Skin Lesion Melanoma Detection Using Digital Image Processing.

Mr. Anand Upadhyay, Mr. Arvind Chauhan, Mr. Darshan Kudtarkar
Asst. Professor, Post Graduate Student, Post Graduate Student
Dept of IT,
Thakur College of Science & Commerce, Mumbai, India

Abstract : A skin lesion is a part of the skin which has abnormal growth on the body parts. Early stage detection of lesion is necessary. Here the detection of the Melanoma disease is done. There has been a rapid growth in melanoma disease in current era. Melanoma can be deathly disease. In medical field it can be used for quantitative information about the lesion on the body part. The simple way can be done by investigation of the digital images of the skin lesion on the body part. In this research paper feature extraction is an important part which can be used to analyze and explore the image properly. Different images have been pre-processed and features were extracted from these images. Image Pre-Processing is also an important part to detect the lesion on the body part. We have proposed the detection of Melanoma disease using the svm technique in early stage of melanoma detection. The methodology uses image processing methods and Support Vector Machine Algorithm (SVM). Support Vector Machine algorithm is used for classification purpose. The features are given as the input classifier. The classifier which is to be used is Support Vector Classifier. The technique which is used is python and results are calculated through confusion matrix to give better accuracy. The Paper gives an idea of the algorithm applied and the comparison of various functions of the accuracy.

IndexTerms - ***Image Processing; Melanoma; Feature Extraction; SVM; SVC classifier; Accuracy; Kappa Value***.

I. INTRODUCTION

The occurrence rates of melanoma are rising rapidly, which is resulting in higher death rates. Melanoma disease is considered to be more dangerous as compared to other of skin cancer diseases. The number of people who are diagnosed with melanoma is sharply raised in past 3 decades. It causes 75% deaths related to other skin cancer disease. The incidence rate of melanoma in India is between 0.65% to 6%. Melanoma generally looks as degree enlarging the colored skin spot. They will have varied reminder brown, black and blue. They will be flat or raised. a little proportion of melanoma don't appear to be vivacious, but appear as a high-powered of intensity as a "colored skin" spot. Melanoma skin cancers have different stages which are stage 0, stage I, stage II, and stage III . In stage 0, tumors only begin on the surface of skin. In stage I, tumors invade the skin but are un nucleated and grow at a slow mitotic rate. Stage II is considered as intermediate melanoma and has different classifications. In stage IIA, tumor is 1- 2mm thick, in stage IIB, it is 2-4mm thick and in stage IIC, the thickness is above 4 mm. stage III is the most advanced stage of melanoma which affects various organs and the treatment becomes difficult. So early detection of melanoma is very essential. The skin cancer detection system saves a lot of time for the doctor and can help diagnose more accurately. It can also easily evaluate the future development of the skin through dialysis at the present skin age and present the best characteristic skin cancer project for the client. Keep in mind that the majority of melanoma doesn't have any symptoms when they are found. Some is additionally fretful, and injury could also be a late sign. Melanomas, like totally different skin cancers, are alone really rarely irritating to the bit. Inside the bulk of cases they are detected alone by their look. it's vital to urge eliminate a melanoma early in its life. Usually this can be often as results of "thin" melanoma have a sensible prognosis (96% cure rates). They most often develop in the areas where the sun exposure is there such as back, legs, arms and faces.

The sign of melanoma disease starts as the change of the color in the skin. Usually they are mixed colors (pink, red and brown). Most often, it is found in women rather than men. While in women's the most common part is legs at which the cancer occurs and while in case of men's the most common part is back. If it is not detected at an early stage, it will quickly invade at nearby tissues and can spread to other parts of the body. Segmentation of skin lesion is considered due to complexity under and over segmentation. It has a greater capacity to spread to other organs; thus, it is responsible for the highest death rates even with its low incidence. The image processing is one of the most common methods used to detect and classify this disease. This is the most promising technology now days we are using for the early detection and identification of the disease. Image processing is nothing but an imaging process. Where an image, a series of images or videos or a photograph is entered after that, the output can be an image processing or a set of characters or parameters related to the input images. Images have widespread and wider future work in modern science and technology. It is the method of performing certain image operations to obtain an improved image for useful information. Image processing plays an important role in skin cancer detection. A framework must be developed with dermatological photographs to analyze and evaluate the risk of melanoma. It is possible to define an approach for this type of skin cancer through digital image processing techniques. This approach provides a skilled person with diagnostic reliability and agility. Increasingly, the areas of digital image processing applications require methods that emphasize the information contained in images for human interpretation and analysis.

