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Skin Cancer – Melanoma Detection in Skin Images Using Local Binary Pattern (LBP) and GLCM

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Abstract: ***The skin properties like skin dryness, fungus and allergic symptoms i.e. etching kind of problem that may led to starting symptoms of malignant melanoma skin cancer. The correct identification of skin spots based on certain features is the key steps in detecting the skin cancer disease in advance. To improve the accuracy level, a k-means clustering is proposed followed by local binary pattern. This not only clearly detects the melanoma but also segment the cancerous part from the back ground. Further, the image is confirmed by using the local binary pattern in order to do the dimensional analysis of the skin cancer. The algorithm is tested on different skin image data base covering different stages of skin cancer and b=normal images. The results very accurate and later stage could be predicted in consultation with medical practioner. The prime concern in the presented work is on extracting the skin image features in textural domain as well as radial domain i.e. area, perimeter and standard deviation of radii. This enables in analyzing the cancer spot analysis and guides for the direction of spread of the cancer. This is the vital information where the skin expert may get vital information at fine accuracy.***

Keywords: Histogram Equalization, K-means clustering, LBP, GLCM, Dermoscopic Images.

1. Introduction

Skin is the sensory organ of the body that represents the first layer of the defence against the environmental factors. Skin helps to regulate the body temperature and permits the sensation of the touch. Skin cancer - Melanoma is not common like other skin cancers. Melanoma is very dangerous. Anyone can get melanoma. However, melanoma is curable if it found in the initial stages otherwise it may causes the majority of deaths. Skin cancer diagnosis is done by doctors. Globally, doctors diagnose about 160,000 new cases of melanoma annually. However, this is common among the non – Hispanic males and females. The most common sites of the cancer in human beings are legs and back. There are various causes of skin cancer but 90% of the skin cancer cases are caused by the exposure of the UV (Ultraviolet) radiations from the sun. This exposure of the UV rays increases the risk of all three types of the skin cancer i.e BCC (Basal Skin Cancer), SCC (Squamous cell cancer) and melanoma.

2. Related Work

In recent advances, many computer vision based melanoma detection systems have been implemented and used in many hospitals and clinics. As melanoma is a most rapidly increasing cancer, so the systems are aiming at detecting the skin lesions at the early stages so that the chance of cure is high.. [1]

Many computer vision-based diagnosis systems have been commonly used in various hospitals and by dermatologist in their clinics to extract and detect the melanoma at the early stage and mainly the recognition of malignant tumor. This dissertation presents new approach to classify and diagnose the cancerous tumor. [2]

The article proposed the algorithm that helps in the detection the precancerous or tanned part of the skin by using the image segmentation method and boundary analysis to locate the layers of the tissues in the skin. Skin cancer-Melanoma is a malignant cancer that may cause to death of the person if not treated at the early stages. When the detected object compared to the regular skin then it seems irregular in shape or dark in color. [3]

A new method is developed for evaluating and detecting the textures that visible in the abnormal skin sample image. In the skin images that acquired through the dermetoscope, these texture features are used to identify and locate the nature of the skin lesion whether it is cancerous or not. The proposed method uses the adaptive filter to find the threshold that inspired by Swarm Intelligence (SI) optimization algorithms..[4]

Image Processing Area plays important role in the Medical field. Skin Cancer occurs with the growth of abnormal cells which damages or destroys the surrounding cells. Melanoma skin cancer is less common cancer which leads to death of the patient if not treated at the early stages. [5]

In image processing, there are various skin detection methods are available but SPM (Skin Probability Map) among them is one of the effective method. SPM method has highly True Acceptance Rate (TAR) where False Acceptance Rate (FAR) in many cases is not acceptable. The reason behind this is that SPM method uses the color information at every pixel level. In this paper an improved skin detection method is proposed which integrates the texture, color and space information. After the color filter, a texture filter is constructed that is based on texture features extracted with Gabor Wavelet transform. [6]

