Modified Squamous with Biomedical Image Processing

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Abstract: *SQUAMOUS CELL CARCINOMA(SCC) of the lip is an infiltrating and destructive malignant epithelial tumour, with high potential for lymphatic and/or blood metastasizes. Lip SCC is 15-30% of all SCC the cephalic extremity and 1/5 of the upper aerodigestive tract cancers. We conducted a prospective study in Dermatology Clinic from Craiova, between 2004-2010, with the aim of highlighting the epidemiological aspects, clinical and therapeutically evolution of patients with lip SCC.Lip SCC onset occurs frequently on premalignant lesions, especially on chronic keratoziccheilitis, pointing out the importance of early diagnosis and appropriate treatment for preblastomatouscheilitis. Early establishment of treatment of lip SCC offers the safety of therapeutic accomplishment. Option for surgical treatment of T0, T1N0M0 lip SCC is justified by the very good oncological, aesthetic and functional results in most cases. Surgical treatment of primary T0, T1 lesions, respecting the oncological surgery principles makes it not recommended to "filling in" the results with other therapeutic methods. Patients should be regularly examined for a period of at least three years to capture the moment of occurrence of metastases, or a possible relapse of a lip SCC. Actions are needed to educate the population about the risk factors and to detect precancerous lesions and SCC of rim in early stage. To present incisional biopsy importance as an effective clinical approach for the diagnosis of lip squamous cell carcinoma and actinic cheilitis malignancy as well as the professional's lack of knowledge on these two diseases. The physician and dentist must be aware of the main clinical features of lip squamous cell carcinoma so that they can establish its correct diagnosis and early treatment.*

Keywords:*Multi-model image alignment , extrinsic method , intrinsic method, Smoothing ,Enhancement, Thresholding, Histogram Analysis*

1. Introduction

Squamous cell carcinoma (SCC) is an uncontrolled growth of abnormal cells arising in the squamous cells, which compose most of the skin's upper layers (the epidermis). SCCs often look like scaly red patches, open sores,elevated growths with a central depression, or warts; they may crust or bleed. SCC is mainly caused by cumulative UV exposure over the course of a lifetime. It can become disfiguring and sometimes deadly if allowed to grow. An estimated 700,000 cases of SCC are diagnosed each year in the US, resulting in approximately 2,500 deaths. SCCs may occur on all areas of the body including the mucous membranes and genitals, but are most common in areas frequently exposed to the sun, such as the rim of the ear, lower lip, face, bald scalp, neck, hands, arms and legs. Often the skin in these areas reveals telltale signs of sun damage, such as wrinkling, changes in pigmentation, and loss of elasticity. Squamous cell carcinoma most commonly occurs on the lip, floor or roof of the mouth, tongue, soft palate, gums, and other areas of the oral cavity. Symptoms include tender painful lesions, wounds or sores that won't heal, a lump or thickened skin, a white or red patch, loose teeth or dentures, trouble chewing or swallowing, swelling of the jaw, and sore throat. In medicine, squamous cell carcinoma (SCC) is a form of cancer of the carcinoma type that may occur in many different organs, including the skin, lips, mouth, esophagus, urinary bladder, prostate, lungs, vagina, and cervix. It is a malignant tumor of squamous epithelium (epithelium that shows squamous cell differentiation).Incidence of squamous cell carcinoma varies with age, gender, race, geography, and genetics. The incidence of SCC increases with age and the peak incidence is usually around 66 years old. Males are affected with SCC at a ratio of 2:1 in comparison to females. Caucasians are more likely to be affected, especially those with fair Celtic skin, if chronically exposed to UV radiation. There are also a few rare congenital diseases predispose to cutaneous malignancy. In certain geographic locations, exposure to arsenic in well water or from industrial sources may significantly increase the risk of SCC. Squamous cell carcinoma may be classified into the following types:

- Adenoid squamous cell carcinoma (Pseudoglandular squamous cell carcinoma)
- Clear cell squamous cell carcinoma (Clear cell carcinoma of the skin)
- Spindle cell squamous cell carcinoma
- Signet-ring cell squamous cell carcinoma
- Basaloid squamous cell carcinoma
- Verrucous carcinoma
- Keratoacanthoma

