# Color and Texture based Feature Extraction for Classifying Skin Cancer using Support Vector Machine and Convolutional Neural Network

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**Abstract -** *Melanoma is a series form of skin cancer that begins in cells and sometimes its very toffee to diagnoses. Noninvasive dermatology is used to diagnoses the type of cancer, and it is very difficult for dermatology. To classify skin cancer images into malignant and benign images are segmented using active counter model and texture color feature are extracted. Texture based features are used to diagnoses the disease and ISIC dataset is used for implementation to calculated average accuracy for Support Vector Machine (SVM) and Convolutional Neural Network (CNN). It is proved that CNN is achieved higher than SVM.*

*Key Words*:  Color feature extraction, Texture feature extraction, Support Vector Machine, Convolutional Neural Network

## 1. INTRODUCTION

Content Based Image retrieval is the important research in the current scenario due to the rapid growth in the internet and social media. There are lots of images are stored in the digital form and it is very important to develop a good algorithm in searching and indexing. Many recent technologies is focused to organize digital pictures by their visual features. "Content-based" means that the search analyses the contents of the image rather than text such as; keywords, tags, or descriptions associated with the image. Low level features like texture, color and shape are considered as the prominent features than textual features. Color feature are extracted using histogram, grid layout and wavelet transform etc… texture feature identical through Laws, Gabor filters, LBP, polarity and shape feature extraction are using geometrical, statistical and margin based properties. There is necessity to go for content based image retrieval (CBIR) for supporting clinical decision making.

Medical application used in CBIR Medical imaging systems produce more and more digitized images in all medical field visible, ultrasound, X-ray tomography, MRI, nuclear imaging, etc...The most of research are focused to classify skin cancer image based on color feature and texture features. The proposed approach includes ISIC dataset segmentation in region of interest. Feature color and texture properties two classifiers SVM and CNN used to benign and malignant. This presents a content-based image retrieval system for skin cancer images as approach include image processing, segmentation, feature extraction. The segmentation is a diagnostic to the dermatologists for skin cancer recognition the benign or malignant.

This paper proposes a color and texture based feature extraction using classification. Section2 describes about the related work on color and texture features for skin cancer images. Session3 exploratory preprocessing techniques to separate the color and texture information. And segmentation is explained to identify ROI for the given image. Session4 explain about the feature extraction procedure color and texture based feature extraction.Session5 provides the implementation part for the support vector machine and conventional neural network using dataset ISIC. Finally the session6 concludes the work.

## 2. Related Work

Farzam and Saied in 2017, is proposed an approach for melanoma skin cancer detection using color and texture features. They have introduced new texture features in their proposed work; they are Variance Mean Square (VMS) and Turn Count (TC). They are also used color based feature extraction techniques to identify various statistical features such as mean, variance, standard deviation, skewness and kurtosis [1]. In the year 2016, [2] Kavitha and Suruliandi have focused on texture and color feature extraction for classification using Support Vector Machine (SVM). There are three types of color feature extraction technique is used namely RGB, HSV and OPP and texture is used to extract GLCM of the image. Software Approach for Skin cancer Analysis and Melanoma is developed in 2017 by Ashwini and Sunitha. Dermoscopic images are pre-processed, segmented, color and texture features are extracted and finally classified using SVM. There are mainly three fundamental types of skin cancers; Basal Cell Carcinoma (BCC), Melanoma (M) and Squamous Cell Carcinoma (SCC) [3].

SVM classification for Melanoma detection is determine is determined by Suleiman, et al [2017]. There are various techniques is used for detection and one of the most important rule is the ABCD.  Color feature is extracted by HSV (Hue, Saturation and Value) and computer aided diagnosis is developed for melanoma detection [4]. Ebtihal and Arfan [5] in the year

2016, have proposed intelligent automated method for classifying skin lesion using machine learning approach. Thus a fused hybrid texture local and color as global features has been proposed to classify the melanoma and nonmelanoma. Marwan in 2016, new prediction model that classifies skin lesions into benign or malignant lesions based on a novel regularizer technique. Binary classifier is applied to discriminate benign or malignant lesion [6].