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In medical image processing, segmentation of skin images is a fundamental problem, also plays an important role in computer vision applications. Skin segmentation subdivides an input image into constituent regions that isolate the skin regions. This paper proposes a skin color segmentation method i.e texture feature extraction and K-means clustering. Existing skin segmentation classifiers are improved by combining the extracted features of color and texture for segmentation purpose. [7]

Detection is a very effective method used by the doctors to diagnose the sensitive images or can say to detect the tumor or cancer regions. In this research, the methodology consists three color spaces: HSV, RGB and YCbCr, these are used to do experimental comparison of skin color detection. HSV color space based skin color detection has a very fundamental characteristic..[8]

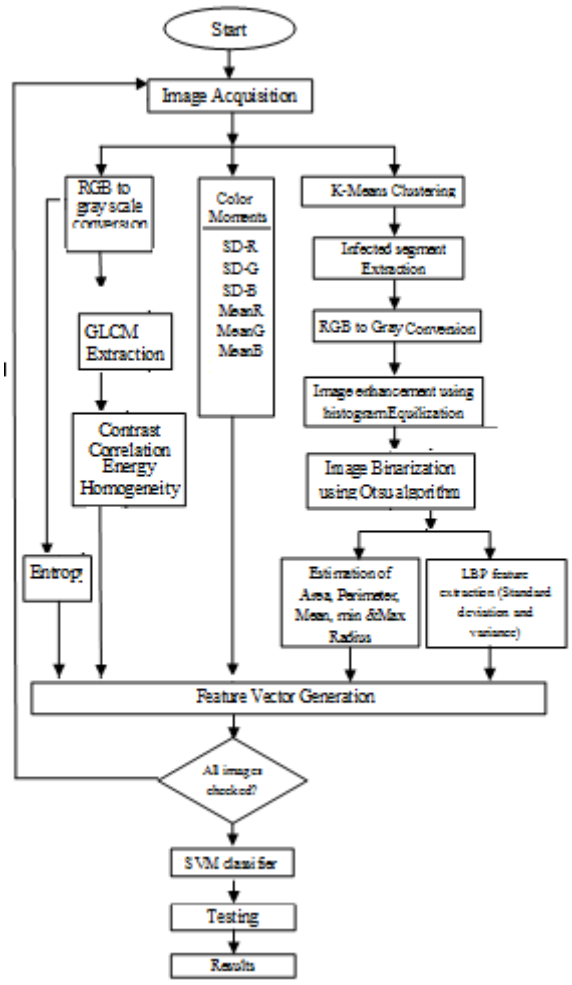
The most common form of the cancer in the humans is the skin cancer and it is type of deadly skin affecting cancer. Early detection of skin cancer can save the patient life as most of the skin cancers are curable at initial stages by biopsy method which is a conventional diagnosis method for skin detection. [9].

Melanoma is not much common like other type of cancers but it is dangerous if not treated during its initial stages. Anyone can get melanoma. However this is particularly common among the non-Hispanic males and females. When melanoma found early and well treated then the cure rate is nearly 100%.. [10]

Skin cancer – melanoma is not a much common type of cancer but it is very harmful. Anyone can get it. Skin cancer diagnosis is done by doctors. Melanoma is curable if found during early stages of cancer. Many image processing methods were developed and implemented to improve the accuracy level of the segmentation of skin lesion and classification of skin cancer..[11]

3. Algorithm

The image processing techniques on original image is implemented in primarily three streams: gray scale format of the original image, direct on original image for color moment's computation and using k-means clustering to extract the infected part. The gray scale format is used to compute the texture features in GLCM domain. The original RGB image is used to compute the color moments like mean red, green and blue color component and standard deviation in red, green and blue color domain. The k-means clustering is used to extract the infected part and then local; binary patterns are computed by thresholding the segmented part using Otsu algorithm. Area and size related features are extracted from the binary image. The whole process is depicted in the below given flow chart (figure 1).



