

SKIN CANCER DISEASE DETECTION USING IMAGE PROCESSING TECHNIQUES

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ABSTRACT— Detection of skin cancer disease is very important in early stage. In these days, Skin cancer is most dangerous, a type of man-made cancers. Skin cancer occurs in various forms such as melanoma, basal cells of which, the most impredicable is Melanoma. Early cancer diagnosis can be effective in treating it in the diagnosis of Medical Picture. In this study we present a MATLAB cancer detection programme using image techniques for production. It tells us about cancer's existence. The analysis software lesion image tests for different parameters of melamine such as Asymmetry, Boundary, Colour, Diameter are calculated for texture and shape analysis, edge detection and other levels of feature. The result derived from software is nearly to identify an image as a non-cancerous and cancerous skin.

Keywords—Skin Cancer, Image Processing Techniques, Melanoma, Basal, Squamous, ABCD, MATLAB.

I. INTRODUCTION

In Skin Health, diagnostics are defined as the method of recognizing a skin texture by its symptoms or sign. The findings we learn in this method are called diagnosis. The method known as the diagnostic system, which can be used to determine any problem by answering every question that leads to problem solving.

In the US, more than 1 million Americans melanoma skin cancer in the year of 2007 and about 60,000 were diagnosed Of Melanoma, Riding to Tumor American society [1,2].

The detection of this disease at early stages is so significant. There are some issues behind this which are explain as [3]:

First the detection of skin cancer due to its position on the skin is very straightforward. Nevertheless, Melanoma is more likely to be metastasized propagated to other tissues relative to other skin cancers. Secondly, the melanoma expectation is purely important in terms of its thickness.

The melanoma can be effectively treated in beginning phases where the thickness is under 1 mm. Nevertheless, it is not apparent even by experienced dermatologists to detect the melanoma in early stages [4].

There is a lot of cancer disease in the world that causes death among humans. Day by day, there is new inventions and new techniques were discovered for the treatment of that cancers. Among all of them Skin cancer is also a most deadly cancer which causes deaths among humans [5].

Fortunately, in children skin cancer has been rare. The symptoms of cancer shift are swelling, bleeding and a mass under the skin. It was abnormal skin cell development. Basically, skin layer is divided into further three layers [6]. The cancer begins in the outermost layer consisting of the first layer of squamous membrane, the second layer of basal cell and the last and innermost layer of melanocyte cells. Non-melanoma cancer is sometimes referred to in the squamous and basal cells. And those skin cancers that are non-melanoma often response to the curable and less chances of spreading to other cells. If the first type of skin cancer which is Melanoma is not detected early, it spreads to other tissues and causes a death.

Skin cancer is a most expensive cancer. In 2002, Melanoma skin cancer cost \$30 million and non-melanoma \$264 million. The diagnostic is based on simple visualization inspection. Formal method of detection of skin cancer is Biopsy method. In this, a small piece of tissue removed from skin and send it to a laboratory for further results. It is a convenient approach and it takes so much time for result. There is the risk of spread out into the other areas of the body [6].

Human Skin

Human body is being protected by ultraviolet (UV) radiation from heat, injury, infection, and damage. This can also contain vitamin D and hold water and fat. Human skin has several layers. Epidermis and Dermis are the two principal layers of human skin which are explained below [8]:

• **Epidermis:** This layer as the upper layer of human skin consists of squamous cells which are smooth skin cells. The circular cells below the squamous cells are called basal cells. The cells in much of the inner epidermis are called Melanocytes found within the basal cells. Melanocytes show the pigment (color) in the blood [14].

• **Dermis:** The second major skin layer is dermis, which is found under the epidermis. It contains other cell forms, such as lymphatic channels, blood vessels, and glands. Some glands help dry out the skin, and some help to cool the body and make sweetening [15].

To carry out tasks, computer scientists rely heavily on math's. MATLAB can be used with its rich toolbox to quickly test an algorithm before committing the development capital to implementing the algorithm in another language, either such as C++ or Java. Programmers are usually reliant on MATLAB to increase their performance. MATLAB is a practical Computing language for programming-performance [7]. It combines calculation, perceptions, and algorithms into an accessible platform where traditional math notation explains problems and solutions. Functions can allow more than one input statement and can return more than one statement for the output. Programmers are usually dependent on MATLAB to increase their efficiency.

II. LITERATURE REVIEW

Study of the identification of skin cancer disease was practiced from time immemorial. By studying the research related to it. A number of general skin experiments have been found to be conducted without any automated method. Work has suggested several methods to solve this issue by using multiple electronic tools to take different images of skin cancer.

