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Decision Support System Analysis for Malignant Melanoma Detection

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Abstract— One of the most deadly dangerous disease is cancer which is among human beings. Skin cancer is of different types that is found recently among humans. Melanoma is one such type of skin cancer which causes majority of death rate. Biopsy method leads to conventional clinical diagnosis for detection of melanoma. The study in this paper presents different benchmarking techniques for melanoma prediction and evaluation. The main challenge is detection of malignant melanoma, which is found to have asymmetrical, irregular borders, notched edges and colour variations. The various stages of skin cancer prediction were analyzed in this paper. A detailed study on various techniques of medical image processing as applied to melanoma images for past years which need the more attention which is discussed here. The techniques and methods that exit are helpful in each of these process are evaluated and summarized. The paper aims at presenting an analysis on to identify on investigation efforts required to group and classify the sub categories available in the literature and to provide a summary of all the available methods for identification of melanoma cancer.

Index Terms— Melonama, ABCD rule, cancer predictio

I. INTRODUCTION

Though there are many soft portions in the body, skin is considered to body sensitive one. It consists of several layers with distinct features with white light passing onto the inner layers with some being absorbed, scattered and remitted back. There are hard and soft layers which should be noted which have potential impact. The protective layer (stratum corneum) contains keratin impregnated cells which varies significantly by means of thickness. The epidermis layer composes of connective tissues. Melanin cell is a strong pigment in it that absorbs ultra violet (UV) radiation which requires careful attention in protecting the deeper layers from such exposure as it does not absorb the light. The dermis has collagen fibers, blood vessels and nerve ends. Figure 1 presents the basic structure of skin presenting the internal parts. Figure 2 and Figure 3 is our concern which shows the presence of benign and malignant melanoma images respectively.

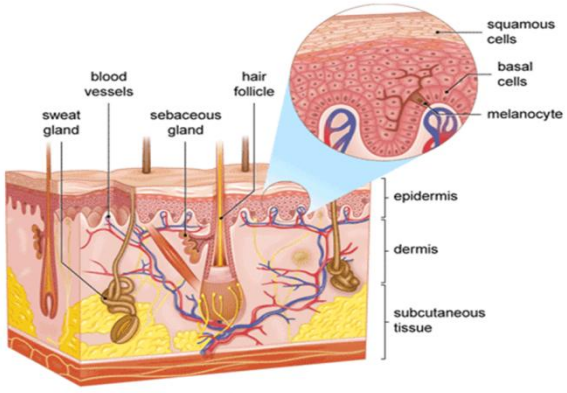

Fig 1:Basic structure of the skin

Fig 2: Benign images

Fig 3: Malignant melanoma images

There are various stages of cancer as presented in Figure 4. Figure 2 & Figure 3 shows pigmented lesions on the skin that appear as patches of darker color which possibly would be a symptom of melanoma.

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If it is of benign type, melanin deposits are found in the epidermis level and for the malignant type, melanocytes reproduces the melanin at abnormal rate. Malignant melanoma is highly pigmented skin which has been penetrated into the dermis with skin colour changes with thick collagen fibers in the papillary dermis resulting in increased blood supply. The color in the dermis shows the deposits of melonama. Melanoma type of skin cancer starts from melanocytes with some noted risk factors like exposure to sunlight, presence of unusual moles, genetic predisposition and various others factors analyzed using classifiers [15]. Melanoma is leading cause of morality (75%). The time line is presented in Figure 5, which shows survival rate of melanoma for past 10 years. Cancer detection at early stage as shown Figure 4 would reveal a simple excision for early recovery. The cancer prediction is usually done using biopsy method as presented in Figure 6, with skin lesions being extracted or removed and tested over a period of time.

