

## Detection Of Skin Cancer Using Image Processing Techniques

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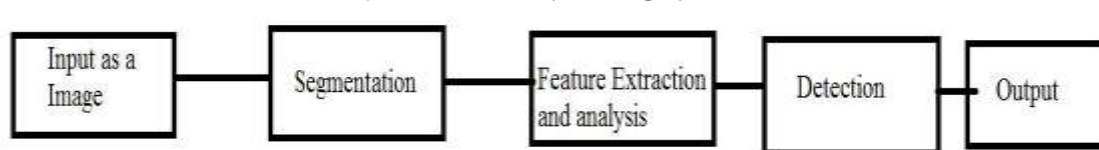
**Abstract**—Smartphones are playing major role in e-health in such a way that m-health is playing a significant role in healthcare industry. Image processing techniques are instrumental in healthcare industry to detect abnormalities in human body. Skin cancer (Melanoma) is one of the most deadly cancers, but when diagnosed early, it can be cured. Reports tell that more than million deaths occur due to Skin cancer itself. This paper speaks about how skin cancer can be detected in early stages using smartphone application by analyzing properties of the cancer, Asymmetry, Border, Color variation, Diameter and Expansion(ABCDE). These properties are analyzed using different image processing techniques like Grey scale conversion, Segmentation, contour tracing and histogram analysis.

**Keywords**- Skin cancer, Melanoma, ABCDE, segmentation, contour tracing, edge detection.

### I. INTRODUCTION

Human Cancer is a complex disease caused mainly by genetic instability and accumulation of multiple alternative molecules. Current diagnostic classifications do not reflect the whole clinical heterogeneity of tumors and are not sufficient to predict for the successful treatment and patient outcome. Most of the currently applied anti-cancer agents do not greatly differentiate between cancerous and normal cells. In addition cancer is often diagnosed and treated too late, when the cancer cells have already invaded into other parts of the body. At the time of clinical presentation, a great percentage of patients with breast, lung, colon, prostate, and ovarian cancer have hidden and over metastatic colonies. At this stage, therapeutic modalities are limited in their effectiveness. Among many types of cancer, Skin cancers are the most common form of cancers in human. It is severe among the faired-skinned population in Europe, North America, and Australia. There are two major types of skin cancer, name malignant melanoma and non-melanoma. Melanoma is more dangerous and can be fatal if not treated. If melanoma is detected in its early stages, it is curable, yet advanced melanoma is lethal.

### II. IMPLEMENTATION



Color images can be represented by three matrices. Each matrix specifies the amount of Red, Green and Blue that makes up the image. This color system is known as RGB. The elements of these matrices are integer numbers between 0 and 255, and they determine the intensity of the pixel with respect to the color of the matrix. Thus, in the RGB system, it is possible to represent 16777216 different colors.

#### 2.1 Grey scale conversion:

Each pixels intensity is determined by the each element of the matrix. For convenience, most of the current digital files use integer numbers between 0 (to indicate black, the color of minimal intensity)

and 255 (to indicate white, maximum intensity), and resulting into 256 different levels of gray. This number of gray levels is enough to work with medical images.

All grayscale algorithms fundamentally use 3 steps.

- 1) Find pixel values of red, green and blue.
- 2) Use averaging algorithm to convert these RGB values into Grey values  

$$\text{Grey} = (R \cdot 0.3 + G \cdot 0.59 + B \cdot 0.11)$$
- 3) Then grey values replace the original RGB values.

## 2.2 Grey level co-occurrence matrix:

Gray level co-occurrence matrix (GLCM) examines through statistical method by considering the spatial relationship of pixels. And the gray level co-occurrence matrix is also called as gray-level spatial dependence matrix. The pairs of pixels with specific values and in a specified spatial relationship occurring in image is calculated by GLCM, and then extracting statistical measures from this matrix. These statistics provide information about the texture of an image. The following table lists the statistics.

Statistic	Description
Contrast	It measures the local variation in the GLCM.
Correlation	Measures the joint probability occurrence of the specified pixel pairs.
Energy	Provides the sum of squared elements in the GLCM. Also known as uniformity or the angular second moment.
Homogeneity	Measures the closeness of the distribution of elements in the GLCM to the GLCM diagonal.

## III. SEGMENTATION:

Segmentation is the method of partitioning an image so that the region of interest can be extracted from the image for analysis. Segmentation is an important step in finding if the image is Cancerous cell since it affects the accuracy in later stages. Segmentation is difficult when there is smooth transition from lesion to skin. Region based, thresholding and edge based algorithms can be used in segmentation.

### 3.1 Gradient vector flow algorithm:

Gradient vector flow algorithm is very popular and efficient algorithm used in various medical imaging problems. Gradient vector flow algorithm is the extension of Snakes or active contour

algorithm. Gradient vector flow converge to boundary concavities and initialization close to the boundary is not required.

The original snake  $S$  is a two dimensional dynamic contour defined parametrically as  $V(s) = [x(a), y(a)]$ , where  $A \in [0, 1]$  that minimizes the energy function:

$$E = \int_0^1 E_{int}(V(s)) + E_{image}(V(s)) + E_{con}(V(s)) da$$

where  $E_{int}$  represents the energy of the contour due to bending, the  $E_{image}$  denotes the energy due to intensity of the image and  $E_{con}$  is constraint energy established by a high-level process.