By observing the different literature review of others, it is found that there are many other procedures to tackle out this issue. An intensity thresholding method is used by reducing the color image into intensity image so that they find out the affected area. Another technique which is known as elastic curve technique is used for detecting the accurate boundary of the affected image [8].

For Melanoma diagnosis, a GLCM method which is abbreviated as Grey Level Co-occurrence Method used to take out features and a classifier which is known as Multilayer Perceptron Classifier classify an image between cancerous and non-cancerous [9].

There is another framework which used rule based and onward chaining method to detect skin disorder. The proposed framework helps the user to recognize illness of children online and to provide effective diagnostic ideas. The skin disease was predicted and analyzed using various data mining classification algorithms (AdaBoost, Bayes Net, MLP, and Naive Bayes). That works for only three skin diseases: Eczema, Impetigo and Melan [10].

Although many researchers improve different type of system, but these systems do not fulfill the requirements. An automatic Global border-detection method in dermoscopy images based on colour-space analysis and global histogram thresholding which shows high performance in detecting the borders of melanoma lesions.

This study based on detection method was designed with the use of digital image processing techniques to analyse melanoma in early phases. There are many steps like pre-processing, segmentation, feature extraction and detection process which give the acceptable results for skin cancer detection problems [11].

Skin cancer is a most expensive cancer. In 2002, Melanoma skin cancer cost \$30 million and non-melanoma \$264 million. The diagnostic is based on simple visualization inspection. Formal method of detection of skin cancer is Biopsy process. In this process, a small piece of tissue removed from skin and send it to laboratory for further results. It is uncomfortable method and takes too much time for results. There is a chance of the cancer spreading to other areas of the body [12].

Skin Cancer Disease Detection System is used for the identification and recognition of signs of skin cancer and early detection of melanoma. The consumer should take advantage of their health preventive early. Skin Cancer Disease Detection System may help save a lot of doctor's time and help detect more accurately. Further, it can quickly determine skin's potential development by dialysis of the skin's current age and

bring the best characteristic skin cancer project forward to client.

Another researcher uses a method ABCD with its TDS calculation which is helpful in the detection of skin cancer [13].

III. METHODOLOGY

In this study, we explained a step by step procedure that how a system works and how we collect data. Firstly, a raw data is collected including Benign, Malignant and Negative images which is converted into data set.

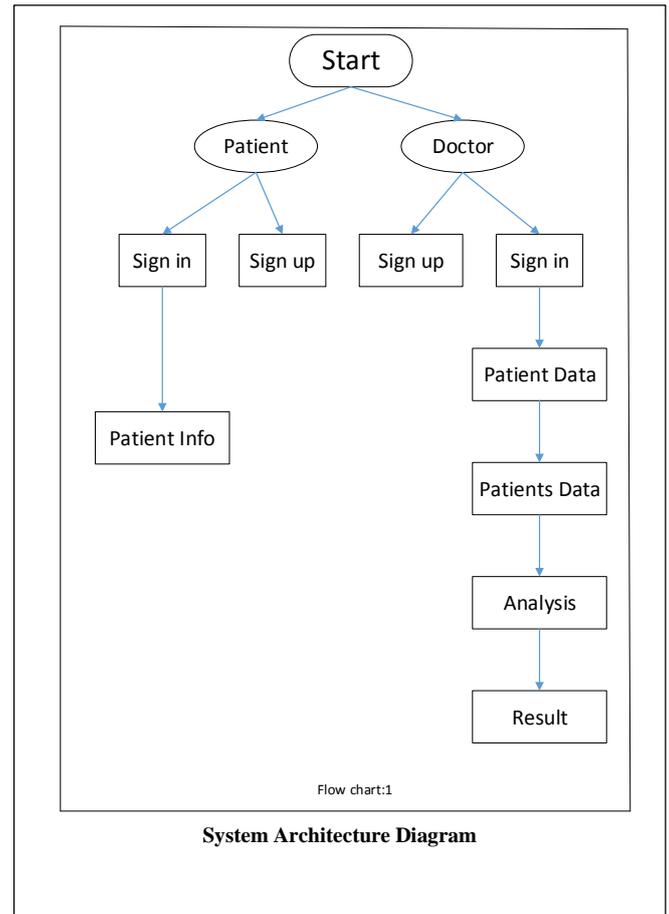
Different image processing techniques are used in this research. A system which is based on MATLAB software, is used. This system works as it first upload desired image. After uploading it pre-processed that image. It converts that image into Gray level image. Gradient Vector Flow segmentation is applied on selected image for detecting its edge and shape recognition. It defines its edge map which is derived from image.

