Dermoscopy Image Classification using Different Color Constancy Algorithms

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Abstract:
Skin cancers which ensue the cancer from the skin by cause of development of anomalous cells that have the capability to invade or spread to other parts of the body. Three major categories are basal-cell cancer, squamous-cell cancer and melanoma. Melanoma is a sample of cancer that developed from the pigment enclosing cells noted as melanocytes. Melanomas typically arise in the skin although may hardly ensue in the mouth region, intestines, or eye. Identification of skin cancer can be done based on the Melanoma figures. The melanoma figures were enlarged based on four types of enhancement approaches. The enhancement process highlights the affected portion in the images and hence it can be easily identified. The features were separated from the images based on the affine detectors. The extracted features were then classified to identify the defected portions of the images. The target of the process is measured. The main scope of the progress is to distribution the tumorous section in the melanoma figures and to enlarge the images depend on color constancy approaches. To divide the images into patches and extract the features from the images based on the affine features separated from the images. To categorize the tumorous and non-tumorous sections in the images based on SVM classifier.

Keywords: Dermoscopy images, Image color normalization, Color Constancy, Computer Aided Diagnosis System, Color Features

I. INTRODUCTION
Malignant melanoma has a satisfying prognosis if treated early. Exact skin lesion distribution from the background skin is important because some of the features anticipated to be used for diagnosis deal with shape of the lesion and others deal with the color of the lesion correlated with the color of the enclosing skin [1-2]. Melanoma, also noted as cancerous melanoma, is a sample of tumor that expands from the pigment-enclosing cells noted as melanocytes [3]. Melanomas typically occur in the skin but may hardly ensue in the mouth, intestines, or eye. In women it most commonly ensues on the legs, while in men they are most common on the back [4]. Sometimes they expand from a mole within the patient and can be hard to distinguish. The dominant cause of melanoma is ultraviolet light (UV) exposure in those with below levels of skin pigment. The UV light rays may be from either the sun or from tanning apparatus. About 25% develops from moles [7]. Those with many moles, a history of concerned family members, and who have poor immune functions are at greater risk [8-9]. A number of rare genetic defects such as xeroderma pigmentosum (XP) is limited autosomal relapsing ancestral disorder of Deoxyribonucleic acid overhaul and also increase risk. Avoiding UV light and the purpose of sunscreen may avert melanoma. Treatment is typically removal by surgery. In those with marginally larger cancers nearby lymph nodes may be tested for spread. Most people are relieved if spread has not occurred. In those in whom melanoma has spread, immunotherapy, biologic therapy, radiation therapy may better survival. With treatment the five-year survival rates in the USA is 98% among those with localized disease and 17% among those in whom spread has ensued [10-12]. Melanoma is the best speculative type of skin tumor. Universally, in 2012, it ensued in 232,000 people and issued in 55,000 deaths [13]. New Zealand and Australia have the topmost rates of melanoma in the universe. There are also high rates in Europe and North America while it is in a lower degree common in Asia, Africa, Latin and America. They are more natural in men than women. Melanoma has developed into more natural since the 1960s in areas that are mostly Caucasian. In this project, the system investigates four algorithms. The colour constancy methods are Gray World, max-RGB, Shades of Gray color and General Gray World method [14].

