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Digitizing the Skin for Cancer Detection

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Abstract: It is crucial to detect skin cancer at an early stage. Skin cancer has recently gained a reputation as one of the worst human cancers. Among the many forms of skin cancer, the most unexpected is melanoma, but basal cell carcinoma and squamous cell carcinoma are also present. Early diagnosis of melanoma cancer increases the likelihood of a successful treatment outcome. Numerous current technologies have shown that computer vision can play a significant role in medical image diagnosis. Using image processing techniques, we provide a computer-aided approach for detecting melanoma skin cancer in this study. The system takes the picture of the skin lesion as input and uses cutting-edge image processing methods to determine whether or not skin cancer is present. Using analysis of texture, size, and form for picture segmentation and feature phases, the lesion image analysis tools check for the many melanoma characteristics such as asymmetry, border, color, diameter, and so on. Using the feature parameters that were retrieved,

discern between a melanoma cancer lesion and normal skin in the photograph.

Keywords: Cancer, Melanoma, and Digital Images

1. Introduction

In skin health, diagnosis or diagnostics is the process of identifying a skin texture or problem by its signs, symptoms and the result of various diagnosis procedures. The conclusion reached through this process is called a diagnosis. The diagnosis system is a system that can be used to analyse any problem by answering some questions that lead to a solution to the problem. Skin cancer is a malignant tumour that grows in the skin cells and accounts for more than 50 percent of all cancers. In the US alone, more than 1 million Americans will be diagnosed in 2007 with non-melanoma skin cancer, and 59, 940 will be diagnosed with melanoma, according to the American Cancer Society. Fortunately, skin cancers (basal cell and squamous cell carcinoma, and malignant melanoma) are rare in children. When melanomas occur, they usually arise from pigmented nevi (moles) that are large (diameter greater than 6 mm), asymmetric, with irregular borders and coloration. Bleeding, itching, and a mass under the skin are other signs of cancerous change. If a child has had radiation treatment for cancer, nevi in the radiated area are at increased risk of becoming cancerous. Skin Cancer Detection System is the system to identify and recognize skin cancer

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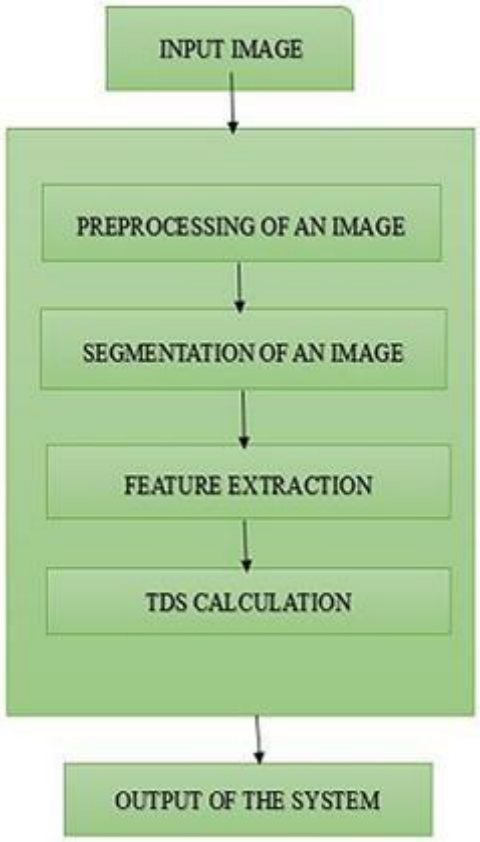

symptoms and diagnose melanoma in early stages. The user can take early prevention of their healthy. Skin Cancer Detection System will help save lots of doctor's time and could help to diagnose more accurate. It also can easily assess the future velopment of skin via dialysis today's age of the skin and put forward the best characteristic skin cancer project to client [1].

2. Image Acquisition

Image acquisition Dermoscopic images are basically digital photographs/images of magnified skin lesion, taken with conventional camera equipped with special lens extension. The lens attached to the dermatoscope acts like a microscope magnifier with its own light source that illuminates the skin surface evenly. There are various types of dermoscopy equipment, but all of them use the same principle and allow registering skin images with x10 magnification and above. Due to light source integrated into dermatoscope lens, there happens to be problem with skin reflections. To counteract this problem, a liquid is used as a medium layer between the lens and the skin. In modern dermatoscope the liquid is not necessary, because of the polarized light source that removes the reflection problem. Digital images acquired using photo dermatoscope are sufficiently high resolution to allow for precise analysis in terms of differential structures appearance.

Dermatologist can create accurate documentation of gathered images, opening a path for computer analysis, where images are processed in order to extract information that can later used to classify those images[6].