An OTSU segmentation is applied which performs automatic thresholding on image. It separated the image pixels into two forms: foreground and background. It works as a K-means.

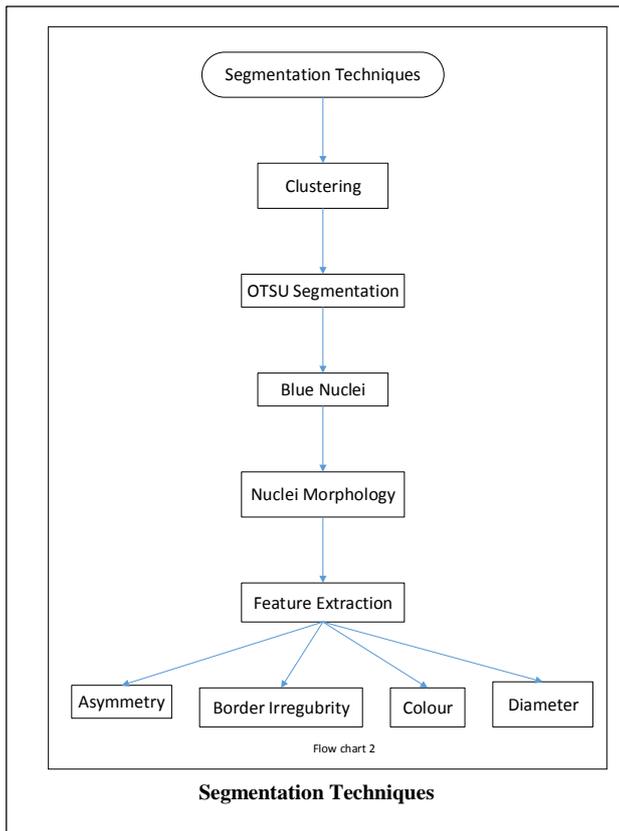
After that process, a Nuclei step is performed. These nuclei are extracted from background by using OTSU segmentation and it further separated into RGB clusters. It is important step in grading and diagnosing cancers.

For computing morphology of nuclei, feature method uses the exact boundary point of that specific colour nuclei. Further the system will calculate ABCD of that selected image. At the end, on the base of input image when all the procedures are being done, it will tell us as it is cancerous image or non-cancerous image.

Throughout all the procedure, a program work as a real time machine which performs different techniques. It is an offline-system where first a data will be saved in a database.



In the above flow chart, it explains the overall system architecture diagram. It shows that how a system will be starts and how it woks. First a patient enters in the system. It will be login through their username and password. If a user is a new person, it will first create an account. After that, patient enter their personal data with an image and save it. After saving information, the user will go to the doctor and tells about their history. The doctor will also login through their username and password. After login into system, a patient's info page will be appeared. Here the doctor double clicks on the patient's data and get that data in another form. He will examine the image that was saved by patient through MATLAB code. This code find out the final result.



We used different Image Processing Techniques to detect skin cancer.

Grayscale Conversion:

The system converts a colourful image into Gray Scale image. It separates each pixel of the image into RGB by using this equation:

$$\text{Grayscale Intensity} = 0.299R + 0.587G + 0.114B$$

Segmentation Techniques:

1. Clustering

It is used as a segmentation technique. It is used for analyzing data in high-dimensional patterns. It combines those patterns which are similar in some way. The purpose of this clustering is to segment an image.

2. OTSU Segmentation

The system uses an OTSU Segmentation method which performs an automatic thresholding on an image. Basically, it separates image pixels into two classes: fore ground and upper ground.

3. Blue Nuclei

Initially, nuclei are separated from the context by using local Otsu thresholding. It is important step in cancer diagnosis and grading.

4. Nuclei morphology

Some computation methods are required to find out nuclei morphology by using the actual boundary of that nuclei.

Feature Extraction:

Feature were extracted by using ABCD rule which is applied on selected image. It calculates Asymmetry, Border, Colour, and Diameter of an image.

Asymmetry (A):

Skin lesions are screened and broken into two parts for symmetry. If both halves are the same, it is said that skin lesion is non-cancerous, otherwise it is said that it is cancerous, and melanoma is likely the case. For this element weight is 1.3.

Border Irregularity (B):

The edges of skin lesions are confirmed by factor B. If the edges are jagged, twisted, or blurred, then melanoma can cause skin lesion. The value of the boundary irregularity factor is centred on 4 parameters, i.e. variance, asymmetry-calculated parameter, gradient mean and image variance, and fractal. For this element weight is 0.1.