The object boundary is approximated by an elastic contour  $X(a) = (X(a), Y(a))$ ,  $A \in [0, 1]$  which is initialized in the image domain by the heuristic criteria. The elastic contour is then modified as according to the differential equation:

$$\frac{dy(s,t)}{dx} = F_{int}(X(s,t)) + V_{int}(X(s,t))$$

Where  $F_{int}$  is an internal force, similar to that in traditional snakes helps to keep the shapes continuity and smoothness and  $V = (u(x, y), v(x, y))$  is the Gradient Vector Flow field. The GVF field is a regularized version of the image, edge gradient which allows long range attraction of the contour toward the object boundary even if the contour is located in homogenous region where the gradient is zero.  $V$  can be calculated by minimizing the energy

$$E = \iint \mu (u_x^2 + u_y^2 + v_x^2 + v_y^2) + |\nabla f|^2 |v - \nabla f|^2 dx dy$$

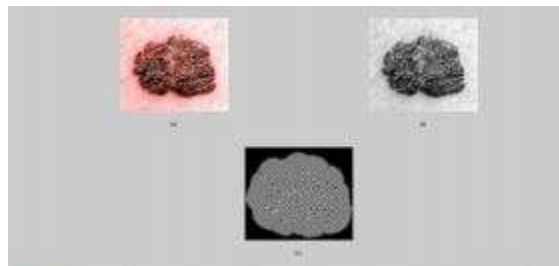


Fig: (a) RGB image,(b) Greyscale image obtained from RGB image(c): Segmented image using Gradient vector flow technique.

### 3.2 Feature Extraction

Feature extraction is done using the properties called ABCDE in automated diagnosis of skin cancer. ABCDE represents Asymmetry, Border, Colour variation, Diameter and Evolution.

**Asymmetry:** Asymmetric nature of melanoma is property in which the imaginary line passing through middle of lesion, either up or down or side to side gives two unequal or two non-symmetric parts. Degree of asymmetry can be calculated by using asymmetric Index which is calculated by using the formula

$AI = \frac{\Delta A}{A} \times 100$ , where  $A$  is the total area of the image and  $\Delta A$  is the difference in area between total image and lesion area.

**Border irregularity:** The border or edge of the skin cancer affected area will be usually blurred or ragged or irregular or notched. Border irregularity is usually calculated by compact index in medical image processing. Compact index is used to estimate unanimous 2D objects. The measure is sensitive to noise along the boundary. Compact index is calculated using the formula

$CI = \frac{Pl * pl}{4\pi Al}$  where  $Pl$  is Perimeter of the Lesion and  $Al$  is area of the Lesion.

**Colour variation:** Emergence in colour variation can be detected if lesion is melanoma. The colours can be variations in black, brown and red depending on the production of melanin pigment in the affected area.

Colour variation can be detected statically and by plotting histograms of the segmented image. The intensity variation is high if there are colour variations.

**Diameter:** Skin cancer (melanoma) usually have diameter more than 6mm. Since diameter is irregular, it is calculated by drawing from edge pixels to pixels in the midpoint and averaged.

#### IV.RESULT ANALYSIS

Segmentation is the first step in early detection of skin cancer. To analyse, it is necessary to accurately locate and isolate the lesions. In this three unsupervised segmentation method for skin lesions have been discussed. In the Ostu's method, it has shown the best segmentation results among the three methods. It is fully unsupervised that does not require any change of parameter for different skin lesions. The second one, the gradient vector flow gets in active contour to boundary concavities, even when the noise is present. The execution speed is very slow and that is the drawback. To converge to objects long time is taken. This method is not fully unsupervised. For different skin lesions changing parameters is required. On the other hand, using colour based segmentation; it is possible to reduce the computational cost avoiding feature calculation for every pixel in the image. Though the colour is not frequently used for image segmentation, it gives a high discriminative power of regions present in the image. This kind of image segmentation may be used for mapping the change in land use land cover taken over temporal period in general but not in particular. Feature extraction is considered as the most critical state-of-the-art skin cancer screening system.

#### V. CONCLUSION

From last two decades melanoma skin cancer is on the rise. So, early detection of skin cancer is very important. If detected at an early stage, skin cancer can be cured, and in most cases, the treatment is simple and involves excision of the lesion. Moreover, at an early stage, skin cancer is very economical to treat, while at a late stage, melanoma skin cancer gets really difficult to cure and also costs a very large amount for the treatment. Four analyses are done when skin lesion is suspected as melanoma. If the suspected skin lesion go through only the three of these, it might be melanoma or not. For this reason, all the four measures are considered to decide whether a skin lesion is melanoma or not. The best way to lower the risk of melanoma is to limit the exposure to strong sunlight and other source of Ultraviolet light. The necessary measures to be taken care are: covering skin with cloth, using sunscreen, staying in the shade. Staying alert about skin and doing monthly skin-self exams to reduce the chance of getting any skin cancer which is a risk to human life.

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