

Melanoma Extraction Using Information Theory & Its Diagnosis Using Deterministic Scoring Based Approach

Priya Sharma
M.Tech Student,

Department of Computer Science & Engineering,
Mewar College of Engineering & Technology,
Mewar University, Chittorgarh (Rajasthan)
priya.sharma729@gmail.com

B.L. Pal

Head of Department
Deptt. of Computer Science & Engineering,
Mewar College of Engineering & Technology,
Mewar University, Chittorgarh (Rajasthan)
contact2bl@rediffmail.com

Abstract— Malignant Melanoma, essentially the most deadly type of dermis cancer, has a good prognosis if dealt with in the curable early levels. Early prognosis and surgical excision is probably the most robust treatment of melanoma. In this article, we use some data set clinical dermatoscopic images of skin lesions, in which some images are of malignant lesion and some images are of benign lesion, image pre-processing and segmentation techniques is used to distinguish melanoma from benign pigmented lesions. This study reward Asymmetry, Border Irregularity, color variation and Diameter characteristic and extraction of Dermatoscopic images for melanoma dermis cancer prognosis. This selection is used to calculate Total Dermatoscopic Score (TDS) for melanoma epidermis melanoma analysis. The pertinent proves that Havrda Entropy and Harris Corner Detector based melanoma diagnosis approach achieve more sensitivity with respect to Otsu and Harris based combined approach. While as compared to prior arts the sensitivity performance of proposed scheme outperforms the standard arts of Zagrouba and Joanna. The targeted model achieved an specificity and sensitivity of 27.48% and 92.45% respectively.

Keywords—malignant melanoma; image segmentation; entropy; dermatoscopic.

I. INTRODUCTION

Cells are the building blocks that make up tissues. Tissues make up the epidermis and different organ of the body. Cancer cell growth is one-of-a-kind from usual cell growth. Cancer cells can unfold to other components of the physique through the blood and lymph methods. When cells of the body at a specified site begin to grow out of control, they are going to emerge as cancerous. Now not all tumors are cancerous; Tumors may also be benign and malignant. The reasons of cancer are complex, various, and understood in part most effective. There are quite a lot of matters which are known to increase the chance of melanoma, including special infections, exposure to radiation, lack of physical endeavor, obesity, tobacco use, dietary causes, and environmental pollutants. There are countless approaches to observe cancer, which includes the presence of targeted signs and indicators, clinical imaging or screening exams. As soon as a kind of melanoma perhaps possible is detected, it's identified by microscopic examination of a tissue sample. When cancer starts off evolved, it invariably produces no signs. Neighborhood symptoms may just occur as a result of the mass of the tumor or its acceleration. For illustration, the mass results from lung melanoma can purpose blockage of the bronchus leading to cough or pneumonia; esophageal melanoma can motive narrowing of the esophagus, making it difficult and painful to swallow; and colorectal cancer may just result in narrowing or blockages within the bowel, resulting in alterations in bowel habits [2].

The fundamental and essential categories of melanoma comprise[10]:

- Carcinoma: - Cancer that evolved within the epidermis or in tissues that line or duvet inside organs. It has a number of subtypes, which involves adenocarcinoma, basal cell carcinoma, squamous cell carcinoma, and transitional cell carcinoma.
- Sarcoma: - A type of cancer that begins in bone, cartilage, fat, muscle, blood vessels, or other connective or supportive tissue[9].
- Leukaemia: - Probably the most cancer forms which begins in blood-forming tissue such as the bone marrow and causes big numbers of abnormal blood cells to be produced and enter the blood Lymphoma and myeloma - cancers that start within the cells of the immune procedure[6].
- Central nervous system cancers: - It begins in the tissues of the brain and spinal cord.
- Germ cell tumor: - A type of cancer which is derived from pluripotent cells, most often presenting in the testicle or the ovary (Seminoma and Dysgerminoma respectively)[9].
- Blastoma: - It is derived from immature "precursor" cells or embryonic tissue. Blastomas are more common in children than in older adults.

II. LITERATURE REVIEW

In this section a walk through about the existing work and techniques for detection of melanoma is given. The various approaches used in the previous research are illustrated as under[10]:

- In [2], validated in his study that MATLAB is strong software for the early prediction and prognosis of malignant melanoma by utilizing numerical image processing procedures. Only a few lines of compactly written code are sufficient to be able to program the required algorithms.
- In [3], reviewed systems by means of first of all offering the visible points used for skin lesion classification and ways for outlining them after which described extraction of these features by way of digital image processing approaches, i.e., segmentation, registration, border detection, color and texture processing.
- In [6], provided introduction on SVMs and a number of applications of SVMs in sample cognizance issues. SVMs had been effectively utilized to a number of applications ranging from face detection and cognizance, object detection,

realization and handwritten persona & also digit cognizance, speaker and speech cognizance, and knowledge and picture retrieval, prediction etc.

- In [11], studied area detection strategies of Gradient-situated and Laplacian centered. The application used to be implemented utilizing MATLAB.