Colour (C):

Pigmentation for skin lesion in the case of cancerous lesions is not standardised. It is important to detect the presence of up to 6 colours-white, black, red, blue, dark brown and light brown-to measure the non-uniformity of the pigmentation. The existence of any colour contributes 1 to the value of factor C. For this element weight is 0.5.

Diameter (D):

Malignant cells reach 6 mm in diameter. For specific types of lesions, differential structures which have at least five patterns are important. One should be preoccupied with a mole's growth. A diameter measurement using the 'area props' Function.

TDS Calculation:

The Total Dermatoscopy Score (TDS) index is a result of given variables (ABCD) mentioned below. Both parameters are used to assess the cumulative score used to identify the skin lesions according to their weighting as cancerous (case of melanoma) or non-cancerous (case of non-melanoma) (Table 1). The equation used to measure TDS Index is as follows:

$$TDS = 1.3A + 0.1B + 0.5C + 0.5D$$

Range of TDS Index	Nature of Skin Cancer
TDS Index < 4.75	Benign (Non-cancerous)
4.75 < TDS Index < 5.45	Not Benign nor Melanoma
TDS Index > 5.45	Melanoma (Cancerous)

Table 1: TDS RANGE

Table 1 shows a TDS Range calculation that calculates and tells about the disease.

IV. RESULTS

We have been used visual studio 2019 for designing main interface Loading page, Start Page, Doctor/Patient sign in page, Doctor/Patient sign up page, forget password page, patient info page, patient data page, analysis page. MATLAB 2020 is used to identify the skin cancer from input image of skin that shows the image of skin is affected or normal image. SQL server 2018 is used to store Doctor and patient information.

A collection of effected images is collected from different patients. First, an image is load into a system which calculates its ABCD, define its edge, detect its border, converted into RGB, applied OTSU segmentation and GVF segmentation, applied Blue Nuclei and Blue Morphology. At the end it showed as it is Melanoma or Normal Skin Image.

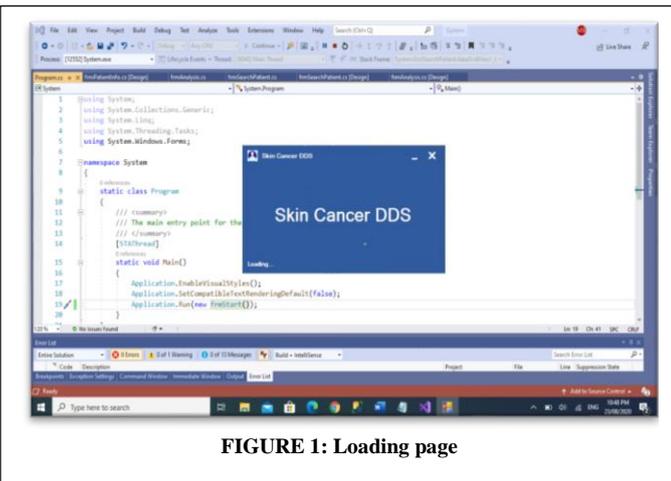


FIGURE 1: Loading page

In figure 1, the start-up or loading page of the Main System is shown. It leads towards the entrance of page where Patient and Doctor can access the system.



In figure 2, the Start Page of the system is shown from where user which is a Patient and Doctor will be SignIn to their account.

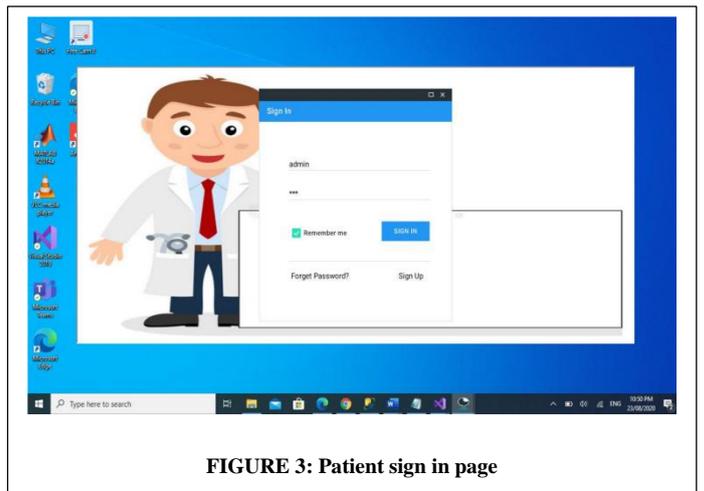


FIGURE 3: Patient sign in page

In figure 3, the Patient SignIn page is shown through which a patient can access the system.