2. A brief review on Squamous cell carcinoma

Now a day's most of the people are addicted in smoking and drink alcoholic product. That's why squamous cell carcinoma is one of the most common and deadly disease in the world. VIRGIL PATRASCU and RALUCA CIUREA wearing in paper titled "Lip Squamous Carcinoma- Epidemiologic, Clinical, Evolutive and Therapeutical Aspects [7]" proposed brief review on this subject matter. The distribution by sex was M-78,95%; F-21,05%. The distribution by area of residence: rural 85,53%; urban-14,47%. Average age was 67,79 years (29-84 years). Regarding their profession, most were farmers (76,32%), mechanics (10,53%), constructors (9,21%), the rest having other professions. 84,21% of them were smokers and 42,10% of them have recognized chronic consumption of alcohol. The disease history was between 6 and 14 months. [10]The site of cancer prevailed at the lower lip: 97,37% of cases. I encountered the following clinical forms: ulcerative and vegetant (42,10%), nodular (21,05%), keratozic (15,79%), ulcerative and infiltrating (9,72%), vegetant (5,92%), in situ carcinoma (4,60%) and fisurating form (1.32%). The frequency of chronic keratosickeilites was 49,34% and smoke leucoplasiccheilitis is about 17,76%. In terms of histopathological exam, the situation was the following: well differentiated SC(64,47%), moderately differentiated SC (28,95%), poorly differentiated SC(6,58%). Evaluating therapeutic results, at the end of the time of hospitalization and after 2 years of periodic checks, allowed us to notice healing at 98,03% of the cases. Aesthetic and functional results were very good at 92,76% of patients.For better treatment so many image

processing techniques were developed by various authors. To differentiate cancer cells and non-cancerous cells based on its morphological features, in term of colour texture, size and shape, Jeremiah [8] has introduced pattern recognition of cervix cells. To distinguish attached cancer cells into individual objects, in [9] authors proposed a marker controlled watershed algorithm. This watershed algorithm is implemented by applying the distance transform [10]. Also in paper [11], Prasanna G. shete et al. made use of the marker controlled watershed algorithm. They used stained tissue sample which is contained N and P cells. Image background is removed by using thresholding method. After removing this, rough cell edges are appeared and holes in the bodies. Morphological operation is done to remove these faults. To remove overlapping cells or separating touching cells they used watershed algorithm by using distance transform.[22]Separating touching objects in an image is one of the more difficult image processing operations. The water shed transform is often applied to this problem. The marker based watershed segmentation can segment unique boundaries from an image. The strength of watershed segmentation is that it produces a unique solution for a particular image. The placement of internal and external markers into regions of interest can easily cope with the over-segmentation problem. Another disadvantage of watershed segmentation, again related to the image noise and the image's discrete nature, is that the final boundaries of the segmented region lack smoothness. [8]In this paper [12] for eliminating spike noise and separating cancer cells according to their colour contents PornchaiPhukpattaranont et al. used colour classification using neural network. Mainly stained cancer cells are divided into two parts according to their nuclear colour contents, i.e. brown (P) and blue (N), and brown indicates for positive staining and blue indicates for negative result. According to this colour contents, image pixels are classified by back propagation algorithm. After that they used two segmentation algorithms, i.e. high and low histology noise. [15] Anita chawudhary and Sonitsukhraj sing wearing in paper titled "Lung Cancer Detection using Digital Image Processing proposed image enhancement technique" [13] to improve the quality of image this image enhancement technique are divided by two categories. Those are spatial domain techniques and frequency domain techniques. They also developed the feature extraction method to detect and isolate various desired points or shaped by the help of Binarization and masking approach. The Gabor filter was originally introduced by Dennis Gabor, we used it for 2D images (CT images). The Gabor function has been recognized as a very useful tool in computer vision and image processing, especially for texture analysis, due to its optimal localization properties in both spatial and frequency domain.The image presentation based on Gabor function constitutes an excellent local and multi-scale decomposition in terms of logons that are simultaneously (and optimally) localization in space and frequency domains. A Gabor filter is a linear filter whose impulse response is defined by a harmonic function multiplied by a Gaussian function. Because of the multiplication-convolution property (Convolution theorem), the Fourier transform of a Gabor filter's impulse response is the convolution of the Fourier transform of the harmonic function and the Fourier transform of the Gaussian function. This approach depends on the fact that the number of black pixels is much more than white ones in a normal lung image, so that we started to count the black pixels for normal and abnormal images to get the average which will be denoted later as threshold then each image black pixels will be compared to this threshold, whether it is greater, then it is normal, else the opposite.This method depends on the fact that the masses are appeared as white connected areas inside ROI (lungs) as they increase the percent of cancer presence increase. Combining the two approaches together will lead us to take a decision whether the case is normal or not.Another most successive approach developed by authors that distinguished cancer cells by Fourier transform, [14] calculated based on the mean, variance and entropy. In this paper Thanatip et al. alsoused five different classifier and get more than 85% accuracy. This classifier consists of Linear Discriminant Analysis (LDA), Bayessian Classifier, K-nearnest neighbour algorithms (KNN), Artificial Neural Network (ANN), Support Vector mechine (SVM). Paper [15] describes an image processing systems using MRI image. Pixel Intensity value is measured in booth images but intensity values of cancer cell is higher than normal cell image. In paper [16] Rosidi et al. described the cervical cells based on label colour intensity distribution. In this method morphological operation to be converted into label image, because of easily find out the properties of each and every labelled cells. Due to labelling leukocytes and other elements which present in the cervix cell is pointed out and cell intensity, centroid and area were measured by the boundary tracing method. To find out the boundary 'bwboundaries' function is used and this returns a cell array, where image properties are assigned into the row and column format. In paper [17] Zhi-Hua Zhou* et al. proposed an automatic pathological diagnosis procedure which is two-level ensemble architecture named ensemble architecture named 'Ensemble based Detection (NED)'. In the first ensemble level it is judge that whether the cell is normal or cancerous and second ensemble depending upon the plurality voting or required pathologists to decrease the missing diagnosis. In paper [18] BasimAlhadidi et al. "proposed Mammogram Breast Cancer Image Detection using Image Processing Function". They used MATLAB software and MATLAB toolbox function to detect the cancer cell. [2] Mainly they are used segmentation method by edge-based and watershed segmentation method. To enhance the image contrast they used 'imtophat'(To enlarge the gaps between objects and contains the peaks of the objects) and 'imbothat'(To maximize the contrast between the objects that separate them from each other) transformations. In paper [19] HosseinGhayoumiZader et al. used labVIEW software to recognize and classify the cancer cells. They proposed Gaussian Process, convolution and fast Fourier transform. Gaussian smoothing mainly create a blur effect in image which is as similar as mean filter. Actually it works upon each neighbourhood pixel's which shows a "weighted average".

