solution for number of visual problems, which includes detection of lines, edges and subjective contours(snakes),those model were used to handle ROI, not the entire image .validation using receiver operating characteristic(ROC)analysis as a Performance measure.
Adv: snakes reduced the need for edge linking compared to traditional edge based segmentation

Anuradha and Sankaranarayanan [2], proposed a technique for mouth cancers detection utilizing a morphological mathematical watershed algorithm, this approach preserves the edge details, the marker controlled watershed is used for tumor segmentation purpose, and then the marker controlled watershed

segmentation algorithm was compared with the watershed segmentation, and the marker controlled watershed has better results. Preprocessing is carried out by linear contrast stretching of input(x ray) image, then marker-controlled segmentation is applied.

F., Abdolali, R. A., Zoroofi, Y., Otake, & Y., Sato [3],proposed automatic segmentation algorithm based on the symmetric axis analysis has proposed, which is an analysis of the left and right sides of each image. In this, automatic segmentation of tumor of CBCT images is used. In preprocessing, diffusion filtering is used to image enhancement and smoothing .for symmetry axis detection, an efficient method with modern feature points is used.Multi resolution hierarchical FFD is used in multi-scale registration with fastness and robustness. Using this approach high TP and low FP is obtained. Dice's coefficients, jaccard index and hausdorff distance are performance metrics of this automatic segmentation.

ADV: Multi resolution hierarchical FFD is used in multi-scale registration with fastness and robustness.

DisadV:FFD registration is computing Inverse FFD

Limitation of this method is incapability of handling cysts and lesion without specific boundary and cases with large asymmetric variations.

Maghsoudi et al. [4], proposed an intelligent system based on artificial neural networks. This proposed system used 120 patient images, 120 for training process and 30 for testing and validation, and four features were extracted and used for diagnosis of mouth legions. This work indicated that artificial neural network when employed in the diagnostic systems provided a powerful approach for prediction and diagnosis of dental and oral diseases. In this, diagnosis and prediction of lichen planus, leukoplakia and oral squamous cell carcinoma diseases have been studied using artificial neural network.

Anuradha and Sankaranarayanan [5], proposed an oral cancer detection system; it works by preprocessing images using Linear Contrast Stretching for noise removal, and then Watershed Segmentation is utilized. Because of Watershed segmentation problems, Marker Controlled Watershed segmentation is utilized, and Marker Controlled watershed segmentation decreases the over segmentation problem. The Improved Marker Controlled Watershed Segmentation algorithm obtains better segmentation result (higher speed) with or without linear contrast stretching of the image. The Processing Speed is calculated before stretching and after stretching.

M. K. Alsmadi, [6], proposed The hybrid Fuzzy C-Means and Neutrosophic approach which is used for segmenting jaw image and detecting the jaw lesion region in panoramic X-ray images which may help in diagnosing jaw lesions. Area error metrics are used to assess the performance and efficiency of the proposed approach from different aspects. Both efficiency and accuracy are analyzed. Specificity, sensitivity and similarity analyses are conducted to assess the robustness of the proposed approach. Comparing the proposed approach with the Hybrid Firefly Algorithm with the Fuzzy C-Means, and the Artificial Bee Colony with the Fuzzy C-Means algorithm, the proposed approach produces the most identical lesion region to the manual delineation by the Oral Pathologist and shows better performance.

Zhalong Hu , Abeer Alsadoon , Paul Manoranjan 1, P.W.C. Prasad, Salih Ali, A. Elchouemic[7], proposed system focused on image pre-processing and segmentation steps, using anisotropic diffusion and Fuzzy C-Means to enhance the quality of the image, then improve the accuracy of tumor detection and classification. The proposed algorithm can remove noise and improve image quality by keeping all the edges clearly visible. In the segmentation stage, the use of the fuzzy c-means is aimed at improving the accuracy and specificity which would affect results.