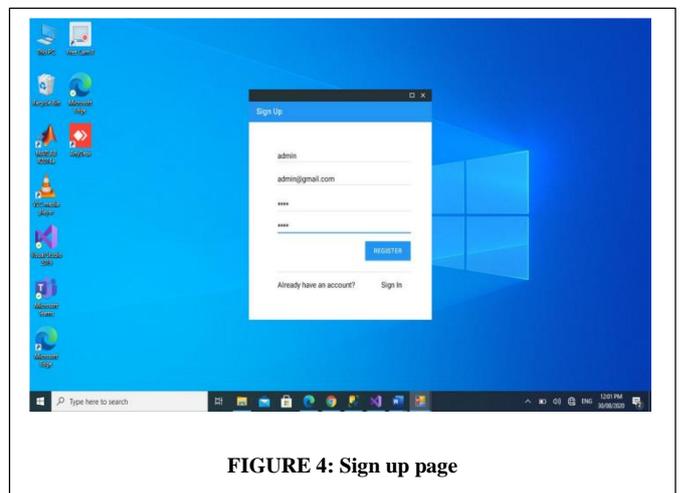


FIGURE 4: Sign up page

In figure 4, a SignUp page is shown. Through this page a new user can create their account.

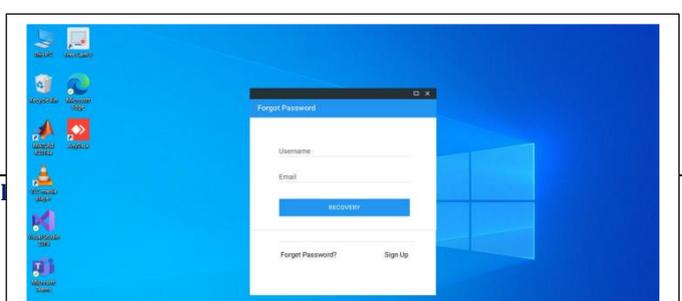


Figure 5 shows a page through which a user can update their account password if he/she forgets.

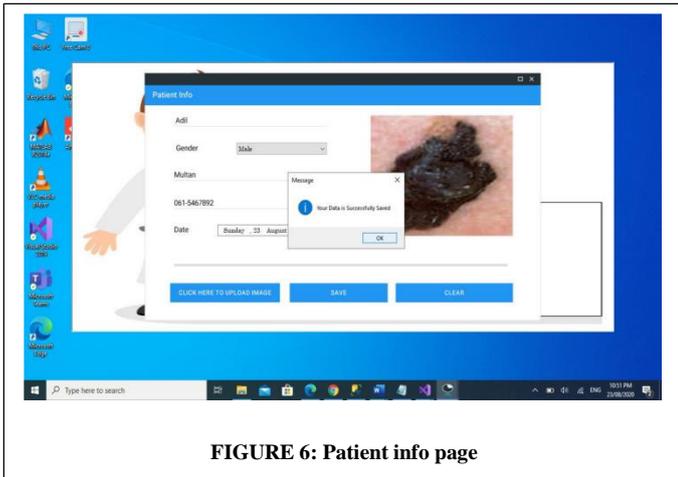


FIGURE 6: Patient info page

In figure 6, Patient enters their information through accessing account by entering username and password in SignIn page which is already shown in figure 3.

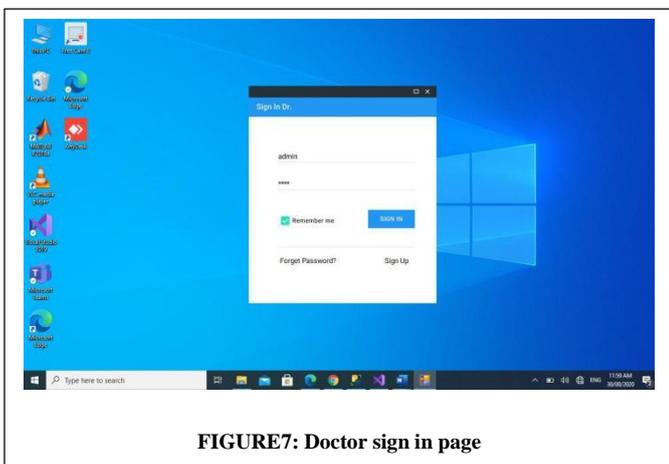


FIGURE7: Doctor sign in page

In figure 7, another user which will be a Doctor login through this page.

Figure 8 shows a page which will be accessed by a doctor after login into a system. Here doctor can see the patient info that would be entered by patient.