III. PROPOSED WORK & IMPLEMENTATION

The contribution proposed in this thesis can be listed as below:-

- Consider clinical images of skin cancer patients using high speed cameras.
- Medial filtering and histogram preprocessing to avoid uneven illumination problem.
- Utilization and comparison of novel image segmentation algorithms Otsu and Entropy based approach for lesion extraction.
- Deployment of Harris Corner Detector to account border irregularity.
- Utilization of Total Dermoscopic Value to define the weight coefficients.

For the detection of malignant melanoma, we are utilizing Image Processing Toolbox in MATLAB. The purpose of computerized-aided epidermis melanoma detection process is to discover probably malignant lesions within the acquired graphics of affected skin. The processing consists of extracting the valuable and desired understanding of the skin lesion. It means that an image processing system will take a picture as an input and gives again an extra image as an output.

A. Image Segmentation

An image segments into its constituent regions or object. There are various segmentation techniques, discussed by scholars in literature. The simplest method of photo segmentation is called the thresholding method. This procedure is based on a threshold price to transform in to a gray-scale photo right into a binary picture. Premiere threshold separates one of kind objects from history [1,5]. Threshold determination in a image segmentation is a very complicated mission. It provides main understanding about image and play predominant function in segmentation of photo.

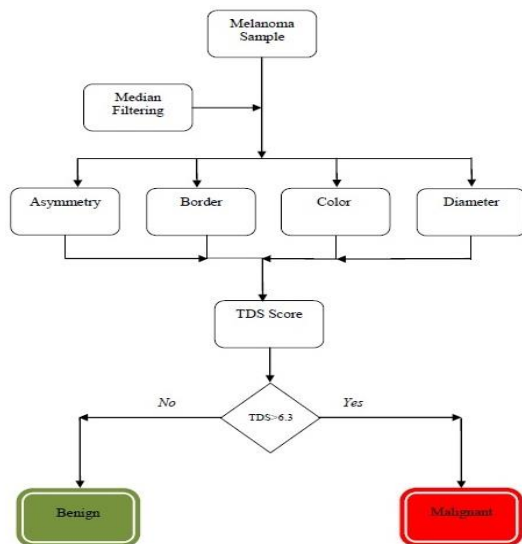


Fig. 1. Flow Diagram of Melanoma Detection and Classification

1) Histogram-based methods

Histogram-established ways are very effective when compared to other photo segmentation methods for the reason that they ordinarily require just one move by means of the pixels. In this technological know-how, a histogram is computed from all the pixels in photograph, and the peaks and valleys within the histogram are used to locate the clusters in the picture [11].

2) Entropy based approach

The methodology of snapshot segmentation using the gray level co-occurrence matrix (C_{m₁,m₂}).

The basic steps of the algorithm are reproduced right here for the sake of convenience [5]:

- First of all, the co-occurrence matrix C_{m₁,m₂} [5] of the image to be segmented is computed for each color channel.
- The probability distribution P_{m₁,m₂} = C_{m₁,m₂} / MN is then calculated from its co-occurrence matrix C_{m₁,m₂}.
- Entropy function for each entropy definitions, as defined below, are then calculated for each t ∈ [0,1,2,...,L-2] for a given image to be segmented using the probability distribution P_{m₁,m₂}.
- The numbers of minima points are determined from the entropy function versus gray level (t) plot. The gray and color component level corresponding to the smallest minima may be taken as a threshold for image segmentation problems[2,7].
- Below table depicts different entropy measures [8]-[11], which are used in this thesis for a comparative study in image segmentation problems.

TABLE1: ENTROPY FUNCTIONS

Entropy Function	Functional Representation
Shannon	$\sum_{\forall m_2} \sum_{\forall m_1} P_{m_1, m_2} * \log(P_{m_1, m_2})$
Renyi	$H_s p(m_1, m_2) = \frac{1}{1 - \alpha} \log \sum_{m_1} \sum_{m_2} (p_{m_1 m_2})^\alpha$
Havrda	$H_s p(m_1, m_2) = \frac{1}{2^{\alpha-1}} \sum_{m_1} \sum_{m_2} p_{m_1 m_2}^\alpha - 1$
Kapur	$H_k p(m_1, m_2) = \left(\frac{\sum_{m_1} \sum_{m_2} p_{m_1, m_2}^{\alpha+\beta-1}}{\sum_{m_1} \sum_{m_2} p_{m_1, m_2}^\beta} - 1 \right) (2^{1-\alpha} - 1)^{-1}$
Vajda	$H_v(p_{m_1, m_2}) = \left(\frac{\sum_{m_1} \sum_{m_2} P_{m_1, m_2}^\alpha}{\sum_{m_1} \sum_{m_2} P_{m_1, m_2}} - 1 \right) (2^{1-\alpha} - 1)^{-1}$

IV. FEATURE EXTRACTION

The features used for the diagnostic method for the detection of melanoma are Asymmetry (A), Border (B), Color (C), Diameter (D) and Evolving (E).

Asymmetry (A): About 1/2 the time, a melanoma develops in a present mole; in other cases it arises as a new lesion that may resemble a traditional mole. A noncancerous mole is commonly symmetric and circular in form, at the same time melanoma traditionally grows in an irregular, asymmetric manner[7].