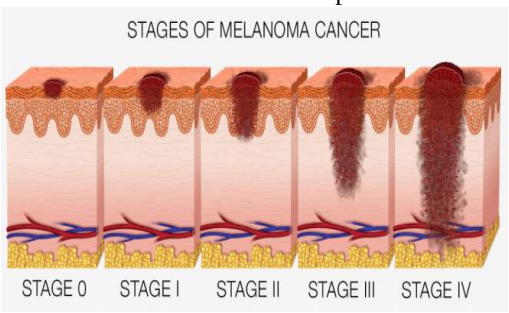

Fig 4: Stages of cancer

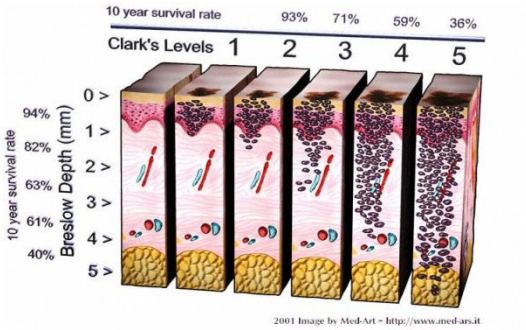

Fig 5: Clark's levels of melanoma stages

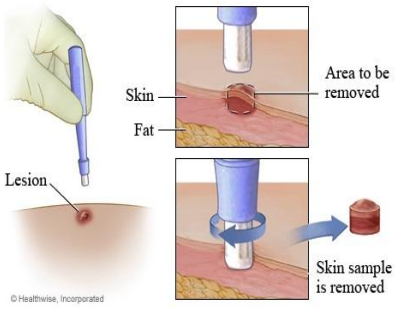

Fig 6: Biopsy method

II. BASCIS OF MELANOMA PREDICTION

The paper in this section discusses on various types of Melanoma like those of Basal Cell Carcinoma (BCC) and other types. Among several types. melanoma is the most unpredictable and leave great challenge for human study [10]. Nearly 40% of melanomas arise from a preexisting mole. Melanoma appears suddenly as a new mole or it can even develop slowly on mole that exists eralier. Hence forth idetying them through a standardized process is challenging and it varies across men and women. The areas were melonama occurs are between the shoulders, hips, head, toe nails, palm areas and neck areas. Figure 7 presents different types of melonama. Figure 8 presents a broad view of skin cancer prediction process. The way of prediction is detailed below in several subsections here.

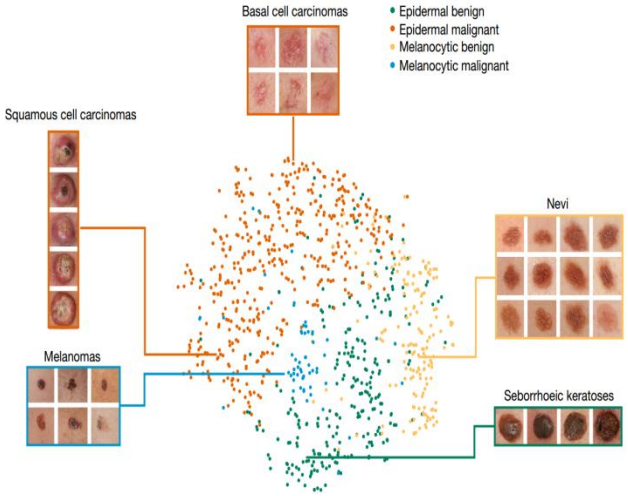

Fig 7: Types of melanoma

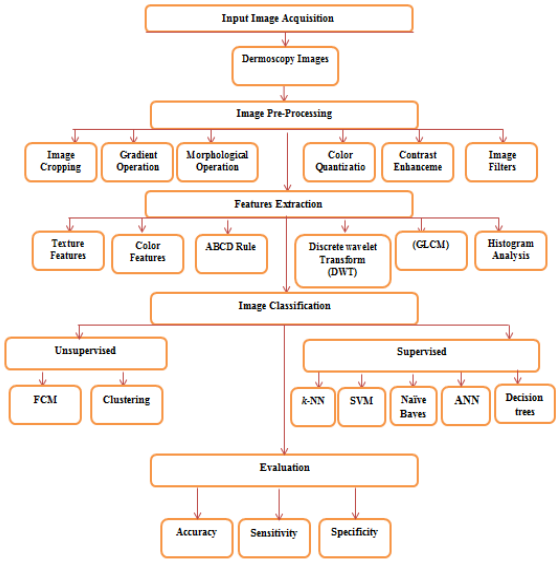

Fig 8: Overall process of skin cancer Detection

2.1 Dermoscopic criteria

One of the predominant set of features is the study to perform clinical diagnosis [11]. It is to be noted that the features that are most widely used in diagnosis procedures such as the ABCD rule. These rules work using the seven point check list which is commonly used is discussed in later part of the paper. In clinical diagnosis, dermoscopy improves diagnostic accuracy with the help of trained physicians. Computer aided diagnosis (CAD) may be used to identify these pigmented skin lesion from the dermoscopic images.