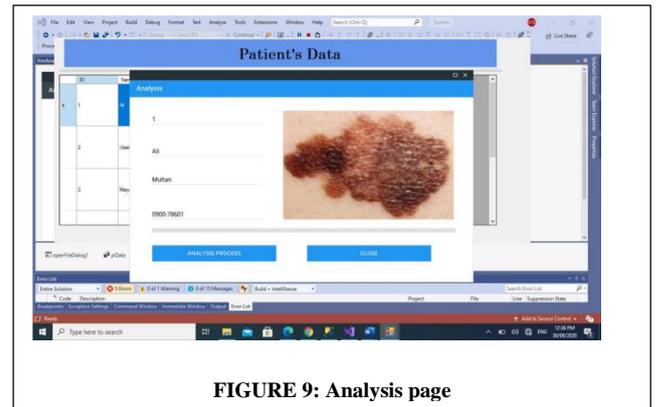


FIGURE 9: Analysis page

Figure 9 shows Analysis page. This page is opened when doctor login into system. A doctor analyse patient's data by double clicking on desired data. In this page as we can see a button named as Analysis Data. By clicking on that button it takes to the MATLAB Program.

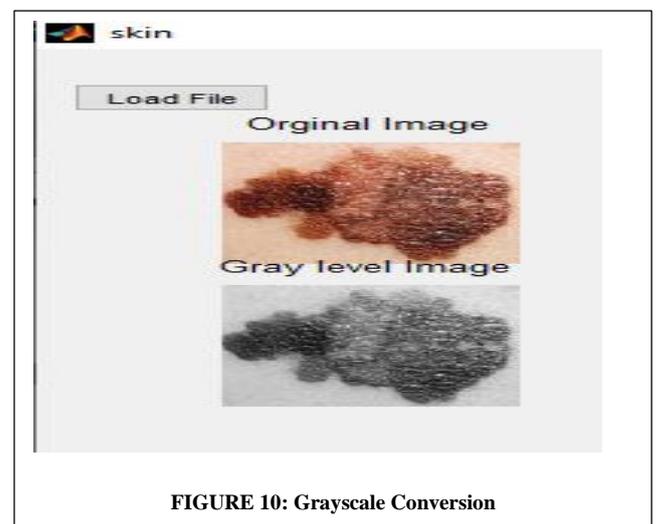


FIGURE 10: Grayscale Conversion

Figure 10 shows the result of selected image from patient's data. It shows the conversion of grayscale.

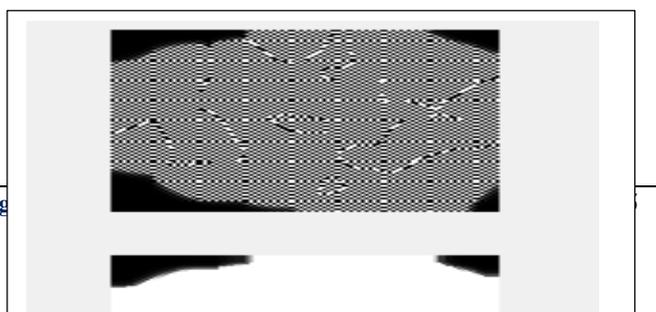
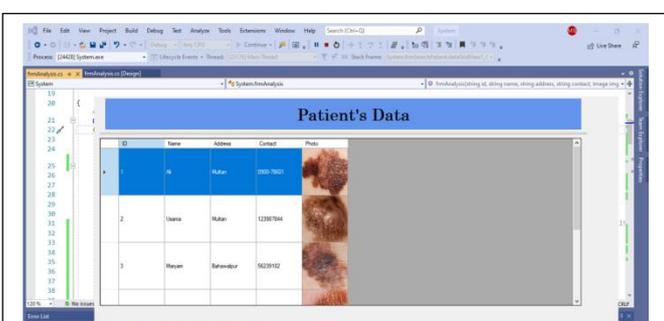




FIGURE 15: OUTPUT

Figure 15 shows the final result or output. It tells about either it is cancerous(melanoma) or non-cancerous(benign). As in above figure it shows that it is a Melanoma. Now in this case it would be helpful in understanding for both Patient and Doctor. They can easily read out that what is the output.

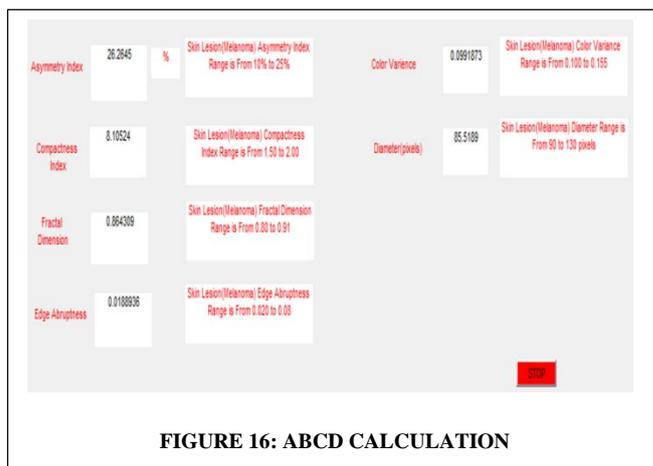


FIGURE 16: ABCD CALCULATION

In the above figure 16, ABCD will be calculated. It tells about the value of each factor in the image.

