Review of Challenges Faced in Automated Diagnosis of Skin Lesions in Dermoscopy Images

Ms. J. Jacinth Poornima  
Karunya University  
Dr. J. Anitha  
Karunya University  
Asha Gnana Priya.H  
Karunya University

ABSTRACT
For few decades, the skin lesions are variously classified as a very challenging task due to the contrast, huge sub variations of skin lesions between melanoma and non-melanoma lesions. Melanoma is the deadliest form of skin cancer. Incidence of death rates have been increasing especially among white skinned humans, but survival of fittest are at high risk. This paper critically reviewed the existing state of art techniques available for melanoma detection through digital image processing methods, i.e., skin images, image enhancement, image segmentation, feature extract, classifier, skin lesions abnormalities, performance analysis. We have compared and enlisted recent performance analysis which will enable us to compare the difference in detection of melanoma in dermoscopy images. Thus, the identified scope of this paper also gives suggestions for further improve the accuracy.

Keywords  
Dermoscopy, preprocessing, image segmentation, skin lesion classification.

INTRODUCTION
Malignant Melanoma is one of the most rapidly increasing cancers all over the world, with the estimated new cases of 76,380 and estimated death of 10,130 in the United States in 2016 [1]. It develops when skin cells multiply rapidly because of mutations in their DNA caused by UV exposure. Melanomas originate in the pigment-producing melanocytes in the basal layer of the epidermis; they often resemble moles and are generally black or dark brown. Melanoma accounts 75% of death associated with skin cancer. Dermoscopy assessment is widely used in the diagnosis of melanoma and obtains much higher accuracy rates than evaluation by naked eyes. Melanoma accounts for 1-3% of all malignancies. It has an increasing incidence worldwide. It is commonly seen in the lower extremities and metastasizes to the draining lymph nodes. Other common primary sites are trunk/head and neck. The most common sites of metastases include inguinal lymph node, lung, brain, liver, bone marrow and intestine. Many studies from abroad have shown the most consistent and useful features of melanoma on fine-needle aspiration cytology (FNAC) specimens. There are not many cytological studies describing the morphological spectrum of melanoma in India. Hence, this study was undertaken to try in describing the various cytomorphological features of melanoma.
Graph No 1 – Graphical Representation of percentage of death with respect to the age factor.

**BLOCK DIAGRAM**

1. **DERMOSCOPY IMAGES**
2. **PRE-PROCESSING**
3. **IMAGE SEGMENTATION**
4. **PERFORMANCE ANALYSIS**

**DERMOSCOPY IMAGES**

The increasing incidence of melanoma has recently promoted the development of computer-aided diagnosis systems for the classification of dermoscopic images. The PH² dataset has been developed for research and benchmarking purposes, in order to facilitate comparative studies on both segmentation and classification algorithms of dermoscopic images. PH² is a dermoscopic image database acquired at the Dermatology Service of Hospital Pedro Hispano, Matosinhos, Portugal. This image database contains a total of 200 dermoscopic images of melanocytic lesions, including 80 common nevi, 80 atypical nevi, and 40 melanomas. The PH² database includes medical annotation of all the images namely medical segmentation of the lesion, clinical and histological diagnosis and the assessment of several dermoscopic criteria (colours; pigment network; dots/globules; streaks; regression areas; blue-whitish veil).

**IMAGE ENHANCEMENT / PRE-PROCESSING**

Image pre-processing before analysis of any image set cantake place, pre-processing 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. We are using Dull-Razor filter to remove the noise and is explained as follows: 1) It identifies the dark hair locations by a generalized grayscale morphological closing operation, 2) It verifies the shape of the hair pixels as thin and long structure, and replace the verified pixels by a bilinear interpolation, and 3) It smooths the replaced hair pixels with an adaptive median filter.

