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Advance Study Of Skin Diseases Detection Using Image Processing Methods

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Abstract- In this research advanced study of skin disease detection using image processing methods is considered. As we know skin diseases vary accordingly from symptom and severity. They can represent permanent or temporary or painful or painless based on affected disease. Some diseases have a genetic cause or some situational. Some diseases can be found life threatens or some minor based condition. But as per the survey report, many skin diseases become serious issues. So it is very important to continuously monitor and detect skin disease to provide proper treatment and faster recovery protocols. In this investigation, advance study of skin disease detection using fuzzy clustering with machine learning methods KNN and SVM classification algorithm with wavelet analysis is tested with 50 sample images. The results represent the K-Nearest Neighbor classification algorithm works well compared to the Support vector machine (SVM) classification technique with an accuracy of 91.2%. The algorithm also identifies the type of skin disease using classification methods.

Keywords- Disease detection, KNN, SVM, fuzzy clustering, symptoms, prevention.

1. Introduction

Skin infection is an infection related to soft tissue and membranes mucous tissues. Every year many diseases affect the human system due to different reasons [1]. Various conditions affect the entire body

of the surface which associates with hair, skin, nails, and muscle or glands problems. Skin disease is also one of the important aspects to detect and track diseases continuously to maintain human health [2]-[4]. The major factors are the environmental barrier which is usually known as functions of system barrier. The skin made up of three distinct layered known as epidermis, dermis, and tissue subcutaneous and two square meter coverage area [5]-[8]. The epidermis is a superficial layer of the skin without direct blood supply. It consists of four types of cells they are keratinocytes, Langerhans, Merkel, and Melanocytes cells. This kind of cell consists of 95% chances of skin diseases. This stratified cell is maintained by cell division within the basale through which cell differentiating slowly display outward through the spinosum stratum to corneum stratum, in which cell shed continuously from the surrounding or surface[9]-[10]. Based on the normal skin the rate of loss is equal to the rate of production. Around two weeks needed to recover or to cells migrate from cell layer basal to the top layer of granular cell and need additional time to cross the corneum stratum layer[11]. The dermis is another form of skin layer which lies between subcutaneous and epidermis and subcutaneous tissue is the layer of fats between fascia which is underlying and dermis [12]. There are two main types of skin they are skin called glabrous (Hairless skin) and hair-bearing skin. Skin infection causes bacterial, fungal, parasitic, and viral. Bacterial diseases affected around 155 million people around the world in a year [13]. It includes Cellulitis, Folliculitis, and Impetigo and Erysipelas kind of bacterial diseases. Fungal infections cause deep infection over the body, hair, skin, and nails. A report of 2010, globally it affected around 1 billion patients around the world [14]. Parasitic skin diseases caused by several organisms of phyla which include Annelida, Bryozoa, Arthropoda, Chordata, Cyanobacteria, Cnidaria, Echinodermata, Protozoa, Platyhelminthes, and Nemathelminthes. Viruses also cause skin diseases through intercellular agent form from both RNA and DNA viruses [15].

2. Diagnoses

Skin disease diagnoses can be done through the following stages- morphology, configuration, and lesion distribution. In the morphology stage initially, it considers the primary lesion and then identifies the most important method of examination [16]. Based on time, the primary lesion continues to develop or modify by trauma which produces secondary lesion. Some of the primary lesions are macule, patch, papule, plaque, nodule, tumor, vesicle, bulla, pustule, cyst, wheal, telangiectasia, burrow. The secondary lesion is scale, crust, lichenification, erosion, excoriation, ulcer, fissure, induration, atrophy, maceration, umbilication, phyma [17]-[18].

Figure 1- Skin Disease

3. Methodology

These studies investigate four stages, image preprocessing, segmentation of image using fuzzy clustering, feature extraction, and classification. Data collected around 50 patients from the hospital which diagnose skin diseases and help in identifying the number of patients facing problems of skin diseases with two classes: Basal and Squamous diseases.