4. Results and Conclusion

The table 1 shows the parameters extracted from the below seven images. However, the program is tested for more than 100 skin images.

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TABLE 1 → RESULTS FOR IMAGES USING THE PROPOSED ALGORITHM

Image No.	I1	I2	I3	I4	I5	I6	I7
Max.R1	92.28	82.7	36.98	54.84	68.51	42.73	34.99
Max.R2	91.12	45.18	35.52	50.54	64.03	33.26	29.49
Max.R3	83.89	69.39	32.81	43.85	62.96	42	34.82
Max.R4	85.15	59.28	35.05	41.83	65.04	34.18	31.07
Min.R1	36.38	33.07	18.43	8.43	2.72	27.24	27.31
Min.R2	38.52	38.11	18.61	11.53	10.05	24.87	20.59
Min.R3	34.59	39.79	19.58	16.66	11.24	29.32	24.32
Min.R4	36.35	33.06	18.45	11.37	3.92	24.42	23.77
MPerm.	818	432	209	392	359	230	220
Area	11430	7205	2297	2747	2681	3588	2619
Mean R	59.96	50.69	27.06	31.49	39.82	33.81	28.99
Cntrst	0.37	0.12	0.31	0.13	0.15	0.32	0.38
Corrl.	0.61	0.91	0.76	0.56	0.81	0.64	0.59
Energy	0.26	0.3	0.24	0.61	0.42	0.32	0.41
Homo.	0.86	0.94	0.85	0.93	0.94	0.86	0.86
Entropy	6.27	6.64	6.61	5.3	6.14	5.77	5.99
LBP	143.8	106.67	29.35	38.47	79.26	52.83	26.18
SD-Red	0.38	0.34	0.38	0.37	0.31	0.37	0.41
SD-Green	0.28	0.28	0.3	0.3	0.26	0.35	0.28
SD-blue	0.26	0.28	0.23	0.27	0.22	0.33	0.23
Mean Red	0.27	0.23	0.27	0.26	0.21	0.26	0.29
Mean Green	0.19	0.19	0.21	0.21	0.18	0.24	0.19
Mean Blue	0.18	0.19	0.16	0.19	0.15	0.23	0.16
Std Dev.	112.62	122.76	78.08	83.6	112.97	100.33	70.01
Variance	12682.7	15069.94	6096.06	6989.41	12762.47	10066.53	4902.07
CoMass X	62.14	92.94	50.57	123.11	123.35	101.79	59.17
CoMass Y	68.56	76.8	75.23	49.41	62.96	6.38	69.3
Test Class	3	2	3	2	3	3	4