Shreen focused to develop a medical low-cost handheld device that runs a real-time embedded SVM-based diagnosis system for early detection of melanoma. They have proposed a hardware device (chip) for identifying online melanoma detection [7]. Thamizhvani et al [2018], have proposed Statistical and histogram features. Neural Network (NN) classification to find the accuracy of skin tumour. NN classification technique give the high accuracy of feature extraction and classify the skin tumour category [8]. In the year 2017 Aya and Hasan focused on Melanoma detection using regular Convolutional Neural Networks. The proposed method have classify the melanoma images are find the benign or malignant using the Convolutional Neural Network (CNN).CNN evaluated for Accuracy, Sensitivity and Specificity melanoma images [9]. In the year 2019 Youssef et al [10] have proposed work Skin lesion classification based on texture features. CNN classification technique focused on this proposed work. In this approach give the high accuracy compared to the other classification approaches.

## 3. Skin Cancer Classification

The preprocessing techniques are very importance method to decide careful boundary of skin cancer image. Here show that an effective step for processing dermatoscopic images of melanocyte injuries bound is to skin cancer. The skin cancer extension and extraction of exact boundary between skin cancer and context is one of effective parameters to diagnose skin cancer.

The International Skin Imaging Collaboration (ISIC) dataset currently contains one of the largest collections of contact non-polarized dermoscopy images, in each of the two folders, there are 1800 pictures of models from the ISIC-Archive resized to 224px x 224px. The ISIC dataset currently contains one of the largest collections of contact dermoscopy Images, complete with manual placed around the lesions for analysis. The images is used for evaluation that is contained 300 images of benign and 360 of malignant melanomas.

The Proposed method of skin cancer image used to segment. The method is an active counter model based on segmentation and level set methods so that it can identify the best skin cancer images. To segment the dermoscopy image using region based -- region merging and region splitting. The active contours using curve evolution techniques. The next step is border of the segmentation of the grayscale skin cancer images. And also find out the colored of ROI. Another important feature of same method is that because of importance and high accuracy in segmentation, images for initial optimal district are determined by user and the this area can be placed anywhere on the image. Then exact boundary of optimal district is extracted by algorithms. There is more information on segmentation in. Fig. 3 shows one example of segmented images for malign melanomas.
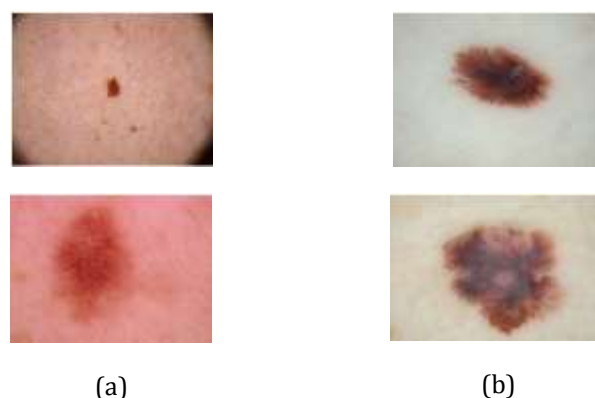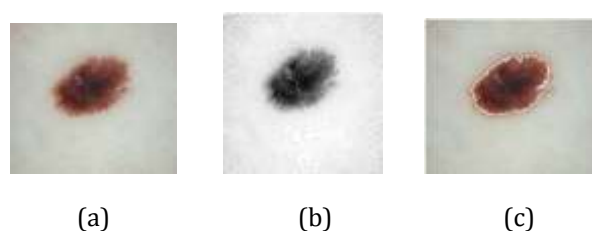


(a)        (b)

Fig 1: (a) Sample Benign image and (b) sample malignant images



(a)      (b)      (c)

(d)                    (e)                    (f)
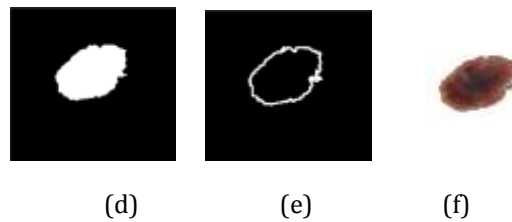
Fig 2: Segmentation process

(a)  original image b)Grayscale c)Segmentation d)Active Countor Model e) Border of the Segmentation of Grayscale image f) Colored of ROI

## 4. Feature Extraction

The skin cancer image features extraction must to classify with high-accuracy. ABCD-based features have been extracted as common features in some research work .To extract features using HSV for color based feature extraction and statistical method for texture based feature extraction. In color feature skin cancer boundary and texture features were to improve performance of system. Color and texture features are used in proposed method. Each feature extraction was separately evaluated using SVM and CNN classification. Finally system was examined using both features simultaneously.