For the clinical diagnosis, Dermoscopy improves diagnostic accuracy depends on the trained physicians. As mentioned in the previous section, melanoma classification process from uninfected skin is done using the ABCD rule [5]. This is done with several features is presented in Figure

9. Figure 10 presents the detection of existing melonama with ABCD rule used by several researchers.

Asymmetry	One half of the tumour does not match the other half
Border Irregularity	The edges are ragged, notched, Blurred
Colour	Pigmentation is not uniform
Diameter	Greater than 6 mm and growing
Evolving	Evolving lesion over time
Firm	Lesion is firm to touch
Growing	Growing rapidly in short time(a few months or weeks)

Fig 9:ABCD Rules

The asymmetry is one another feature for diagnosing a melanocytic lesion which needs experienced clinician for evaluation based on rule presented in Fig 9. The asymmetry evaluation of lesion dominates with reference to contour, colors and structures distribution. Additionally, three possible labels for these parameters are 0,1 and 2. These parameters mean as fully symmetric or otherwise with respect to one or several axis.

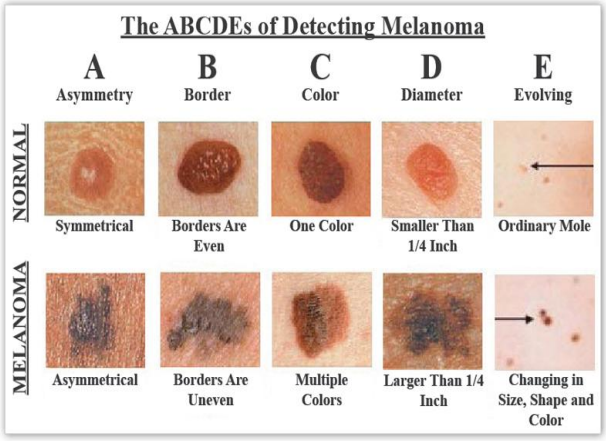

Fig 10: Detection of melanoma using ABCDE Rule

The color difference were normally chosen for analysis during the diagnosis of a melanocytic lesions. The colors include light & brown, white, blue, dark brown, grey and black. Each of the images that exist in the database were evaluated to identify the colour classes. The location of each color class in an image was recorded as a binary mask [7].

The connections between the pigments resembles grid like network which has pigmented lines and hypo pigmented holes which are more crucial in the distinction between melanocytic and non melanocytic lesions. The pigment connections structures were visually evaluated carefully from the dataset and are classified as typical or non-typical .

III. Literature Review

Several approaches exist to identifying melanoma like Blue White Structure (BWS). One another framework is achieved using the goal using Multiple Instance Learning (MIL). Here there is a indication of presence of specific feature. The process involves representing each picture (sample image) as a bag of non-overlapping regions [8]. The output prediction is done by classifying the labels for each of the image. The experiments performed using the datasets is found to produce results outperforming similar other techniques. Similarly several other research investigations aimed at identifying the improvement on the model with image analysis using local features [1].

Most automatic melanoma recognition systems use lesion segmentation as a basic step [13, 14]. The study has used supervised detection approach based on the discriminative regional feature integration (DRFI) to detect the lesions, This integration procedure incorporates regional contrast, property, multilevel segmentation, background descriptors and random forest regressor. The study presented by the authors presented improved saliency detection method with additional features to regional property descriptors achieved using thresholding algorithm [2].

Computer aided systems are predominant for the detection of melanoma which is well known to researchers working in this area as far as research perspective is concerned. The findings from the study made concluded that the borders exhibit differential structures [9]. Finer attempts, aims in validating the findings by performing segmentation process. The subsequent process leads to extraction of the peripheral region subject to feature extraction and classification [3]. The imaging system for early detection focus on smart phone captured images. The process involves images exposed to various flow with stringent computation and memory constraints. The results with combined lightweight method based on hierarchical segmentation were promising as compared to other existing systems [4]. Non-invasive systems estimates the depth of skin lesions for diagnosis with 3-D skin lesions. The reconstruction mechanism also estimates the depth obtained from regular dermoscopic images along with 2-D shape feature extraction. These features are more critical to achieve accurate results as expected [5].

Melonama workflow involves non invasive real time analysis for improved detection followed by prevention mechanism. The stages are decried clearly in section 2 which indicates the complexity of the proposed work. In addition the work reported here focus on some other additional parameters like lesion segmentation, prevention of skin burns, hair detection, hair exclusion, feature extraction and classification. The authors have implemented a two stage SVM classifier for easy identification and comparison of benign and malignant infections which provide accurate results [6].