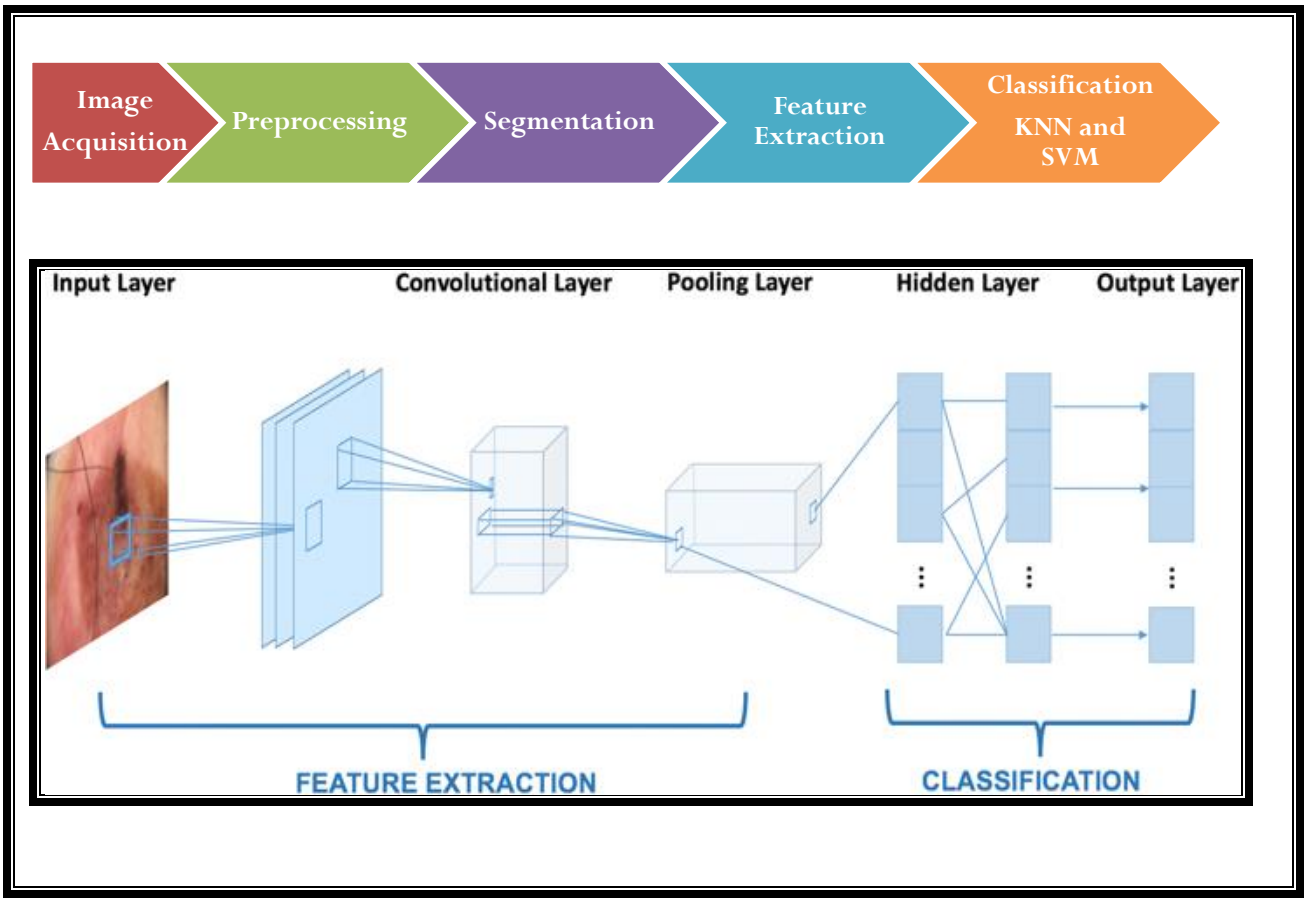


Figure 2- Methodology

4. Preprocessing using Median Filter

Preprocessing is a method for removing background noise from images. To remove noise from images median filter is used. Median filters play an important role in removing noise from images. The median filter is a non-linear statistical filter, which describes in spatial domain form. It smoothing images be utilizing the median value of the neighborhood pixels over the image. In the processed image median filter perform two tasks. Firstly all pixels in the neighborhood and the original image are sorted in ascending value orders. Secondly, the sorted median value computed and chosen as the pixel value for the processed image.