II. LITERATURE REVIEW

[1] In this research we are going to target work done by numerous folks on melanoma detection by mistreatment totally different techniques like FCM, K-means, GLCM and Contour Signature. According to the importance of early detection, many corporations have dedicated time and efforts to boost the first screening method [1].

[2] Skin cancer classification using a water shed method and edge detection. PCA (Main Component Analysis) provides 92 percent accuracy compared to TDS (Total dermatoscopy score) [2].

[3] We found that the classification and the segmentation of images by their asymmetry border color diameter. Analysis of patterns and texture can also be done. We find the associated origin image with the specific property. It includes filtering and detection of samples [3].

[4]An image segmentation method was done for early detection of melanoma stated that with the help of MATLAB the stage of melanoma can be detected. [4]

[5] It captures and analyses label pictures of pigmented skin lesions that square measure hold on for subsequent lesion observation or confirmation. The system was tested and one paper revealed within the application of the system. In the year of 2002 Thomas Bayes rule in concert of the skin lesions classification technique was revealed with rather inconclusive results. However, dermoscopic images results a magnified view for skin lesions its interpretation and diagnosis accuracy mainly depend on the experience of the viewer. Several diagnosis models with similar reliability have become more widely accepted by physicians as, 7-point check, Menzie rule and the most popular scoring system so called ABCD rule Determination and Extraction of characteristics that indicate lesion characteristics usually involve error- prone operation through all automated diagnostics. The introduction of these automated diagnostic systems as a non- invasive diagnostic support tool is therefore an endless work of interest. A considerable number of researches and publications focused on the area of image analysis and pattern classification related to melanoma images identification and classifications. Over the last 20 years, the computer aided diagnosis systems for melanoma diagnosis developed to have diagnosis accuracy around 73% to 98%. Common classification strategies like applied mathematics and rule-based ones were applied within the researches of. K nearest neighborhood as another classification technique was used within the analysis [5].

[6] In 1985, recognizing the need to educate physician and the public to recognize melanoma in its 7 early clinical presentation, group from New York University coined the ABCD acronym (Asymmetry, Border irregularity, Color variegation, Diameter > 6mm). For melanoma skin lesion detection, ABCD features are most widely used for feature extraction which is based on morphological analysis of dermatoscopic image of skin lesion . [6]

[7] Earlier the detection was done by features of the lesion which was compared with ABCD rule. In this research the disease is detected by Support Vector Machine in which feature is as input classifier. And the accuracy is also measured for other SVC classifier with the comparative studies. Image processing has a promising scope for early detection and classification of cancer of the skin by using the image of the skin. There has been a lot of research in this area covering various avenues such as early detection of symptoms, malignant transformation, cancer classification, benign / malignant discrimination, etc. However, further research in this field should be carried out to make the system more useful and applicable. To this end, the author(s) propose several improvements to this technology to improve people. [7].

III. RESEARCH METHODOLOGY

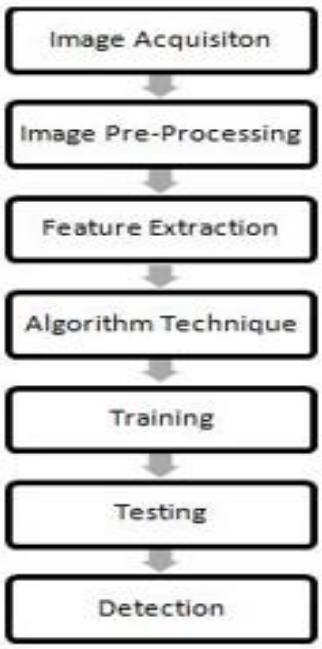

Fig 1 – Proposed Archiecture

Image Acquisition: -The main stage of any vision system is image acquisition. Image Acquisition is the process in which the creation of the digitally encoded representation is done. In this methodology the skin lesion images were acquired by digital camera. Image was in the form of JPEG.