IV. MELONAMA DETECTION PROCESS & RESULTS

The proposed method includes several steps and is eloborarted in this section. The context is presented in Figure 10 and the overall block diagram in Figure 11.

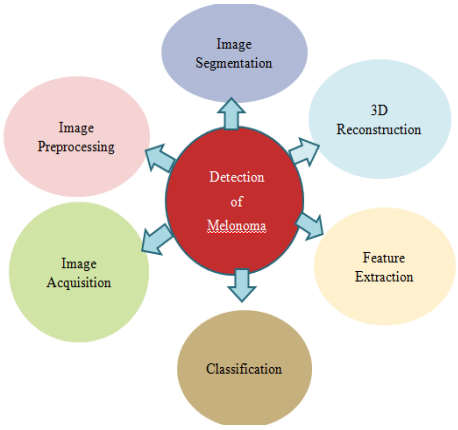

Fig 11: Context of melanoma

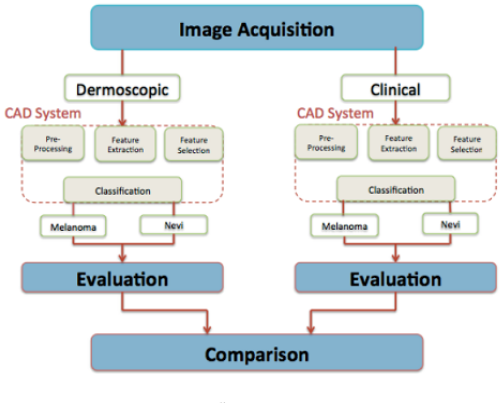

Fig 12: block diagram for melanoma Detection

4.1 Image acquisition

The medical imaging process are very minute process used to examine lesions with dermoscopy images by means of Epiluminescence light microscopy (ELM). The procedure involves oil immersion between the skin and optics. Then the microscopic lens is placed directly in such a way as it illuminates the skin surface. The lighting exposure also magnifies the skin in order to reveal on the most pigmented cell structures shades. During this image acquisition procedure, structures which weren't also be visible to naked eye. It also identifies and allows direct viewing and analysis of dermis.

4.2 Image preprocessing

The images extracted normally have impulse noise due transmission errors. This occurs due to factors like malfunctioning of pixel elements in camera sensors, timing errors during digital conversion and several others. Noise arises in sensors or imaging process. To reduce the noise and to improve the quality, filtering is used to suppress the noise.

4.3 Image segmentation

Segmenting image and portioning it into digital images from multiple regions is substantially important process. Here the regions are extracted by marked boundaries or regions known as Region of interest. The marked regions are measured for similarity or using the discontinuity principle. The aim is extraction of regions with significant properties having differences in colour, intensity, texture and other features to improve the quality.

4.4. Segmentation based on Edge detection

Segmentation process is preferably done using edge detection. It provides an outline of objects for efficient detection and proper identification. For the process to be more effective, grey scale discontinues depending on the edges with respect to the depth, surface orientation and lighting parameters. The edges are nothing but connected pixels lying between boundary regions varying significantly by means of grey values.

4.5 Segmentation based on Thresholding

Thresholding produces uniform regions based on pixels values. The segmentation technique mainly deals on lighter and dark background objects. The threshold criterion is the measure of image pixels divided into separate regions and objects from back ground. The determination of intensity values is done by splitting the desire classes with grouping of appropriate pixels. Such broadly classified pixels have intensity much greater as compared with threshold into one class and those with others.

4.6 Region based segmentation

The disadvantage of the thresholding is that it still produces isolated regions. So it necessary to process the segmented image to produce coherent region. The region based segmentation is the principle of similarity. Such similarity rate is coherent if the pixels of that region are homogenous with respect to some characteristics such as colour, intensity, texture or other statistical properties [12]. The idea is to pickup pixels inside the region of interest as a starting point (seed point) and comparison with neighbours. Based on the strong adherence with respect to similarity values the merging process is done. This process is iterated till the regions converge to an extent that no further merging is possible. The overall final result leads to segmentation of the region of interest.

4.7 Feature Extraction

Here the features are meant for selection and extraction of the right features among those from a large dataset. From these larger groups, finer set of features with reduced dimensions are selected. Then the transformation process in the input data using set of features is done. The feature selection influences the classifier performance with various features extracted including contrast, correlation, energy and entropy.

4.8 Classification

The process of classification is predominantly important by identifying appropriate labels or pattern class.