5. Segmentation

In the segmentation method, it helps to detect the region of interest area for the particular image which needs to be examined. The main objective of image segmentation is to find out region-based interest over the image. Segmentation steps involve split methods which help the image to split into the equal region or called as a unit. For iteration, it involves a split and merges process. Firstly, iteration split the region into different parts of the region then it followed by the merging process. In segmentation, the threshold value is set to 0.1.

6. **Fuzzy Clustering**

The clustering technique helps to cluster the pixels features into similar groups. The pattern depends on membership values over distributions. It determines the relationship between cluster and pattern data naturally. Fuzzy clustering follows grading system values and iteratively updates the centroid of the cluster and estimates membership class functions by using the gradient approach method. The dissimilarity function can be calculated by choosing the scale and diversity of patterns.

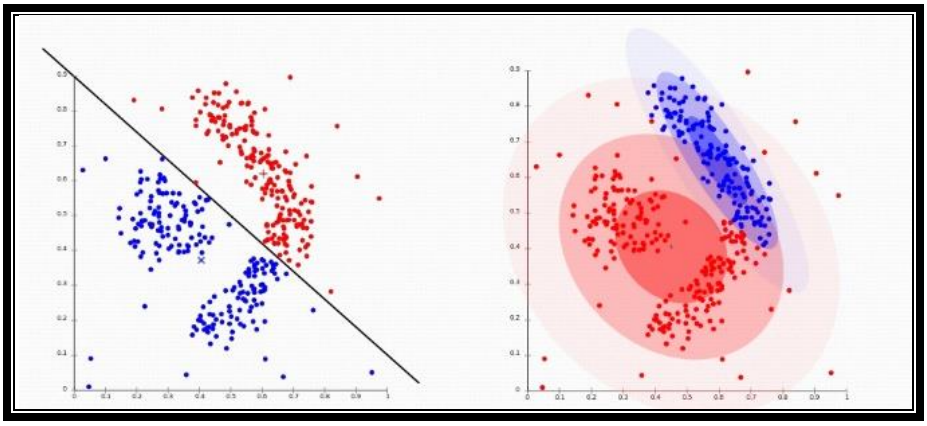


Figure 3- Fuzzy Clustering

7. Feature Extraction

For skin disease detection collections of features, extraction is color-based features RGB, mean standard deviation, entropy, ellipticity, intensity, coefficient with Correlation. These are the feature considered for the detection of skin diseases using wavelet analysis SYMLET analysis family.

8. Classification

Machine learning is a computer-based study algorithm that automatically improves through experience. It is also seen with an artificial intelligence subset. It built a mathematical model according to sample data called training data to make proper decisions and predictions for programmed to implement. It related to statistical and computational work which helps in calculating and perdition of using computers. In this research, KNN and SVM classifier is used in which it determines which classification method performs best in skin disease detection. In the K-Nearest Neighbors classifier algorithm (KNN) it consists of closest training k in feature space. The output value depends on regression or classifications. In KNN classification a class membership is an output, an object is classified using neighbors vote system with most common

among k nearest neighbors. If the value of k =1 then the object is assigned to a single nearest neighbor. In these work, 70% of training data and 30% testing data are used with k=2. Around 50 sample images have been considered for skin detection. In KNN classifier two classes used Basal and Squamous diseases. In SVM classifier helps the data to form cluster representation. When classifying data is clustered into two lasses and goals to decide which point belongs to which cluster then SVM is used which is called data point. In SVM the data point is denoted with p and to the separation between point p is (p - 1) called a hyperplane. This hyperplane is known as liner classifier value. To choose the best hyperplane to classify data it is represented with the largest separation or margin between two classes. During the process, if hyperplane exists than its called margin hyperplane –maximum.