3. Image Preprocessing

Image pre-processing before analysis of any image set can take place, preprocessing should be performed on all the images. This process is applied in order to make sure that all the images are consistent in desired characteristic. When working with dermatoscopic images, pre-processing can cover number of features like: image illumination equalization, color range normalization, image scale fitting, or image resolution normalization. This can be dependent on defined prerequisites and methods applied in post processing. An example of elementary operation such as image normalization is the resolution matching. Assuming that the image size in pixels is given, and all images are in the same proportion (e.g. aspect ratio of 4:3), it is easy to find the images of smallest resolution and then scale the larger images to match the size of the smallest one. This operation allows calculating the features like lesion dimensions, lesion border length and lesions area coverage. It is possible to normalize the other parameters like color palette normalization, color saturation normalization, normalization of color components, and so on. Very common operation in preprocessing is color components normalization, known as the histogram

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equalization. Image histogram is the distribution of colors values in between extreme colors used in the palette. Assuming the situation where the brightest points of the grayscale image are not white and the darkest points are not black, performing histogram equalization will redistribute all the colors of the image in a way that brightest spot of the processed image will be color and the darkest regions of the image will become black[7].

4. Segmentation Techniques

A. 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 postprocessing techniques.

B. 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.

C. Edge Detection Based

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 [4].

5. Feature Extraction

As per ABCD rule the features which we need to extract include Asymmetry Index Border Color Index Diameter.

A. Asymmetry Index

Asymmetry Index is computed with the following equation:

AI=(A1+A2)/2Ar

Where, A1= Area of non-overlapped region along minor axis of the lesion A2= Area of non-overlapped region along major axis of the lesion Ar= Area of lession Implementation: Area of lesion(Ar) can be calculated using bwarea over the binary image of the segmented region. For calculating non overlapped area over axis. The segmented region is divided along the lines passing through centroid of the region Two separate areas are generated which are then adjusted so that the areas will be overlapped by flipping one area. Using XOR over the area will generate the non-overlapped region whose area is calculated using bwarea function To generate area along x axis the bisection will be generated using first Gx pixels and the next Gx pixels along x axis and bisecting line on y axis. To generate area along y axis the bisection will be generated using first Gy pixels and the next Gy pixels along x axis and bisecting line on y axis. After calculating area of the regions Asymmetry index is calculated using the specified formula.

B. Border Irregularity

In order to calculate border irregularity, there are different measures such as: compactness index, fractal index, edge abruptness.

Compact Index:: Compact Index can be determined by using the following equation:

CI=(P2L)=(4AL)

Where, PL = Perimeter of the Lesion.

AL = Area of the Lesion.

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Fractal Dimension: Fractal set is provided by the
"boxcounting" method. It returns two variables whose differential log ratio provides the fractal dimension as the mean value along 4-8 index.

Edge Variation: Edge variation is calculated using the following equation EI= ((Max Min)%6+2)/100; Where, Max and min are length of major and minor axis. Axis lengths are calculated using region props function.

C. Color Index

Color index is calculated by converting the input image to hsv image value by checking the presence of the following colors. Length of all the available pixels with given values is divided by total number of pixels. The presence of color is dependent on the value of resultant not equal to zero. For each color present the Color Index is +1.

D. Diameter

The diameter value is said to be 5 if the diameter of lesion is greater than 6mm. For other values the diameter is one less than its actual rounded value. To calculate Diameter the regionprops function is used to get the minor axis length of the lesion region. Resultant value is converted into mm value and the value is assigned to diameter [2].

6. TDS Calculation

Following formula is used

TDS = 1.3A + 0.1B + 0.5C + 0.5D

If the TDS Index is less than 4.75, it is benign
(noncancerous) skin lesion. If TDS Index is greater than 4.75 and less than 5.45, it is suspicious case of skin lesion. If TDS Index is greater than 5.45, it is malignant melanoma (cancerous) skin lesion [2][3].

7. Conclusion and Future Work

Incident rates of melanoma skin cancer have been rising since last two decades. So, early, fast and effective detection of skin cancer is paramount importance. If detected at an early stage, skin has one of the highest cure rates, and the most cases, the treatment is quite simple and involves excision of the lesion. Moreover, at an early stage, skin cancer is very economical to treat, while at a late stage, cancerous lesions usually result in near fatal consequences and extremely high costs associated with the necessary treatments.

After all, the best way to lower the risk of melanoma is to limit the exposure to strong sunlight and other source of Ultraviolet light. Take care of all the necessary measures such as: protecting skin with clothing, wearing hat, using sunscreen, staying in the shade (etc.). Moreover, always stay alert about skin and do monthly skin-self exams to reduce the chance of getting any skin cancer which is a risk to human life.

The final output given by the system will help the dermatologist to detect the lesion and its type, accordingly with his knowledge he will examine the patient to draw a final conclusion whether it can be operated or not or any other way to cure it for e.g. using medicines or ointments, etc. Skin cancer detection System will help Dermatologist to diagnose melanoma in early stages. The future scope of the skin cancer detection system is that it can be more accurate and efficient. The ABCD rule of skin cancer detection is the most adopted method of skin cancer in the world. The scope is that the system can be implemented in the stand alone application. The system can be more reliable and robust. The system may provide the Encryption of data and authentication for the users so that there is no unauthorized access of the data of the patient, because if there is unauthorized access is performed on the data then the data integrity may be lost. In future it is more interactive and use friendly for checking the lesion that if it is cancerous or not [9].

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