Border Irregularity (B): benign lesions generally have clear defined borders. A melanoma in contrast, often shows notched or indistinct borders that may signal ongoing growth and spreading of the cancer[4].

Color Variation (C): One of the earliest signals of melanoma could also be the appearance of more than a few colors within the lesion. In view that melanoma arises within pigment forming cells, there by large varicolored lesion of tan, dark brown, or black reflecting the construction of melanin pigment at one-of-a-kind depths inside the epidermis[11].

Diameter (D): early melanoma tends to grow larger than common moles and show typically at least a diameter of about 6mm[6].

V. EXPERIMENTAL RESULTS

In this section we discuss the simulation outcome carried out in MATLAB on the melanoma images. Tests of correct implementation of the dermoscopy ABCD rule method were carried out on the data sets of images, instances of which are depicted by Table2. The system has been tested on 184 lesions (144 malignant and 40 benign lesions).Dataset inherited[12].

Brought simulation outcome for lesion segmentation are proven in Table 3. The horizontal coordinates of entropy plot represents the possible grey value of thresholding while vertical axis represents the associated entropy value.

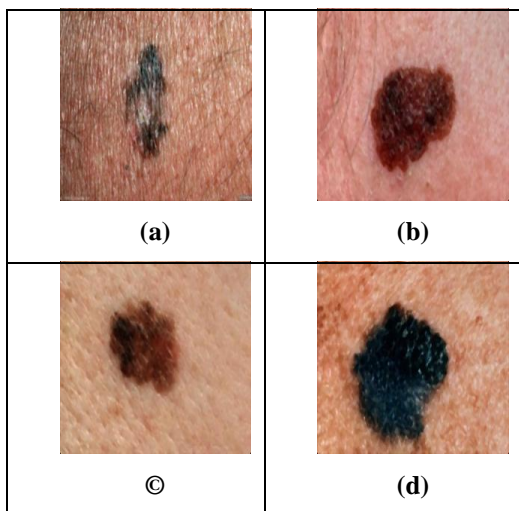
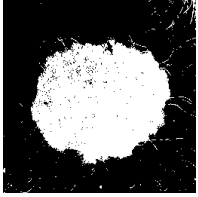
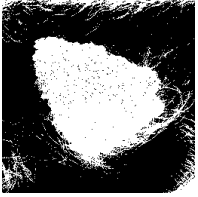
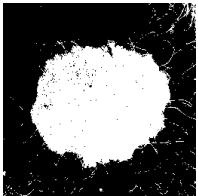
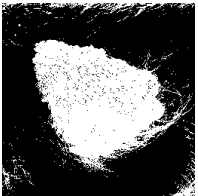


TABLE 2: Melanoma Images Under Investigation [12]

TABLE 3: Original images & entropy based segmentation results for different segmentation approach

IMAGE		
SHANNON ENTROPY		
KAPUR ENTROPY for $\alpha = 0.5$ $\beta = 3$		
VAJDA ENTROPY for $\alpha = 2$ $\beta = 1$		
RENYI ENTROPY For $\alpha = 2$		

<p>HAVRDA-CHARVAT For $\alpha = 0.5$</p>		
<p>OTSU METHOD</p>		

dermatologist but first and foremost by family physicians. This is an opportunity for people that live in remote and rural areas outside the regional center and are faced with the usual difficulties of making an appointment with a dermatologist. It is very important to diagnose melanomas in the early stage because it will reduce the melanoma-related mortality rate.

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The ABCD feature results obtained for investigated image set are mentioned in the Appendix section, which contain the Asymmetry score (A), Borders (B), Color variation (C), Diameter (D), Total Dermatoscopic Score (TDS) and the interpretation that the lesion is benign or malignant. The TDS score less than and equal to TDS threshold D are benign lesions and TDS greater than D are malignant lesions. TDS plot shown in fig.2.

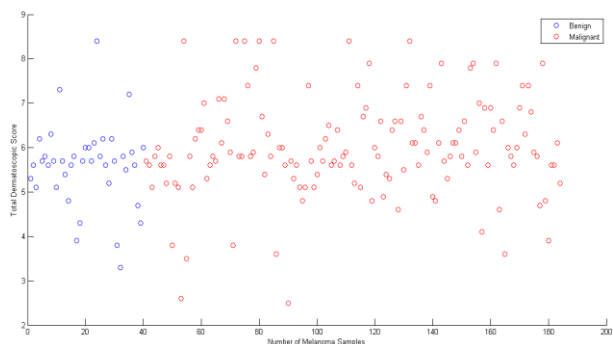


Fig.2: TDS plot for Havrda Entropy based feature extraction

TDS threshold D = 6.3 (in order to achieve optimum results with respect to Otsu and Entropy plot)

VI. CONCLUSION

In the article, we attempted to diagnose melanoma from color skin images using image processing techniques. Achieved results indicate that the application can be used for the diagnosis of malignant melanomas. It can be used not only by young inexperienced