V. DISCUSSION

It is a most common type of cancer among people who play outside. As the rates of skin cancer are increasing day by day, so an easy, effective, and fast detection system is necessary. If a cancer is detected at early stages, it will curable. But at the last stages, it leads to an end. As this cancer is being caused by the exposure of sun light (UV) rays, so best way is to protect yourself from these rays which is harmful for our skin.

VI. CONCLUSION

It is concluded that, we can easily detect skin cancer disease

Figure 11 shows another technique result which is formed out through the MATLAB code. It shows the Gradient Vector Flow segmentation.

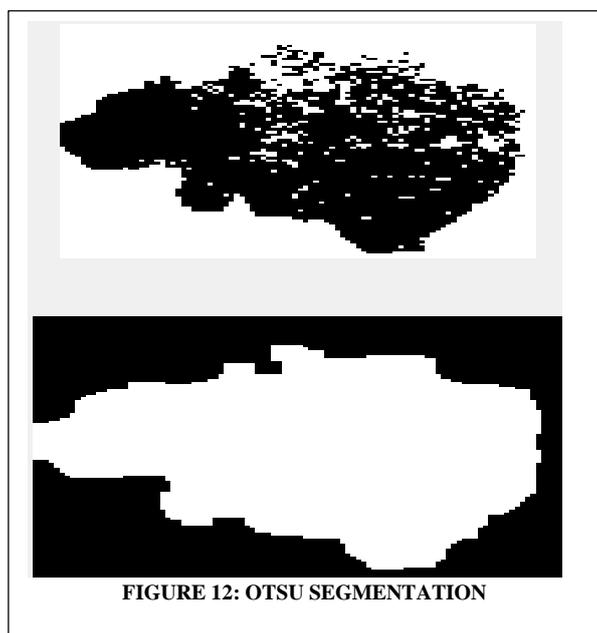


FIGURE 12: OTSU SEGMENTATION

Figure 12 shows OTSU segmentation which performs thresholding. It separates the pixels of selected image into foreground and background.

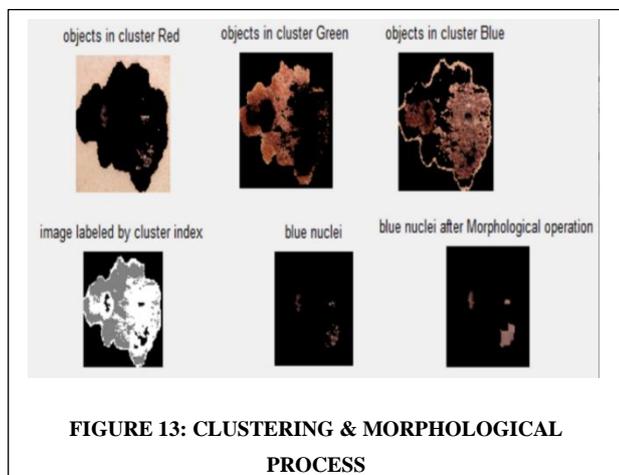


FIGURE 13: CLUSTERING & MORPHOLOGICAL PROCESS

Figure 13 shows a result of selected image in which it find out the nuclei, blue nuclei and morphology. It shows the clusters in RGB.

presented in this paper. This system is helpful in rural area where the experts are not available. It can detect disease within minutes. Rather it is easy to use, but a user can at least an illiterate that he/she can easily operate this system.

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REFERENCES

[1]US Cancer Society. The 2013 Cancer Facts & Figures, in: Annual Report. (Atlanta, GA: American Society on Cancer) (2013). Retrieved from: <http://www.cancer.org/acs/groups/content/@epidemiologysurveillance/documents/acspc-036845.pdf>.

[2]American Cancer Society, facts and statistics on cancer (2010). Accessible in: <http://www.cancer.org/Research/CancerFactsFigures/cancer-facts-and-figures-2010>.

[3]R. P. Braun, L. E. Français and J. H. Saurat, (1999). "Dermoscopy of pigmented lesions: an useful instrument of cancer detection." *Swiss Medical Weekly*, 134:83–90.