II. RELATED WORK
The input images were converted from RGB color space to L*a*b color space. The images were enhanced based on the color constancy of the input images. The color enhancement is based on the contrast enhancement in the L*a*b color space [15]. The thresholding process is employed for the identification of the disease affected portions in the image. The features were then extracted from the detected portions. The extracted features were classified based on the classification methods. In existing system, the system has proposed calibration approach. Its objective was to calibrate images by determining a set of internal camera parameters and transform the image from a device output RGB color space to the standards RGB space [16].
GretagMacbeth color checker chart and determining the relationship between the images and the L*a*b* values of the chart, acquired with a spectrophotometer. The major change is the use of the XYZ color space instead of L*a*b*. Furthermore, the first group tried to correct the non-uniform illumination of the dermatoscope, while in, a chromatic aberration calibration was included. Also take into account the spectral reflectance of the dermatoscope lighting system when computing the transformation matrix. To tackle the aforementioned issues, existing system proposed a calibration system that is software based. Their method performs fully automated color normalization using image content based on the HSV color space. A training step is required to build a set of normalization filters independently using the three channels of the HSV space. The filters obtained in the training step were tested on another dataset and the results showed that the color distribution of the new data set was modified and made closer to the one of the training set. Although this approach does not require hardware information, it still demands a training step. This step upturns the conceptual and implementation complexities of the method. Furthermore, it has to be performed whenever the training set changes. The liability of this existing system is the color enhancement process in the L*a*b* color space does produces enhanced contrast in the images. While enhancing the images in L*a*b* color space noice may occur in the input image. The performance of the process measured indicates that the performance metrics values were very low.

III PROPOSED SOLUTION

The input Dermoscopy images were collected [Benchmark dataset]. The images were enhanced based on four color enhancement methods. Gray World, max-RGB, Shades of Gray method and General Gray World methods were the methods used for the color enhancement. The images were divided into patches. Hessian affine detector features were separated from the input image patches. The extracted features were then classified using Support Vector Machine Classifier. The act of the process is measured in terms of accuracy (ACC), sensitivity (SE) and specificity (SP) of the classifier. The proposed system Gray World, max-RGB, Shades of Gray and General Gray World methods are used. These methods take input image first. And then all images are enhanced by those methods individually. Finally the system gets enhanced image through modification. Gray world is among the simplest estimation methods. The main premise behind it is that in a normal well color balanced photo, the average of all the colors is a neutral gray. Therefore, evaluate the brightness color cast by looking at the moderate color and correlating it to gray. The RGB color exemplary is a preservative color exemplary in that red, green in addition to blue luminous are joined together in numerous ways to emulate a extensive array of colors. The name of the exemplary comes from the labels of the three preservative primary colors are red, green in addition to blue. The vital target of the RGB color exemplary is for the perceiving, portrayal, and demonstration of figures in computerized systems still it has also been used in normal photography. The Max RGB Channel module will replace every pixel with its stable RGB channel component. For example, if a pixel's color value is 255, 45, 22 then this component will take over that pixel with 255, 0, 0 since red is the largest of the triplet RGB values. This module is the best way to investigate the color basis of an image and to afford a form of color segmentation.

This procedure can be looped to try to force the average color to a neutral gray. Usually this is too intense and is an implication that the gray world assumption is not factual in general. The merits of this proposed system is the performance metrics calculated indicates that the proposed method is more efficient. The enhancement applied to the input images enhances the images and hence the regions were segmented more accurately [14].

IV. SYSTEM OVERVIEW

Fig. 1 presents an overview of the proposed system. There were 3 major processes: Color Constancy (Gray World, max-RGB, Shades of Gray, General Gray World), Feature Extraction using Key point Algorithm and Segmentation by SVM classifier. The Dermoscopy image is as shown in Fig.2.
and General Gray World uses the Minkowski norm to estimate the color illumination. General Gray World is the extension of Shades of Gray where image noise is removed by lower frequency filtering using Gaussian filter. Shades of Gray color and General Gray World color constancy algorithms regard that most of the figures need adjustment, since there is a momentous alteration between the predict light and the values for the white light. The Dermoscopy images are normalized using different color constancy algorithms and shown in Fig.3.