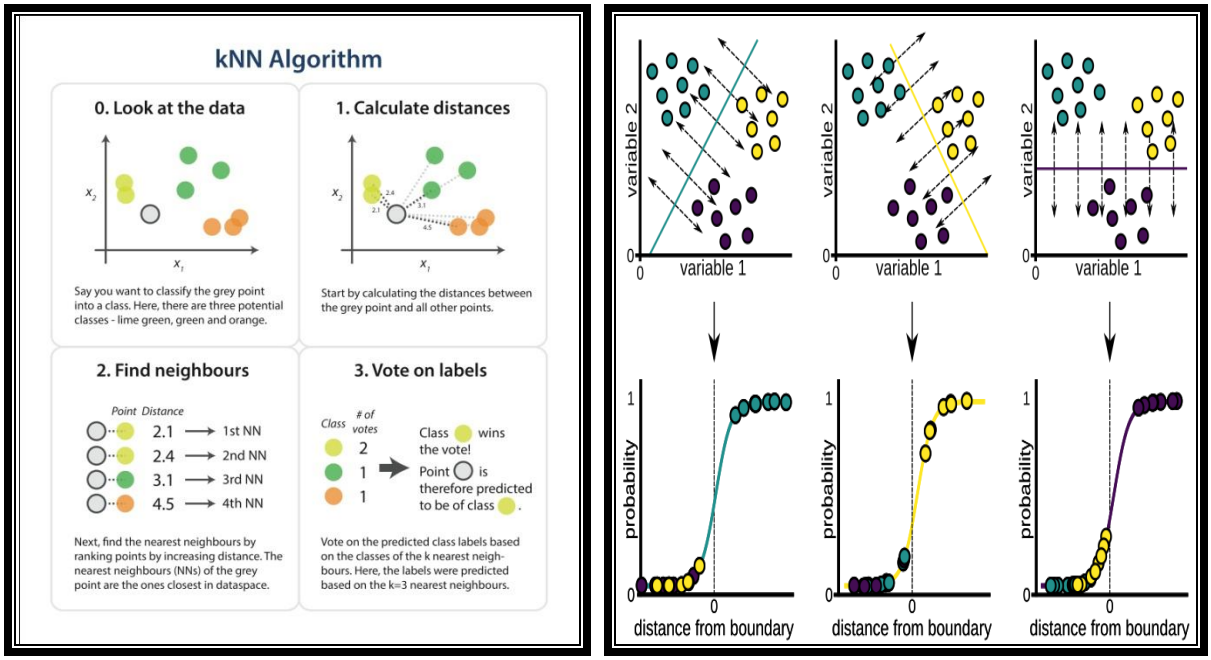


Figure 4: KNN and SVM classifier

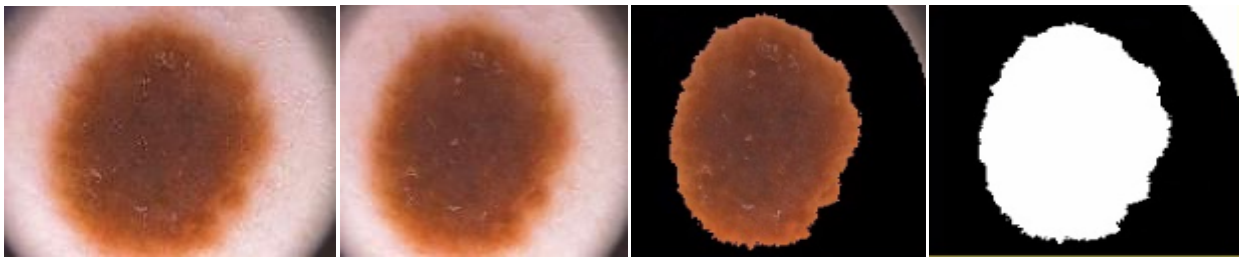
9. Result and Discussion

The result display skin disease detection using image processing techniques. Four stages were examined image preprocessing using the median filter, segmentation with fuzzy clustering algorithm with detection of skin disease, and classification of skin disease. Data collected for testing around 50 patients from the hospital, which diagnosis skin disease problems in the human body.

For this research two classes investigated they are Basal and Squamous diseases for the patients. The resultant image represents skin disease by applying image processing techniques. This research explores the advanced technique to detect boundaries, segmented areas, and enhance detection of skin disease. The output shows skin disease generation with white color and remaining portions with dark black color. The input image was taken for three kinds of skin diseases they are Basal and Squamous disease which represents human skin. Sample images result shown for two patients and the total samples were taken for 50 patients.

(1) (2) (3) (4)

Result 1- Basal Disease Detection



(5) (6) (7) (8)

Result 2- Squamous Disease Detection

Figure 5- Skin Disease Detection

.Figure 5- The resultant image represents a) Input image which considered for testing skin disease, b) Preprocessed image, c) Segmentation results using fuzzy clustering, d) Detection of skin disease with Basal and Squamous diseases for the patients.