3. Proposed Solution and Strategy

So many modern instruments are developed for accurate diagnosis of disease detection, but still there are so many diseases such as Squamous cell carcinoma which are primarily investigated by eye observation, for changes its colour texture or dark spot in the lip. [7]In this case accurate depth or spread of this disease is may be erroneous. The Disease diagnosis and intensity measurement may be more accurate by image processing technique.

3.1 Proposed Methodology

The proposed work consists of several steps of techniques of image processing. These steps are described as follow.

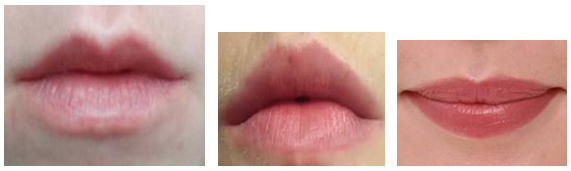


Figure 3.1(a) Sample of Disease Free Lip

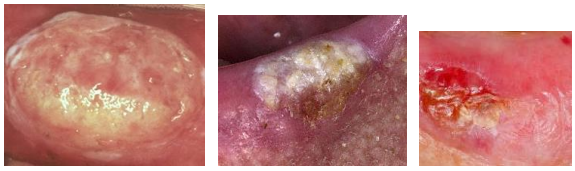


Figure 3.2(b) Sample of Disease Lip

3.2 Image Acquisition

At first capture some squamous cell carcinoma affected lip image in RGB format, and gathered some histopathology image to get better result with high accuracy.[30]

3.3 Image Pre-Processing

In the image Pre-processing stage we started with image clipping; the aim of image clipping is to separating objects from their background in a photograph. After that we perform image smoothing to suppress as much noise as possible, without destroying true edges.[8] Image enhancement is to improve the interpretability or perception of information in images for human viewers, or to provide `better' input for other automated image processing techniques

Figure 1: Testing data- load current (amperes)