Image Pre-Processing: -After image acquisition the second step is Pre-Processing. The image is given as input, the lesion image is checked, if so, it is preprocessed. Image Pre-Processing it is the process in which the image is filtered which can affect the accuracy. So, the digital image is filtered for noise removal.

Feature Extraction: - Feature Extraction plays a important role in digital image processing. Feature extraction is getting the features from the image which is to be classified. Feature extraction also plays a major role in detection of the images. In this research paper the feature was extracted on the image which was affected and unaffected by lesion on the skin. The original image was processed and the feature was extracted by making two classes.

Algorithm Technique: -In 1992, Boser, Guyon and Vapnik introduced the support vector machine (SVM) in COLT-92 for the first time. A Support Vector Machine (SVM) is a formally defined discriminative classifier by a separating hyperplane. In other words, given the labeled training data, the algorithm produces an optimum hyperplane that categorizes new examples. In two - dimensional space, this hyperplane is a line that divides a plane into two parts, where it lay on either side in each class. A set of related supervised learning methods used for classification and regression are support vector machines (SVMs). Support Vector Machine (SVM) is a classification and regression prediction tool that uses the theory of machine learning to maximize predictive accuracy while automatically preventing data over fitting. Support Vector machines can be defined as systems that use the hypothesis space of linear functions in a high-dimensional functional space, trained by an optimization theory learning algorithm that implements a learning bias derived from the theory of statistical learning. SVM uses the SVC classifier to classify two classes in the Training File. Support Vector Machine using the SVC classifier which is libSVM. SVC classifier gives the best fit data for the classification of the skin lesion detection. SVM classifier contains different kernel functions. Example RBF Kernel, Linear Kernel, Polynomial Kernel. This Kernel functions are used for comparative studies in skin lesion detection.

Training: - During Feature Extraction the training file was made with two classes which is class 0 and class 1. SVM classifier is chosen to classify the image as normal skin and melanoma cancer lesion. The SVM classifier was applied to train the data for the matching of the lesion on the affected area.

Testing: - Once the training of the data is done the testing part is important . After applying testing on the data, the confusion matrix was prepared and accuracy was measured as well as the kappa coefficient was measured.

Detection: - Detection was done on the skin lesion image which was a melanoma skin cancer disease.

IV. RESULTS

To measure the accuracy of the skin lesion disease for image SVM algorithm was applied. SVM classifier was applied which was SVC classifier. SVM algorithm was used for effectiveness and the accuracy of the melanoma skin cancer disease.

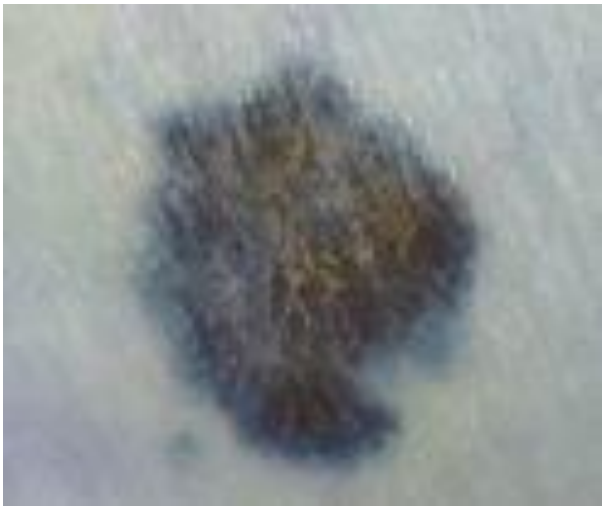

Fig 2. Original Image.

Fig 3. Affected Area.

Fig 3. Shows the Affected area which was classified with the SVM classifier. The affected area shows the lesion on the skin which is the melanoma skin disease. The accuracy for the affected area image was 99.91% and the kappa coefficient was 99.75%. Confusion matrix was applied on the affected area image for the accuracy of the melanoma disease. A confusion matrix is a table which is often used to describe the performance of a classification model on a set of test data for which the true values are known. The confusion matrix is a table of two by two containing four results from a binary classifier.