[4]C. M. Balch, A. C. Buzaid, S. J. Soong, N. Cascinelli, M. B. Atkins, D. G. Coit, I. D. Fleming, J. E. Gershenwald, J. J. Houghton, J. M. Kirkwood, K. M. McMasters, M. F. Mihm, D. L. Morton, D. S. Reintgen, M. I. Ross, A. S. Ober, J. A. Thompson, and J. F. Thompson, (1999). "Original edition of the American Joint Committee for Cutaneous Melanoma Cancer Staging System." *Journal of Clinical Oncology*, 19:

[5] Uzma Bano Ansari, Tanuja Sarode, (2017) "Eye Cancer Identification Using Image Processing," IRJET, e-ISSN: 2395-0056, Volume:04, p-ISSN:2395-0072, Mumbai.

[6] Maglogiannis and C. Doukas, (2009). Overview of advanced computer vision systems for skin lesions characterisation. *IEEE Transaction on*

Information Technology in Biomedicine, 13(5):721–733.

<http://en.wikipedia.org/wiki/Melanoma>.

[7] Aswin: Aswin. R. B. B, J. Abdul Jaleel, Sibi Salim, "Use of an ANN Classifier for Skin Cancer using MATLAB

[8] Ramteke, N., Ramteke, N.S., Jainz, S.V.: (2013) "ABCD rule based on automatic detection of computeraided skin cancer using MATLAB." *Int. Mac hine, J. Technol. Technol. App.* 4(4), and 691697.

[9] Mariam A. Sheha, (2012) "skin cancer skin cancer automatic detection," *International Journal of Computer Applications*.

[10] A.A.L.C. Amarathunga, (2015) "Skin Disease Diagnostic Expert System," *International Journal of Science & Technology Research*, Volume 4, Issue 01, 2015.

[11] R. Garnavi, (2011) "Computeraided melanoma diagnosis," Ph.D. The Dissertation, Melbourne University, Australia.

[12] Adheena Santy, Robin Joseph, (2016), *Global Conference on Communication Technologies (GCCT)*, "Segmentation Approaches for Computer Assisted Melanoma Detection"

[13] Bhubaneswar, Odisha, (2014) "Computeraided skin cancer detection using Image Processing," *International Conference on Intelligent Computing, Communication & Convergence (ICCC2014)*, Organized by the Management and Technology Institute of Interscience, India. Xu, L. (1999), et al. "Segmentation of Photographs from Skin Cancer." *Elsevier Picture Vis. Device*. 17, 65 to 74.

[14] K. Madison, (2003) "The skin barrier function: 'the epidermis' raison d'être," *J Os Dermatol*, vol. 121, no. 2, pp. 231-241.

[15] E. Proksch and J. Brandner. Jensen, (2008) "The skin: a barrier indispensable," *Experimental Dermatology*, vol. 17, number 12, pp. 1063-1072.

[16] Uzma Bano Ansari and Tanuja Sarode *International Research Journal of Engineering and Technology (IRJET)*e-ISSN: 2395 -0056 Volume: 04 Issue: 04 | Apr -2017 www.irjet.net .

[17] A.A.L.C. Amarathunga," Expert System For Diagnosis Of Skin Diseases", *International Journal Of Scientific & Technology Research*, Volume 4, Issue 01, 2015.

[18] M. Chaithanya Krishna, S. Ranganayakulu, "Skin Cancer Detection and Feature Extraction through Clustering Technique", *International Journal of Innovative Research in Computer and Communication Engineering*, Vol. 4, Issue 3, March 2016.

[19] Vijayalakshmi M M @ IJTSRD | Unique Paper ID - IJTSRD23936 | Volume - 3 | Issue - 4 | May-Jun 2019 Page: 780
Melanoma Skin Cancer Detection using Image Processing and Machine Learning .

[20] nikita raut, aayush shah, shail vira, harmit sampat, "a study on different techniques for skin cancer detection", *international research journal of engineering and technology (irjet)*, volume: 05 issue: 09 | sep 2018

[21] yuexiang liid and linlin shen, "skin lesion analysis toward melanoma detection using deep learning network" *sensors mdpi* 11 february 2018.

[22] prashant b. Yadav, Mrs. S.S. Patil "recognition of dermatological disease

area for identification of disease” ijsdr may 2016 volume 1, issue 5 .

[16] [23] mrs. S kalaiarasi, harsh kumar, sourav patra, “dermatological disease detection using image processing and neural networks”, s.kalaiarasi et al, international journal of computer science and mobile applications, vol.6 issue. , pg. 109-118 ,4 april- 2018.

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