**Figure 3.** Color constancy: (a) General Gray (b) Max-RGB (c) Shades of Gray (d) General Gray World

- **Gray World:**
  \[
  \frac{\int I_c(x) dx}{\int dx} = k e_c
  \]

- **Max-RGB:**
  \[
  \max I_c(x) = k e_c
  \]

- **Shades of Gray:**
  \[
  \left(\frac{\int (I_c(x))^p dx}{\int dx}\right)^{1/p} = k e_c
  \]

- **General Gray World:**
  \[
  \left(\frac{\int (I_c^g(x))^p dx}{\int dx}\right)^{1/p} = k e_c
  \]

Where \( I_c \) stands for the \( c^{th} \) constituent of figure \( I \), \( x = (x, y) \) is the location of a pixel, \( k \) is a distribution constant that ensures that \( e = [eReGeB]^T \) has unit section with esteem to the Euclidean norm. \( I_{oc}(x) \) is a smoothed image, obtained by filtering \( I(x) \) with a Gaussian low-pass filter with standard deviation \( \sigma \). Both \( \sigma \) and \( p \) can be tuned according to the dataset.

**B. Feature Extraction:**

A Harris Laplacian point detector algorithm is helps to extract a group of interest points associated with corners or blobs and a small patch is extracted over each key point [14]. Each patch is then characterized by a vector of features. The feature vectors of all training images are clustered into a set of groups (typically a few hundred) and a prototype (centroid) is extracted from each group. During the experiment stage, each new figure is patterned by slight patches and these patches are defined by regional features. Then, the separated features are correlated with the accomplished visual glossary and a histogram is created for that figure and is shown in Fig.4.

**Figure 4.** Feature Extracted Points: (a) General Gray (b) Max-RGB (c) Shades of Gray (d) General Gray World

**C. Segmentation:**

The separated features were then distributed utilizing SVM classifier in order to determine the normal and the tumor affected portion in the images and is shown in Fig.5 and Fig.6. SVM classifier classifies the images depend on the kernel functions for the identification of different classes in the images. SVM is a double (binary classifier) which classifies the input images into two categories like normal or tumorous [14].

**Figure 5.** Tumorous Portion

**Figure 6.** Segmented Image: (a) Tumorous portion, (b) Non-tumorous portion

**D. Performance Evaluation:**

The system estimated the color of the illuminant for the Dermoscopy images using the four color constancy algorithms. To calculate the act of each system, computed three metrics: specificity (SP), Sensitivity (SE), and accuracy (ACC). SE conforms to the percentage of melanomas that are precisely distributed, SP is the percentage of properly distributed benign wounds, and ACC is described as follows [14]:

\[
\text{SP} = \frac{TP}{TP + FP} \\
\text{SE} = \frac{TP}{TP + FN} \\
\text{ACC} = \frac{TP + TN}{TP + TN + FP + FN}
\]
V. DERMOSCOPY APPLICATION

Dermoscopy differentiate melanocytic from non-melanocytic images. Early detection of melanoma. To establish the colors of Dermoscopy images before practicing and examining any system. To improve Dermoscopy figures based segmentation and identification using color enhancement. Dermoscopy may reduce the number of serious injury lesions excised.

VI. CONCLUSION

The images were obtained from the melanoma dataset. The images were enhanced based on enhancement methods in order to identify tumor portions more clearly. Melanoma is a type tumor that develops outside of the pigment enclosing cells noted as melanocytes. Identification of skin tumor can be done based on the Melanoma images. Four types of methods were used for the enhancement of the color images. The features were separated from the patches separated from the input figure. The separated features were segmented based on the SVM classifier. The regions that were classified as tumor portions were represented in separate notations. The performance of the process is measured depend on the performance metrics.

VII. FUTURE WORK

The mechanism can be further enhanced by including different methods for the segmentation process. The SVM classifier can be replaced by different classifier in order to identify the tumor portion in the images more effectively. The Fuzzy Nearest Neighbor classifier can be used instead of SVM classifier in order to enhance the overall performance of the process. In SVM classification the kernel functions defined determines the accuracy of the classification. In FNN the classification process is employed based on distance measured using fuzzy rules. Distance metrics minimizes the overall complexity in the process and also the accuracy of the process is much improved.

VIII. REFERENCES