3.4 Image Clipping

Clipping refers to the method of separating objects from their background in a photograph. These photo clippings can then be transferred to a plain white background for further investigation. There are several different methods of image clipping, depending on the complexity and given condition of the picture. A clipping path is used to cut out objects with straight or round outlines, and represents the most frequent and professional method. The image editor retraces the objects manually and pixel-precise to create a vector path that separates them from their surroundings. In order to make this vector path as precise as possible, the image editor has recourse to the Bézier curve and additional tools. The result is optimal and pixel-precise clipping of the image; and the extracted object can be placed on a different background without any problems. [25]Clipping offers two major advantages. First, there is the removal of interfering surroundings or shadows to emphasize the picture itself. Second, there is the possibility to insert the object harmoniously into a montage with different backgrounds.[30]

3.5 Image Smoothing

In image processing, to smooth a data set is to create an approximating function that attempts to capture important patterns in the data, while leaving out noise or other fine-scale structures/rapid phenomena. In smoothing, the data points of a signal are modified so individual points (presumably because of noise) are reduced, and points that are lower than the adjacent points are increased leading to a smoother signal. Smoothing may be used in two important ways that can aid in data analysis by being able to extract more information from the data as long as the assumption of smoothing is reasonable and by being able to provide analyzes that are both flexible and robust. Many different algorithms are used in smoothing.[19] Data smoothing is typically done through the simplest of all density estimators, the histogram. Smoothing may be distinguished from the related and partially overlapping concept of curve fitting in the following ways:

- Curve fitting often involves the use of an explicit function form for the result, whereas the immediate results from smoothing are the "smoothed" values with no later use made of a functional form if there is one;
- The aim of smoothing is to give a general idea of relatively slow changes of value with little attention paid to the close matching of data values, while curve fitting concentrates on achieving as close a match as possible.
- Smoothing methods often have an associated tuning parameter which is used to control the extent of smoothing.
- However, the terminology used across applications is mixed. For example, use of an interpolating spline fits a smooth curve exactly through the given data points and is sometimes called "smoothing".

3.6 Image Enhancement

Image enhancement is a very essential sub feature of image processing to highlight the importing features of an image. After converting the RGB image to grayscale image, various enhancement techniques are used (complement of image, intensity transformation, point processing operation, local enhancement, HSV colour transform etc.) for enhancing the original image for clear and sharp result.[30] Mainly enhancement methods can be divided into two broad categories; I.Spatial domain methods(operate directly on the aggregate of pixels composing an image, **)**, II. [12]Frequency domain methods **(**simplycompute the Fourier transform for enhanced an image and multiply the result by a filter also take inverse transform to create enhanced image In order to modify the image brightness, contrast or the distribution of the grey levels.**).** Basic image enhancement technique which is generally used, these are described in schematic diagram. [29]

In this paper to detect the squamous cell carcinoma, we use following enhancement methods by Mat lab software.

- First step: Histogram Analysis
- Second step*:* Histogram Equalization

4. Histogram Analysis

Histogram processing is the act of altering an image by modifying its histogram. Common uses of histogram processing include normalization by which one makes the histogram of an image as flat as possible.[25] This is also known as contrast enhancement. Intensity transformation functions based on information extracted from image such as enhancement, compression, segmentation and description.[22] The Histogram of digital image with the intensity levels in the range is a discrete function.

Where is the intensity value.

is the number of pixels in the image with intensity

is the histogram of the digital image with Gray Level

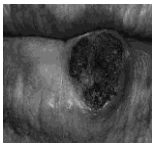
Histograms are frequently normalized by the total number of pixels in the image. Assuming a M × N image, a normalized histogram. (Where K=0, 1,2,3…….L-1 Is related to probability of occurrence of in the image.) gives an estimate of the probability of occurrence of grey level The Sum of all components of a normalized histogram is equal to1. Histograms are Simple to calculate in software and also lend themselves to economic hardware implementations, thus making them a popular tool for real-time image processing.

5. Experimental Results and Discussions

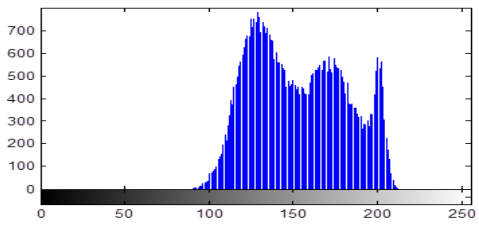
```
x=imread('D:\pic\medical\squamous_cell_cersinoma\3.png');
figure,imshow(x)
I=rgb2gray(x);
figure,imshow(I)
imhist(I)
```

Disease(Original Image) Disease Free(Original Image)

Disease(Original Image) Disease Free(Original Image)