The confusion matrix derives from various measurements, such as error rate, accuracy, specificity, sensitivity and precision. In addition, several advanced measures are based on them, such as ROC and precision reminder. It is the tool to measure the accuracy of the given image. It consists the information to classified and misclassified data in supervised learning. So, the confusion matrix gives the accuracy which efficient for the image which was detected. Kappa coefficient is another method for the measurement of accuracy of the classifiers. This is essentially a measure of how well the classifier performed in comparison to how well it would simply have performed by chance. In other words, if there is a big difference between precision, a model will have a high Kappa score.

Kernel function	Accuracy	Kappa value
Linear	98.67	96.32
RBF	99.25	97.94
Polynomial	98.75	97.16

Fig 4. Different Kernel Functions

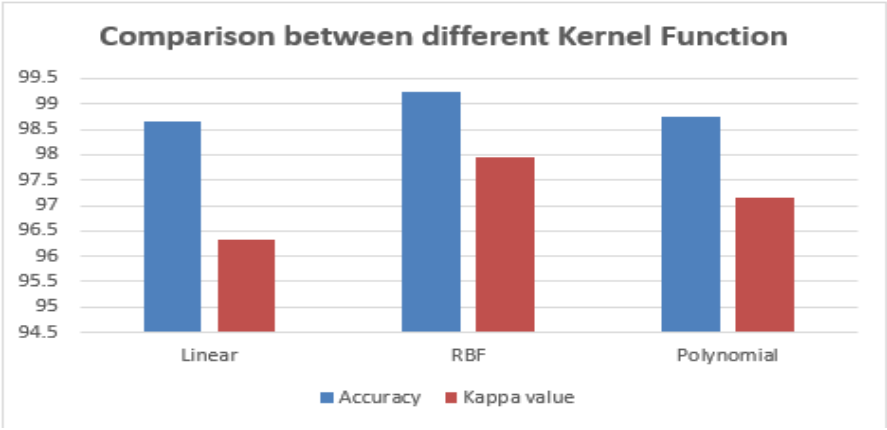

Fig 5. Comparison between different kernel functions.

Linear Kernel: - Linear Kernel function is the important kernel function in SVM machine learning algorithm. The Linear Kernel can be applied to linearly separable data, i.e. data from 2 classes can be divided by a line. For linear kernel function the accuracy is 98.67% and the kappa value is 96.32%.

RBF Kernel: -RBF kernel known also as the Gaussian kernel. The RBF kernel is a popular kernel function used in various learning algorithms kernelized. In particular, it is commonly used for classifying support vector machines. For RBF kernel function the accuracy is 98.67% and the kappa value is 96.32%.

Polynomial Kernel: -Polynomial kernel is a kernel function commonly used with support vector machines (SVMs) and other kernelized models, representing the similarity of vectors (training samples) over polynomials of the original variables in a feature space. For Polynomial kernel function the accuracy is 98.75% and the kappa value is 96.32%.

V. CONCLUSION

Methods for the early detection of melanoma was proposed in the research paper. After applying the SVM algorithm the disease was detected. SVM classifier was developed in the research for the classification of the data. These technique works on image so there is no physical contact with any part of body, so this is noninvasive. The confusion matrix which was applied was efficient to measure the accuracy and as well as the kappa coefficient was also measured for the skin lesion image.

VI. FUTURE ENHANCEMENT

The final output of the system will help the dermatologist to detect the lesion and its type. Accordingly, he will examine the patient with his knowledge to determine whether it can be operated or not or in any other way to cure the lesion, e.g. by using medicines or ointments. The skin cancer detection system will assist Dermatologists in early diagnosis of melanoma. The best way to reduce the risk of melanoma is to reduce exposure to high sunlight and other Ultraviolet light sources. Take care of all measures necessary, such as: we protect the skin with clothes, wearing hat, using sunscreen, staying in the shade.

VII. REFERENCES

[1]. RiteshMaurya,Surya Kant Singh,Ashish k Maurya,"GLCM and Multiclass Support Vector Machine based Automated Skin Cancer Classification",IEEE 2014.