The classification process works with prior knowledge of the object or stored pattern. Here the trial and error process recognizes the object precisely which is used for melanoma identification. To develop a decision making system, physicians were involved for early detection of skin cancer which could simplify the process of surgery. The shape, color, texture obtained from dermoscopic images using skin lesion segmentation technique. The classification based on the benign and malignant melanoma and irregular boundaries of skin lesions from dermoscopic images.

V. CONCLUSION

This paper presented a detailed study on various techniques for identification malignant melanoma. Several schemes, features and appraoches were outlined and work related for the proposed approach is investigated. Also an method was outlined based on the illustrations presented in earlier works. The work identfied presents a study on to impr, aims at presenting an improved system with decision support system for malignant melanoma fication with combination of several features for efficient classification and identification.

REFERENCES

1. Ali madooei and mark S.drew, “Learning to Detect Blue–White Structures in Dermoscopy Images With Weak Supervision”, IEEE J. Transl. Eng. Health Med., vol. 2, 2019.
2. Mostafa Jahanif , “Saliency Map Driven Segmentation of Lesions in Dermoscopic Images”IEEE J. Transl. Eng. Health Med., vol. 23, 2019.
3. Farhan Riaz, “Active contours based segmentation and lesion periphery analysis for characterization of skin lesions of Dermoscopy images”IEEE J. Biomedical Eng. Health Med., vol. 23, 2019
4. Thann taon Do, “Accessible Melanoma Detection Using Smartphones and Mobile Image Analysis”, IEEE Trans.on Multimedia, Vol. 20, no. 10, PP.1520-9210 2018
5. T.Y satheeysha et al, “Melonoma Is Skin Deep:A3D Reconstruction Technique for computerized Dermoscopic skin lesion classification” IEEE Transactions on.Biomedical Engineering., vol. , no. 5, pp. 450-465 2017
6. O. Abuzaghleh, B. D. Barkana, and M. Faezipour, “Noninvasive realtime automated skin lesion analysis system for melanoma early detection and prevention," IEEE J. Transl. Eng. Health Med., vol. 3, 2015.
7. Aurora saez, “Machine learning methods for binary and multiclass classification of melanoma Thickness from Dermoscopic images”, IEEE Trans on medical imaging ,Vol.35.No.4.April 2016.
8. J.Glaister, A.Wong, and D. A. Clausi, “Segmentation of skin lesions fromdigital images using joint statistical texture distinctiveness", IEEE Trans.Biomed. Eng., vol. 61, no. 4, pp. 12201230, Apr. 2014.
9. M.Sadeghi, T. K. Lee, D. McLean, H. Lui, and M. S. Atkins, “Detection and analysis of irregular streaks in dermoscopic images of skin lesions”, IEEE Trans. Med. Imag., vol. 32, no. 5, pp. 849861, May 2013.
10. Soltani Arabshahi, R.; Sweeney, C.; Jones, B.; Florell, S.R.; Hu, N.; Grossman, D. Predictive value of biopsyspecimens suspicious for melanoma: Support for 6-mm criterion in the ABCD rule. J. Am. Acad. Dermatol, Vol. 72, pp. 412–418, 2015.
11. P. Wighton, T. K. Lee, H. Lui, D. I. McLean, and M. S. Atkins, “Generalizing common tasks in automated skin lesion diagnosis," IEEE Trans. Inf. Technol. Biomed., vol. 15, no. 4, pp. 622629, Jul. 2011
12. Leszek A. Nowak, Maciej J. Ogorzaek, Marcin P. Pawowski, Texture Analysis for Dermoscopic Image Processing, Faculty of Physics,Astronomy and Applied Computer Science Jagiellonian University Krakow, Poland,2014 vol 4,pages 786-799.
13. Harpreet Kaur Aashdeep Singh (2015) ―A Review on Automatic Diagnosis of Skin Lesion Based on the ABCD Rule & Thresholding Method‖ International Journal of Advanced Research in Computer Science and Software Engineering, Volume 5, Issue 5, May 2015.
14. Mariam, A.Sheha,Mai, S.Mabrouk, Amr Sharawy, “Automatic Detection of Melanoma Skin Cancer using Texture Analysis”, International Journal of Computer Applications, Volume 42, 2012.
15. Aswin.R.B, J. Abdul Jaleel, Sibi Salim. “Implementation of ANN Classifier using MATLAB for Skin Cancer Detection‖ International Journal of Computer Science and Mobile Computing, ICMIC13, December- 2013, pg. 87-94.

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