**IMAGE SEGMENTATION**

The patch of skin lesion in a dermoscopic image, is a single bounded region that is differentiated from the normal surrounding skin by the variance of colour and texture, this determines the region of interest[11]. To segment these skin lesions from dermoscopy images are further classified as melanoma and non-melanoma so that the classification stage can extract more specific and representative features within the lesion regions instead of performing it in the whole dermoscopy images. [2] The edge of the segmented melanoma region is called as the border or boundary, also provides features for use in the analysis of the lesion[17]. Correct identification of the non-melanoma area, ignoring artefacts present in some images, also provides a region of normal skin for calculating relative colours and other useful features [18] [19]. The absence or presence of streaks in a skin lesions, by further analysing the appearance of detected streak lines, and performing a three-way classification for streaks, Absent, Regular, and Irregular, in a pigmented skin lesion. Orientation estimation and correction is applied to detect low contrast and fuzzy streaklines and the detected line segments are used to extract clinicallyinspired feature sets for orientation analysis of the structure. A graph representation is used to analyse the geometric pattern of the structure over the lesion with new features designed to model the distribution and coverage of the structure. These results demonstrate that the proposed approach can locate, visualize, and classify streaks as Absent, Regular, and Irregular in dermoscopy images. Therefore, it can be used in computer-aided melanoma diagnosis using scoring methods. Furthermore, since the proposed method locates streaks and provides qualitative analysis, it can be used to highlight suspicious areas for experts’ diagnosis and for visualization and training purposes. The method has been successfully applied in the specific case of automatic detection and classification of streaks, which are represented by linear radial patterns. These oriented patterns, produced by propagation, accretion, and deformation in radial phase, are common in nature and in different fields of computer vision, and they are an important class for visual analysis. In future work, the segmented line segments will be investigated more locally to deal with this problem more accurately, by carefully analysing the lesion shape and fitting multiple ellipses. In such cases, as many streaks as possible would be captured[7].

![Image](image.jpg)

**Fig. 1.** Difficulties of dermoscopic images; (a) presence of hair; (b) smooth transition between lesion and skin; (c) multiple coloured lesions; and (d) specular reflections [4].
PERFORMANCE ANALYSIS

Performance measures generally used for assessing the segmentation and classification of dermoscopy images are Accuracy (AC), Sensitivity (SE), Specificity (SP). These evaluation criteria are used to calculate for various dermoscopy images and then average of each criterion on the whole testing dataset to get the final results. The criteria are defined as:

$$AC = \frac{N_{tp} + N_{tn}}{N_{tp} + N_{fp} + N_{fn} + N_{tn}}$$  \hspace{1cm} (1)

$$SE = \frac{N_{tp}}{N_{tp} + N_{fn}}$$  \hspace{1cm} (2)

$$SP = \frac{N_{tn}}{N_{tn} + N_{fp}}$$  \hspace{1cm} (3)

Where $N_{tp}, N_{tn}, N_{fp}, N_{fn}$ denote the number of true positive, true negative, false positive and false negative, respectively and they are all defined on the pixel level.

<table>
<thead>
<tr>
<th>S.NO</th>
<th>PAPER</th>
<th>DATABASE</th>
<th>NO.OF IMAGES USED</th>
<th>METHODS</th>
<th>PERFORMANCE MEASURE OF SEGMENTATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SE%</td>
</tr>
<tr>
<td>1</td>
<td>Fengying Xie [3]</td>
<td>Xanthous Race</td>
<td>240</td>
<td>SGNN</td>
<td>95</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Caucasian Race</td>
<td>240</td>
<td>SGNN</td>
<td>83.33</td>
</tr>
<tr>
<td>2</td>
<td>Lequan Yu [2]</td>
<td>ISBI 2016 Skin lesion analysis towards melanoma detection dataset</td>
<td>900</td>
<td>FCRN</td>
<td>54.7</td>
</tr>
<tr>
<td>3</td>
<td>Yading Yuan [5]</td>
<td>PH2</td>
<td>900</td>
<td>DCNN</td>
<td>92.6</td>
</tr>
<tr>
<td>4</td>
<td>Amir Reza Sadri [10]</td>
<td>-</td>
<td>30</td>
<td>1.FGWN</td>
<td>94.34</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.NN</td>
<td>93.36</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3.FBSM</td>
<td>88.41</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4.GVF</td>
<td>83.96</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5.AT</td>
<td>83.33</td>
</tr>
<tr>
<td>5</td>
<td>Jeffrey Glaister [6]</td>
<td>Dermquest Database</td>
<td>126</td>
<td>1.TDLS</td>
<td>91.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.Otsu-PCA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3.Otsu-RGB</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4.Otsu-R</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5.L-SRM</td>
</tr>
</tbody>
</table>

Table No 1. The classification and segmentation performance of different methods which are analysed from various papers

CONCLUSION

In this study, the performance analysis gives us the clear picture of how the image segmentation can be done for the different database along with the different methods that are used. The further process can be refined by using optimization techniques to get better results in comparison to the similar previous studies.
REFERENCES