Charactersation of Oral Cancer Lesions Using Texture Features

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***Abstract*—**Oral cancer is a serious problem among people due to its aggressive nature, associated with mostly unfavorable prognosis. Clinical examination by experienced medical experts followed by biopsy for diagnosis are time taking. Identification in early stage always helps for better curative measures. An effective image processing techniques were used with watershed segmentation including GLCM texture features extraction, from the analysis of true color images in MATLAB software computed data and analyze images with some useful algorithms. Image processing techniques with marker controlled segmentation and feature extraction enables clear visualization of cancer effected areas with substantial resolution detecting different types of oral cancer lesions. The techniques are rapid, accurate and different than clinical with laboratory investigation for diagnosis for early effective curative measures.

Keywords*-Oral cancer, true color images, marker controlled, watershed transform, algorithms.*

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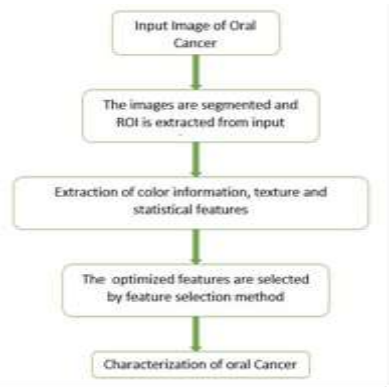
I. INTRODUCTION

Oral cancer is a common malignancy in human being globally among various oral lesions. The most affected oral cancer in some countries like Bangladesh, Pakistan, India, and Sri Lanka and it will affect up to 25 percent of all new cancer cases. Each year, ten millions of people are diagnosed with cancer and half of them die eventually. Appropriate identification of oral lesions (non-cancerous, precancerous and cancerous) have an good impact on effective curative measures. Due to high rate of occurrences of different types of oral leions including cancer, early and appropriate diagnosis of a disease found beneficial for the affected patients. Effective image processing techniques are needed to detect oral lesions including suspected cancer affected areas with high accuracy.

II. PROPOSEDMETHODOLOGY

An approach was made to detect oral cancer lesions from true color images. It comprises in the following steps, which represented in block diagram in Fig.1.True-colour images of different types of oral lesions (like, Leukoplakia and Erythroplakia)in Fig.2 were collected and processed.



A. Image Preprocessing

In this stages, images enhancement to be perform by increasing gray levels with linear contrast stretching. Affected parts are clearly visualized, by increasing contrast in selected regions. Image preprocessing can be done by different techniques and methods.

A) Image Smoothing

B) Image Enhancement

C) Image Segmentation

D) Morphological Operation

E) Extract cancerousareas.

B. Image Segmentation

Segmentation subdivides an image into its constituent regions or objects. It is a process to partition images into more than one segments. The segmentation algorithms are based on two basic properties, i.e. image segmentation can be achieved any one of the two ways.Segmentation based on (i) discontinuities in intensity(ii) similarities in intensity.In the first method, partition an image based on sudden changes in intensity.In the Second method, partition image into regions of similarity of predefined criteria.Marker controlled watershed segmentation use to overcome over segmentation of images.

C. Feature Extraction

The objective of feature extraction is data reduction by measuring certain features or properties, which distinguish objects or their parts, reduce dimensionally. It determines various attributes as well as properties associated with a region or object. Feature extraction detect, isolates distinct portions and features of images. Here, in this paper two orders texture feature are applied. First one is measuring statistics calculation from particular pixels, do not consider neighboring pixels. Histogram and intensity features are first order calculation and the second order texture calculation is GLCM based texture feature. It extracts from the given input images.

GLCM

Gray Level Co-occurrence Matrix (GLCM), the distribution of co-occurring values at a given offset of an image. Gray level numbers are equal for numbers of rows and columns. GLCM texture features used to give features like. Contrast, correlation, energy, entropy, correlation, homogeneity, auto-correlation etc.

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GLCM Features

Moment	Formulae
Energy	$\mu = (1/MN) * \sum_{i=1} \sum_{j=1} p(i,j)$
Contrast	$f_2 = \sum_{n=0}^{N_g-1} n^2 \left\{ \sum_{i=0}^{N_g-1} \sum_{j=0}^{N_g-1} p_{d,\theta}(i,j) \right\}$, where $n = \lvert i-j \rvert$
Entropy	$f_3 = \sum_{i=0}^{N_g-1} \sum_{j=0}^{N_g-1} p_{d,\theta}(i,j) log\,(p_{d,\theta}(i,j))$
Correlation	$f_5 = \sum_{i=0}^{N_g-1} \sum_{j=0}^{N_g-1} p_{d,\theta}(i,j) \frac{(i-\mu_x)(j-\mu_y)}{\sigma_x \sigma_y}$
Homogeneity	$\sum_{i,j=0}^{N-1} \frac{P_{ij}}{1+(i-j)^2}$

D. Characterisation

Image characterization in the segmentation module, detection of an image and after that the features are extracted from the image segmentation by which identity of oral lesions of separate stages including cancers.