### 4.1Color-based features

Color based feature extraction is represent the histogram of HSV model. H is Hue, S is saturation, V is value. Hue denotes the property of color such as blue, green, red, and so on. Saturation denotes the perceived intensity of a specific color. Value denotes brightness perception of a specific colors. The used in color pickers, image, editing software, image analysis and computer vision. Mostly commonly used red, green, and blue color model. Table 1 shows the HSV values for each component.

(a)Hue

Hue is more specifically described by the dominant wavelength and is the first item we refer to (i.e. "yellow") when adding in the three components of a color. Hue is also a term which describes a dimension of color we readily experience when we look at color, or its purest form; it essentially refers to a color having full saturation

(b)SATURATION

Saturation describes the amount of gray in a particular color, from 0 to 100 percent. Reducing this component toward zero introduces more gray and produces a faded effect. Sometimes, saturation appears as a range from just 0-1, where 0 is gray, and 1 is a primary color.

(c)VALUE (OR BRIGHTNESS)

Value works in conjunction with saturation and describes the brightness or intensity of the color, from 0-100 percent, where 0 is completely black, and 100 is the brightest and reveals the most color.

### 4.2 Texture based features

Texture is one of the main feature in skin cancer image. The texture based feature extraction are find out the statistical feature. The each image calculate the mean, variance, standard deviation, skewness and kurtosis. Image texture are used to help the segmentation or classification of the skin cancer image. Thamizhvani et al [2018], have proposed on Statistical method. Table 2 shows the statistical values for each component.

(a)  Mean

Mean is the average value of color values in the calculated by below expression (1)

$$\mu = (\Sigma X_i)/ N.$$                                                    … (1)

(b)  Variance

Variance is the expectation of the squared deviation of a random variable from its mean. In general, it determines the spread out of set of random numbers from their average value. Variance with $\mu$ as mean is shown in equation (1)

$$Var(X) = E[(X - \mu)^2] \qquad \ldots (2)$$

(c)  Standard deviation

Standard deviation ($\sigma$) is a used to determine variation or dispersion measure of a set of data values and is shown in the equation (2) where, $\mu$ is mean; pi is the number of probabilities from p1, p2… pN.

$$\sigma = \sqrt{\sum_{i=1}^{N} p_i (x_i - \mu)^2}, \text{where } \mu = \sum_{i=1}^{N} p_i x_i \qquad \ldots (3)$$

(d)  Skewness

Skewness is asymmetry measure of probability distribution of a real value random variable over its mean [1]. The skewness values can be positive or negative or undefined which is shown in equation (4) with average mean as

$$Skew[X] = \frac{E[(X-\mu)^3]}{(E[(X-\mu)^2])^{3/2}} \qquad \textbf{...} (4)$$

(e)  Kurtosis:

Kurtosis can be defined as the probability distribution measure of a real value random variable. This is a   descriptor of the shape of a probability distribution. Kurtosis is shown in the equation (5)

$$Kurt[X] = \frac{E[(X-\mu)^4]}{(E[(X-\mu)^2])^2} \qquad \ldots (5)$$

Table-1: Color and Texture Based Feature Extraction

| Sample Images | Color Based Feature Extraction | | | | Texture Based Feature Extraction | | | |
|---|---|---|---|---|---|---|---|---|
| | Hue | Saturation | Value | Mean | Variance | Strand deviation | Skewness | kurtosis |
| | 0.0002 | 1.0002 | 2.0002 | 146.963 | 1516.7 | 66.1031 | -0.5397 | 2.2964 |
| | 0.0004 | 1.0004 | 2.0004 | 153.6753 | 115.2 | 37.8897 | -2.1481 | 7.1353 |
| | 0.0005 | 1.0005 | 2.0005 | 115.2226 | 1435.6 | 47.6725 | -0.2980 | 1.7846 |
| | 0.0006 | 1.0006 | 2.0006 | 181.8703 | 4369.6 | 38.9457 | -2.3274 | 7.2480 |
| | 0.0009 | 1.0009 | 2.0009 | 136.0731 | 2357.7 | 48.5569 | -1.0122 | 2.9110 |
| | 0.0010 | 1.0010 | 2.0010 | 143.8253 | 6922.8 | 83.2039 | -0.5626 | 1.5609 |
| | 0.0011 | 1.0011 | 2.0011 | 154.1033 | 1861.0 | 43.1395 | -0.8288 | 2.9803 |
| | 0.0012 | 1.0012 | 2.0012 | 152.7171 | 3730.1 | 61.0751 | -0.9399 | 2.2735 |