[2]. Pauline J., Sheeba Abraham* and Bethanney Janney J. "review: Detection of skin cancer by image processing techniques"Research Article ISSN : 0975-7384 , CODEN(USA) : JCPRC5.

[3]. Nisha Oommachen, Vismi V, Soumya S, Jeena C D "Review: Melanoma Skin Cancer Detection Based on Skin Lesions Characterization" IOSR Journal of Engineering (IOSRJEN) e-ISSN: 2250-3021, p-ISSN: 2278-8719 Vol. 3, Issue 2 (Feb. 2013), ||V1|| PP 52-59

.[4]. Nilkamal S. Ramteke and Shweta V. Jain, "ABCD rule based automatic computer-aided skin cancer detection using MATLAB" in Int.J.Computer Technology & Applications, Volume 4 (4), 691-697.

[5].Celebi ME, Iyatomi H, Schaefer G, Stoecker WV. Lesion border detection in dermoscopy images. Computerized medical imaging and graphics. 2009 Mar 1;33(2):148-53.

[6]. Ho Tak Lau, Adel Al-Jumaily. "Automatically Early Detection of Skin Cancer: Study Based on Neural Network Classification‖", International Conference of SOCPAR, pp. 375-380, 2009.

[7].Ganster, Harald, P. Pinz, Reinhard Rohrer, Ernst Wildling, Michael Binder, and Harald Kittler. "Automated melanoma recognition." IEEE transactions on medical imaging 20, no. 3 (2001): 233-239.

[8].Rubegni, P., Cevenini, G., Burroni, M., Perotti, R., Dell'Eva, G., Sbano, P., Miracco, C., Luzi, P., Tosi, P., Barbini, P. and Andreassi, L., 2002. Automated diagnosis of pigmented skin lesions. International Journal of Cancer, 101(6), pp.576-580.

[9].Ercal, Fikret, Anurag Chawla, William V. Stoecker, Hsi-Chieh Lee, and Randy H. Moss. "Neural network diagnosis of malignant melanoma from color images." IEEE Transactions on biomedical engineering 41, no. 9 (1994): 837-845.

[10].Sheha, Mariam A., Mai S. Mabrouk, and Amr Sharawy. "Automatic detection of melanoma skin cancer using texture analysis." International Journal of Computer Applications42.20 (2012): 22-26.

[11]. Roehrig, Jimmy R., Alexander C. Schneider, and Shih-Ping Wang. "Method and system for computer-aided lesion detection using information from multiple images." U.S. Patent 6,075,879, issued June 13, 2000.

[12]. Alcón, J. F., Ciuhu, C., Ten Kate, W., Heinrich, A., Uzunbajakava, N., Krekels, G., ... & De Haan, G. (2009). Automatic imaging system with decision support for inspection of pigmented skin lesions and melanoma diagnosis. *IEEE journal of selected topics in signal processing*, *3*(1), 14-25.

[13]. Manousaki, A. G., Manios, A. G., Tsompanaki, E. I., Panayiotides, J. G., Tsiftsis, D. D., Kostaki, A. K., & Tosca, A. D. (2006). A simple digital image processing system to aid in melanoma diagnosis in an everyday melanocytic skin lesion unit. A preliminary report. *International journal of dermatology*, *45*(4), 402-410.
[14]. Maglogiannis, I., Pavlopoulos, S., &Koutsouris, D. (2005). An integrated computer supported acquisition, handling, and characterization system for pigmented skin lesions in dermatological images. IEEE Transactions on Information Technology in Biomedicine, 9(1), 86-98.
[15]. Rajab, M. I., Woolfson, M. S., & Morgan, S. P. (2004). Application of region-based segmentation and neural network edge detection to skin lesions. *Computerized Medical Imaging and Graphics*, *28*(1-2), 61-68.
[16]. Erkol, B., Moss, R. H., Joe Stanley, R., Stoecker, W. V., &Hvatum, E. (2005). Automatic lesion boundary detection in dermoscopy images using gradient vector flow snakes. *Skin Research and Technology*, *11*(1), 17-26.