III. RESULTSAND DISCUSSION

Leukoplakia

Erythroplakia

Fig.2 Two different types of oral cancer lesions.

Fig.3 Morphological operation (Leukoplakia image).

Minimum value of images are extracted by watershed segmentation. Finally the cancerous portion extracted from input image. It determines to divide lines with its lower values.

To divide lines gives great change in boundaries and it determines its calculation. In images at the edge lines it transform the catchment basins and watershed edge lines. Image is treated like a plane, where light and dark pixels are high and low respectively. Output isshown in the Fig. 4. To overcome the over segmentation marker controlled watershed segmentation have been done instead of watershed based segmentation.

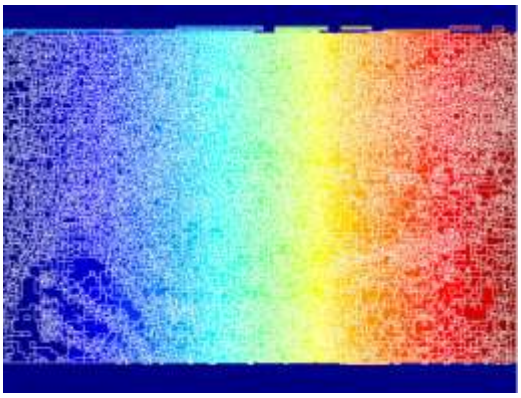

Fig.4 Watershed segmented image.

Fig.5 Cancerous portion extracted from imput image.

GLCM TEXTURE FEATURES OF DIFFERENT TYPES OF ORALCANCEROUS LESIONS

TYPE: LEUKOPLAKIA

Features / Images	Autocorrelation	Contrast	Correlation	Energy	Dissimilarity	Entropy	Homogeneity
Image 1	52.7040	0.0737	0.8931	0.4096	0.0737	1.1606	0.9631
Image 2	48.1945	0.0672	0.9445	0.3203	0.0672	1.3720	0.9664
Image 3	49.1816	0.0739	0.8861	0.9427	0.0739	0.1733	0.9930
Image 4	47.9448	0.0813	0.8275	0.4219	0.0866	1.0386	0.9572
Image 5	50.3628	0.0792	0.8744	0.4487	0.0638	1.0762	0.9615

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TYPE : ERYTHROPLAKIA

Features / Images	Autocorrelation	Contrast	Correlation	Energy	Dissimilarity	Entropy	Homogeneity
Image 1	41.9448	0.0913	0.8275	0.4219	0.0866	1.0386	0.9575
Image 2	40.0371	0.1387	0.8248	0.5306	0.1096	1.0774	0.9329
Image 3	41.8832	0.0929	0.8633	0.4925	0.0956	1.3710	0.9107
Image 4	43.1305	0.1206	0.8364	0.4809	0.0816	0.9949	0.9276
Image 5	41.8154	0.1176	0.8570	0.3988	0.0936	1.3698	0.9109

Discussion :

By using the result, of two types of cancerous images of every type having 5 sets of image, separated the RGB planes from the input images and only take the R-plane from that. By applying GLCM features on the specific images its giving 22 separate features value.

All 5 images in between the two type of cancer give features value which reflects characterization of that specific type. Features like autocorrelation,contrast,correlation, energy, dissimilarity,entropy,homogeneity. From these features extracted values types of cancer will be characterized into the type of cancer.

IV. CONCLUSION

Quality of images enhanced with appropriate identification of oral lesions following image processing, segmentation, feature extraction and characterization. Marker controlled watershed segmentation technique used to avoidover segmentation. In this work by combining the GLCM features with Watershed segmentation gives highly efficient output. This analysis system could be further extended for characterisation ofdifferent types of images of oral non-cancerous, precancerous and cancerous lesions.