## 5. Performance Evaluation

The International Skin Imaging Collaboration (ISIC) dataset is used for implementation purpose and the dataset is collected from the following URL https://www.kaggle.com/fanconic/skin-cancer-malignant-vs-benign. There are 360 images coming under the categories of malignant melanomas and 300 images coming under the categories of benign. The 10flod cross validation techniques used for training and testing. 300 benign images for training and testing and 360 malignant image for

training and testing. To find out the average accuracy, sensitivity, specificity is calculated for both support vector machine and convolutional neural network and the result listed in the graph.

Accuracy

Accuracy is calculated by (TP + TN)/(TP + TN + FP + FN). It specifies the percentage of objects that have been correctly classified.

$$\text{Accuracy} = \frac{TP+TN}{TP+FN+TN+FP} *100 \qquad \dots (6)$$

Sensitivity

Sensitivity refers to the test's ability to correctly detect will patients who do have the condition medical test used to identify a disease, the sensitivity of the test is the proportion of people who test positive for the disease among those who have the disease. Mathematically, this can be expressed as:

$$\text{Sensitivity} = \frac{TP}{TP+FN} *100 \qquad \dots (7)$$

Specificity

Specificity relates to the test's ability to correctly reject healthy patients without a condition. Consider the example of a medical test for diagnosing a disease. Specificity of a test is the proportion of healthy patients known not to have the disease, who will test negative for it. Mathematically, this can also be written as:

$$\text{Specificity} = \frac{TN}{TN+FP} *100 \qquad \dots (8)$$

Here TP, FN, TN, FP Specify true positive, false negative, true negative and false positive respectively.
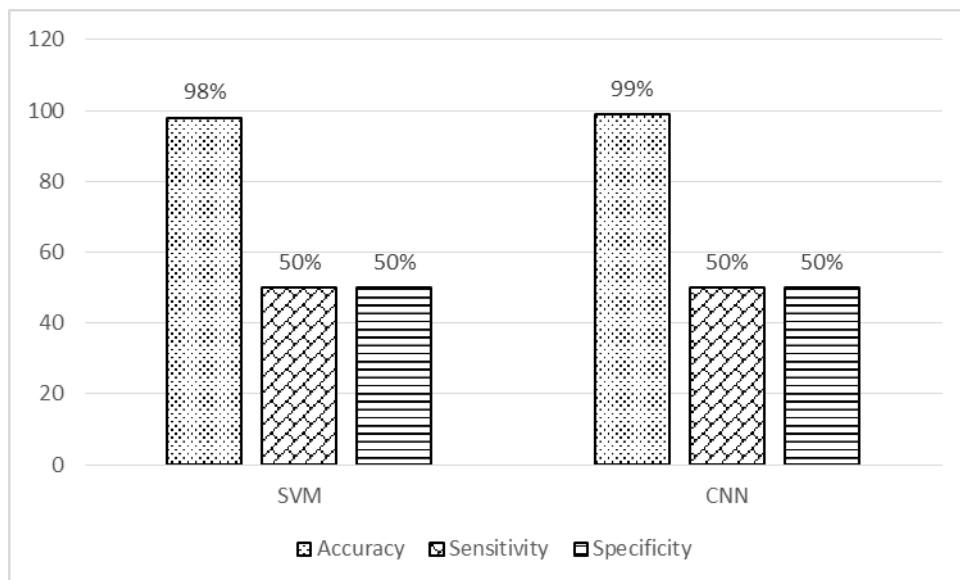


Chart-1: Performance of SVM and CNN in Skin Cancer

## 6. Conclusion

The main aim of this paper is to compare the SVM and CNN classification and helpful to diagnoses the skin cancer image. It is very difficult to diagnoses the skin cancer for dermatology and our proposed approach is very helpful to identify the skin cancer. It is proved that CNN given better accuracy then SVM.

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