Original Image Gray Scale Image



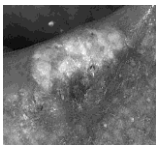


Figure 4.1(a) Histogram Analysis of Normal Lip

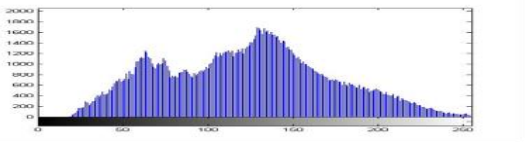


Figure 4.2(b) Histogram Analysis of Disease Affected Lip

6. Histogram Equalization

Image Histogram refers to a graphical representation of tonal (Lightness sometimes called value or tone) distribution of a digital image. It plots the number of pixels at each tonal level. Image histogram equalization is an image processing method for image contrast adjustment. The nice property of image histogram equalization is it makes use of the input image property.[5] It can be very effective for image that has low contrast. Matlab has histogram equalization function built-in, 'histeq'**.** A simple histogram equalization makes use of the Cumulative Distribution Function (CDF),The CDF is able to map the input tonal level for every pixel to a range of [0, 1], once we scale this range to [0, 255], we can produce the output tonal level for every pixel. A histogram is the estimation of the probability distribution of a particular type of data. [7-9]An image histogram is a type of histogram which offers a graphical representation of the tonal distribution of the gray values in a digital image. By viewing the image's histogram, we can analyze the frequency of appearance of the different gray levels contained in the image.[12]

7. Image Segmentation

The division of an image into meaningful structures, image segmentation, is often an essential step in image analysis, object representation, visualization, and many other image processing tasks. [11]A great variety of segmentation methods has been proposed in the past decades, and some categorization is necessary to present the methods properly here. A disjunct categorization does not seem to be possible though, because even two very different segmentation approaches may share properties that defy singular categorization1. The categorization presented in this paper is therefore rather a categorization regarding the emphasis of an approach than a strict division. Generally five segmentation methods are used to image analysis.

Threshold based segmentation:

Histogram thresholding and slicing techniques are used to segment the image. They may be applied directly to an image, but can also be combined with pre- and post-processing techniques.[13]

Edge based segmentation:
With this technique, detected edges in an image are assumed to represent object boundaries, and used to identify these objects.
Region based segmentation:
Where an edge based technique may attempt to find the object boundaries and then locate the object itself by filling them in, a region based technique takes the opposite approach, by (e.g.) starting in the middle of an object and then "growing" outward until it meets the object boundaries.
Clustering techniques:
Although clustering is sometimes used as a synonym for (agglomerative) segmentation techniques, we use it here to denote techniques that are primarily used in exploratory data analysis of high-dimensional measurement patterns. In this context, clustering methods attempt to group together patterns that are similar in some sense. This goal is very similar to what we are attempting to do when we segment an image, and indeed some clustering techniques can readily be applied for image segmentation.[11]
Matching**:**
When we know what an object we wish to identify in an image (approximately) looks like, we can use this knowledge to locate the object in an image. This approach to segmentation is called matching.
Marker-controlled-watershed-segmentation:
This example shows how to use watershed segmentation to separate touching objects in an image. The watershed transform is often applied to this problem. The watershed transform finds "catchment basins" and "watershed ridge lines" in an image by treating it as a surface where light pixels are high and dark pixels are low. Segmentation using the watershed transform works better if you can identify, or "mark," foreground objects and background locations. Marker-controlled watershed segmentation follows this basic procedure:

- Compute a segmentation function. This is an image whose dark regions are the objects you are trying to segment.
- Compute foreground markers. These are connected blobs of pixels within each of the objects.
- Compute background markers. These are pixels that are not part of any object.
- Modify the segmentation function so that it only has minimal at the foreground and background marker locations.
- Compute the watershed transform of the modified segmentation function.

Original image

Figure 6.1(a) Segmented Images for Normal Lip

Segmented image

Figure 6.2(b) Segmented Images for Disease Effected Lip

Original image

8. Conclusion and Future Work

We see that Squamous cell carcinoma is now a common disease and using image processing we identify the disease stages. [27-30]After using Histogram analysis and filtering technique we get better result for detect the disease. After using Sobel gradient algorithm, it is indicated that this approach is more valuable. In future to get more accurate result we will use clustering method or Marker-control watershed algorithm.[26] Also we will dedicate our future works that is developing a web based application. In this application patients upload there disease affected lips and gets instant result that their lips are normal or squamous cell affected lips or minor other lips disease. Another future work is that, now a day's android application is more useful so we try to develop an android application in this subject matter.

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