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REFERENCES

[1] R.I.Haddad and D.M.Shin, “Recent advances in head and neck cancer”, The New England Journal of Medicine, vol.359, pp.1143-1154, 2008.
[2] Dario Salvi, Marco Picone, Mario Teresa Arredondo, Maria Fernanda Cabrera-Umpierrez, Angel Esteban, Sebastian Steger, and Tito Poli, “Merging Person-Specific Bio-Markers for Predicting Oral Cancer Recurrence through an Ontology”, IEEE Transactions on Biomedical Engineering, vol.60, no.1, pp.216-220, January, 2013.
[3] S. Warnakulasuriya, “Global epidemiology of oral and oropharyngeal cancer”, Oral Oncology, pp.309-315, vol.45, no.4-5, April-May, 2009.
[4] Ma Xiomei and Yu Herbert, “Global barden of cancer”, Yale Journal of Biology and Medicine, vol.79, pp.85-94, 2006.
[5] Konstantina Kourou, Konstantinos P. Exarchos, Costas Papaloukas, and Dimitrios I. Fotiadis, “A Bayesian Network based Approach for Discovering Oral Cancer Candidate Biomarkers”, 37th Annual International Conference of the IEEE Engineering in Medicine and Biology Society. pp.7663-7666, 25-29th August, 2015
[6] Konstantinos P.Exarchos, Yorgos Goletsis, and Dimitrios I. Fotiadis,”Multiparametric Dicision Support System for the Prediction of Oral Cancer”, IEEE Transactions on Information Technology in Biomedicine.vol.16, no.6, pp. 1127-1134, November, 2012.
[7] Ranjan Rashmi Paul, Anirban Mukherjee, Pranab K. Dutta, Swapna Banerjee, Mousumi Pal, Jyotirmoy Chatterjee, and Keya Choudhuri,” A Novel Wavelet-Network-based Pathological Stage Detection Technique for an Oral Precancerous Condition”, Journal of Clinical Pathology, vol.58, no.9, pp. 932-938, September, 2005.
[8] James J. Sciubba, “Improving detection of precancerous and cancerous oral lesions”, American Dental Association, vol.130, pp.1445-1457, 1999.
[9] Arlene Gaugliano, “ Dental Tribune – Middle East and African Edition” June-August, 2011.
[10] Woonggyu Jung, Jun Zhang, Jungrae Chung, Petra Wilder – Smith, Matt Brenner, J. Stuart Nelson, and Zhongping Chen,“Advances in Oral Cancer Detection using Optical Coherence Tomography”, IEEE Journal of Selected Topics in Quantum Electronics, vol. 11, no.4, pp 811 – 817, July-August, 2005.
[11] A. Chodorowski, U. Mattsson, and T. Gustavsson,”Oral Lesion Classification Using True-color Images”, SPIE Proceedings, vol.3661, 21st May, 1999.
[12] R. Jaya Suji. and S.P. Rajagopalan,”An Automatic Oral Cancer Classification Using Data Mining Techniques”, International Lournal of Advance Research in Computer and Communication Engineering, vol.2, issue 10, October, 2013.
[13] Ram Krishna Kumar, M. Monica Subashini, Sarat Kumar Sahoo,”An Automated System for the Detection of Stratified Squamous Epithelial Cancer Cell Using Image Processing Technique”, International Journal of Engineering and Technology, vol..5, no.3, June-July, 2013.
[14] K. Anuradha and K. Sankanarayanan, “Oral Cancer Detection Using Improved Segmentation Algorithm”, International Journal of Advance Research in Computer Science and Software Engineering, vol.5, issue 1, January, 2015.
[15] Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, “Digital Image Processing using MATLAB’, Pearson Education, 2003.
[16] Ghassan Hamarnes, Artur Chodorowski, and Tomas Gustavsson,”Active Contour Models : Application of Oral Lesion Detection in Colour Images”, IEEE Conference on System Man, and Cybernetics, 2000.
[17] K.Anuradha and K. Sankaranaranayan, ”Identification of Suspecious Regions to Detect Oral Cencers at an Earlier Stages – A Literature Survey”, International Journal of Advance in Engineering and Technology, vol..3, issue 1, pp.84-91, March, 2012.
[18] K. Anuradha and K. Sankaranarayanan, “Detection of oral tumor based on marker – controlled watershed algorithm”.International Journal of Computer Applications, vol. 52, no.2, August, 2012
[19] Belvin Thomas, Vinod Kumar, and Sunil Saini, “Texture Analysis Based Segmentation and Classification of Oral Cancer Lesions in Colour Images Using ANN”, IEEE International Conference on Signal Processing, Computer and Control, pp.1-5, 26-28th September, 2013.