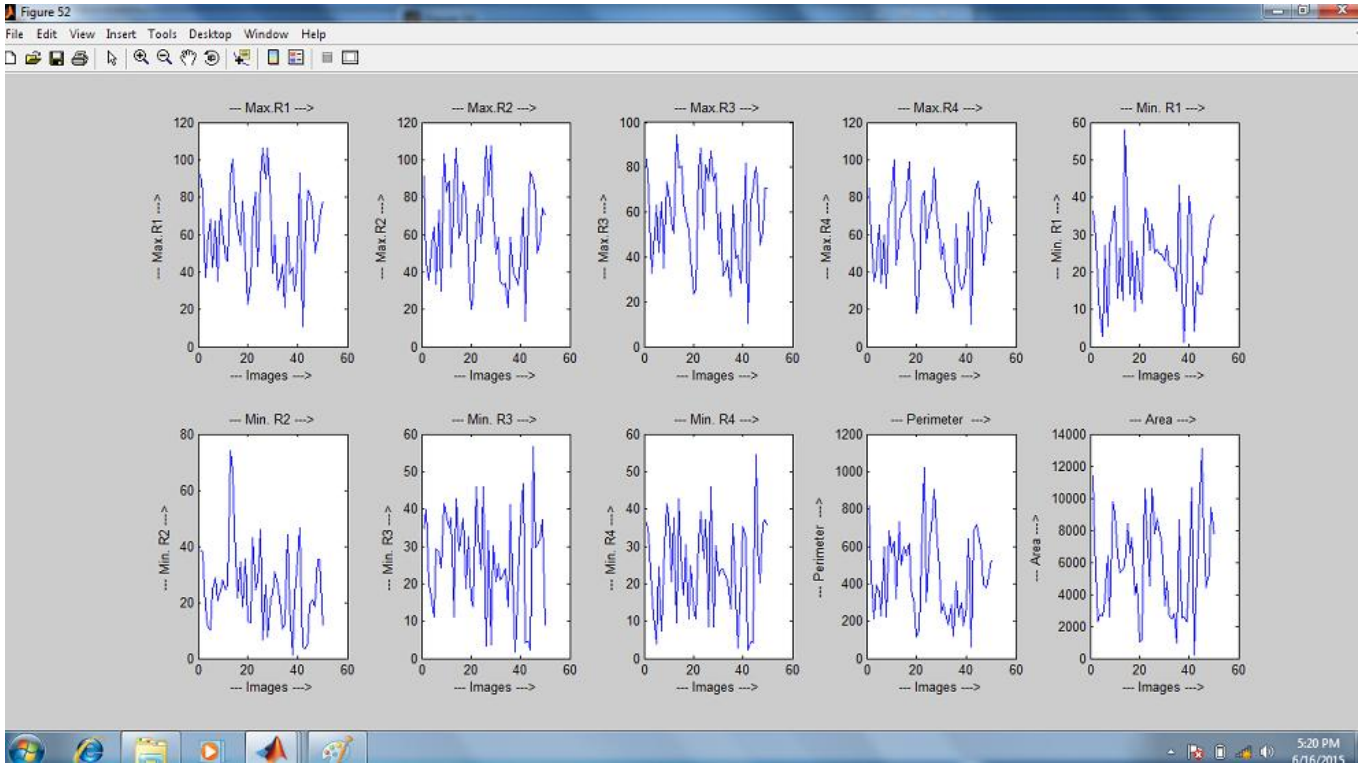

Figure 2 → Features Profile (Mean R, Contrast, Correlation, Energy, Homog., Entropy, LBP, SD. R, SD. G and SD. B)

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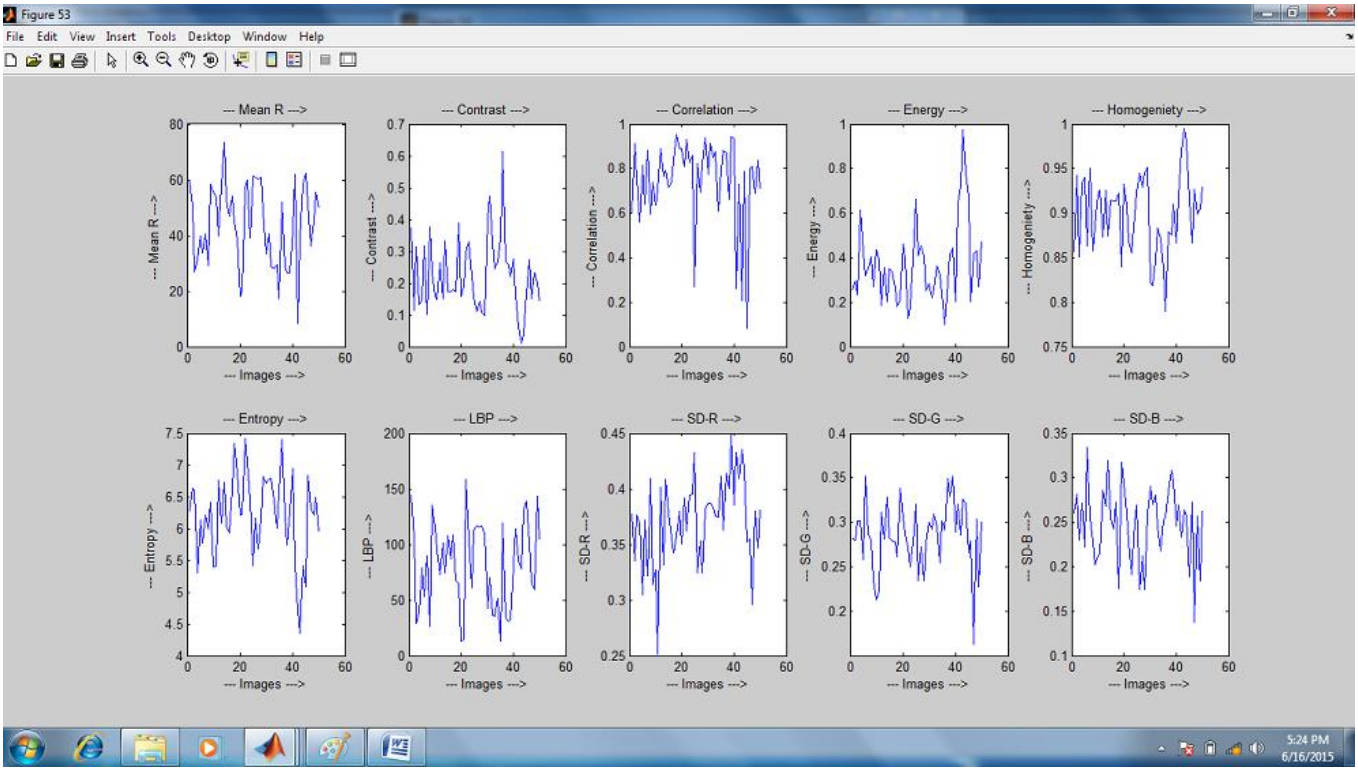