III. COMPARISON OF VARIOUS SEGMENTATION ALGORITHMS:

Sr no	Authors	Segmentation algorithms used (input image)	Results	Future enhancement
1	Nurtanio I, Purnama IKE, Hariadi M, Purnomo MH	Active contour model(snake) (dental panoramic(x-ray) image)	It guarantees continuous and smooth lesion boundaries, it reduced the need for edge linking compared to conventional segmentation methods, accuracy value is 99.67%	
2	Anuradha K, Sankaranarayanan K	Marker-controlled watershed Segmentation (dental x-ray images)	Overcome the problem of Over segmentation. speed obtained is 92.55% &Accuracy obtained is 90.25%	To increase accuracy and speed Up to 99%.
3	F., Abdolali, R. A., Zoroofi, Y., Otake, & Y., Sato,	automatic segmentation algorithm based on the symmetric axis analysis (CBCT image)	High TP and low FP is obtained. it is effective for segmentation of various cysts.	Develop methods to handle cysts and lesions without specific boundary and cases with large asymmetric variations. Future works will investigate other methods to reduce falsely classified healthy tissues.
4	Maghsoudi R, Bagheri A, Maghsoudi MT	Artificial neural network	Using ANN, oral and dental diseases are diagnosed and predicted quickly and accurately.	
5	Anuradha K, Sankaranarayanan K	Improved marker controlled Segmentation algorithms (dental x-ray images)	Speed of algorithm is calculated before Stretching is 90.5% and after stretching 92.6%	To increase speed and accuracy up to 99%
6	M. K. Alsmadi,	A hybrid fuzzy c-means & Neutrosophic approach (dental x-ray images)	It can be used to segment an find lesion accurately even in the low contrast and complicated jaw x-ray images, it reduced noise without blurring the boundary of image. Better performance rate (FP rate 6.1%,TP rate 90%,specificity Rate 0.9412,sensitivity rate 0.9592 &similarity rate 0.9471)	To develop a classifier to distinguish benign or malignant tumor of jaw in feature extraction

7	Zhalong Hu , Abeer Alsadoon , Paul Manoranjan 1, P.W.C. Prasad, Salih Ali, A. Elchouemic	Fuzzy c-means segmentation (CT image)	Proposed method achieved accuracy 90.11%,specificity 87.5% &sensitivity 92.15%	To increase accuracy, specificity, sensitivity

IV. CONCLUSION:

In this paper the survey study of various oral cancer detection techniques in the medical image processing is done. The advanced Medical image processing techniques and algorithms are reviewd. A comparative study is made on various techniques. After evaluation of well-known technique it is clearly shown the various methods which can detect the tumor efficiently and provide accurate result. This work will be extended for new algorithm for Oral tumor detection which will provide more efficient result in terms of accuracy and speed than the existing methods in future.

REFERENCES

[1]. Nurtanio I, Purnama IKE, Hariadi M, Purnomo MH. Cyst and tumor lesion segmentation on dental panoramic images using active contour models. IPTEK J Technol Sci 2011;22(3).
[2]. Anuradha K, Sankaranarayanan K. Detection of oral tumor based on marker-controlled watershed algorithm. Int J Comput Appl 2012;52(2).
[3]. F., Abdolali, R. A., Zoroofi, Y., Otake, & Y., Sato, " Automated classification of maxillofacial cysts in cone beam CT images ," *Computers in biology &medicine, 72108-119,* 2016.
[4] Maghsoudi R, Bagheri A, Maghsoudi MT. Diagnosis prediction of lichen planus, leukoplakia and oral squamous cell carcinoma by using an intelligent system based on artificial neural networks. Dentomaxillofacial Radiol, Pathol Surg 2013;2(2):1–8.
[5] Anuradha K, Sankaranarayanan K. Oral cancer detection using improved segmentation algorithm. Int J Adv Res Comput Sci Softw Eng 2015;5(1):451–6.
[6] M. K. Alsmadi, " A hybrid Fuzzy C-Means and Neutrosophic for jaw lesions segmentation," [Press release], 2016. Retrieved from https://doi.org/10.1016/j.asej.2016.03.016
[7] Zhalong Hu , Abeer Alsadoon , Paul Manoranjan 1, P.W.C. Prasad, Salih Ali, A. Elchouemic,''Early Stage Oral Cavity Cancer Detection: Anisotropic Pre-Processing and Fuzzy C-Means Segmentation,''IEEE 978-1-5386-4649-6/18 2018.