Figure 3: Feature Profile(Mean R, Contrast, Correlation, Energy, Homog., Entropy, LBP, SD. R, SD. G and SD. B)

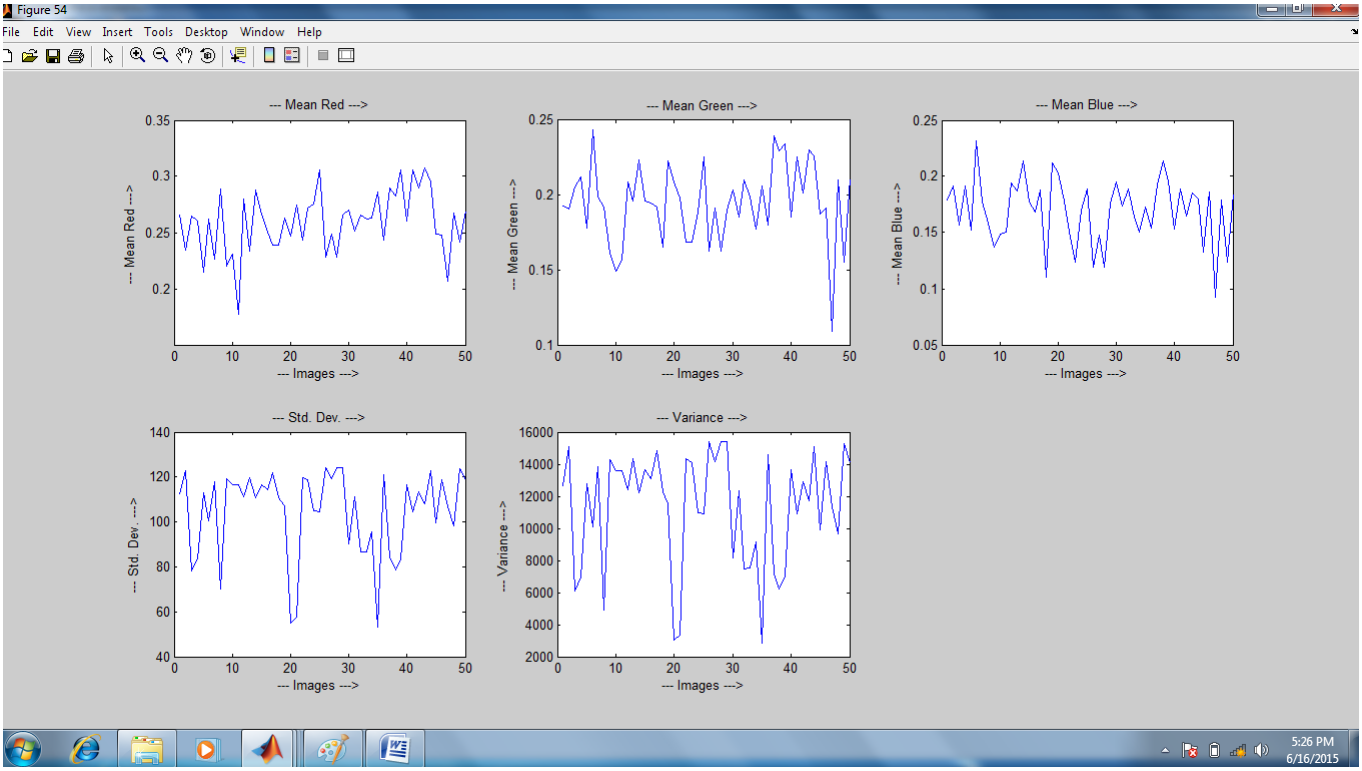

Figure 4: Feature Profile(Mean red, Mean Green, Mean blue, Standard Deviation and variance)

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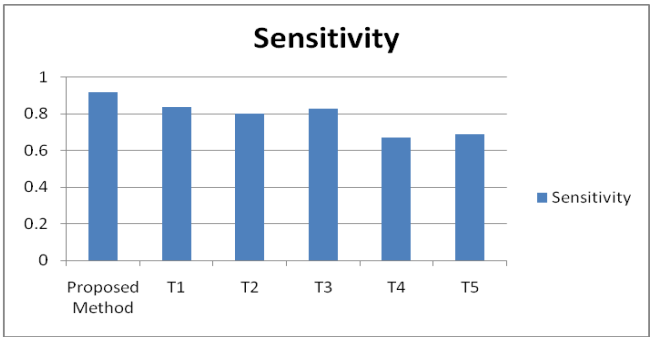
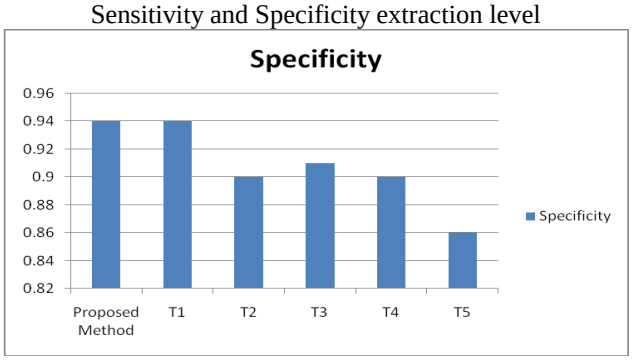
Table 2: Overall classification accuracy for the detection of melanoma when texture and color features are used for feature extraction



Sensitivity and Specificity extraction level



5. Conclusion

The presented work results shows the improvement in identifying the Melanoma skin cancer at different stages using image processing techniques based on textural feature analysis and SVM classifier. The feature table 1 shows a fine distinction between different stages of the Melanoma skin cancer. However, in case of boarder cases, the SVM classifier takes the guard to a good extent. The prime concern in the presented work is on extracting the skin image features in textural domain as well as radial domain i.e. area, perimeter and standard deviation of radii. This enables in analyzing the cancer spot analysis and guides for the direction of spread of the cancer. This is the vital information where the skin expert may get vital information at fine accuracy.

The features are normalized with respect to skin image size so that the features remain same if the image is varied in respect of it attributes. The prime purpose is that the features should not vary for the same image at different orientation, size and location.

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