Table 1 shows the analysis of diagnosed patient's records with skin disease problems using wavelet analysis (SYMLET families) using classification techniques with the type of skin disease detection. Initially, the method performs preprocessing using a median filter then applied segmentation using the fuzzy clustering method then performed symlet analysis then classified the type of skin diseases using KNN and SVM machine learning methods. In this research, KNN and SVM classifier is used in which it determines which classification method performs best in skin disease detection. KNN classifier consists of closest training k in feature space. The output value depends on classifications. In KNN classification a class membership is an output, an object is classified using neighbors vote system with most common among k nearest neighbors. In this research the value of k is 2, the object is assigned to the nearest neighbor. For training and testing (70% training data used and 30% testing data is used with k=2) for this research 50 sample images is considered for skin disease detection with two classes basal and squamous diseases.
Support vector machine used for classification and regression methods. In this research classification of the infected image is the main goal for identification. This work represents the SVM algorithm which helps to create a decision boundary or best line that can segregate n-dimensional space into classes, based on this we can easily put the new data point in the correct category in the future. The best decision boundary

is called a hyperplane. To create hyperplane, SVM chooses the vector/ extreme points for the process. These vectors are called support vectors. The investigation is based on two different categories that are classified using hyperplane and decision boundary. Initially, train the images basal and squamous diseases.) so that to learn about different features of spots and rusts, and then test the images with these strange diseases. In this examination SVM creates a decision boundary between two datasets (basal and squamous diseases.) and choose stream case (support _vector), it will illustrate the extreme case of spots and rust infection using MATLAB coding. On these conditions of support vector, it will classify it with a resultant disease called basal.

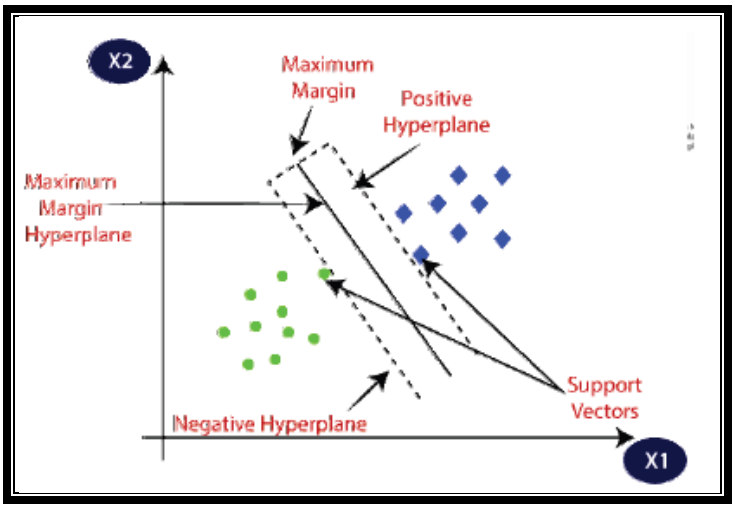


Figure 7- Decision making and hyperplane

Table 1: SYMLET2, 3,4, 5,6,7 and 8 Analysis using KNN and SVM classifier with skin diseases detection

Algorithm	Feature Extraction	Wavelet-based SYMLET Analysis						
		sym2	sym3	sym4	sym5	sym6	sym7	sym8
KNN Classification	R _Color	77	67	87	93	76	54	75
	G _Color	87	65	65	67	88	76	48
	B _Color	68	88	85	77	64	53	64
	Mean_ Value	66	86	65	65	65	85	65
	SD_Value	85	92	73	54	63	76	81
	Entropy	54	66	82	88	66	86	56
	Ellipticity	73	55	76	64	75	96	79
	Intensity	45	76	46	88	74	75	46

	Coefficient with Correlation	65	54	72	64	56	74	56
Overall Accuracy Using KNN Classification								
		sym2	**sym3**	**sym4**	**sym5**	**sym6**	**sym7**	**sym8**
Basal Disease Accuracy (%)		87%	40%	88%	**91.2%**	77%	40%	78%
Squamous Disease Accuracy (%)		34%	89%	50%	39%	54%	84%	60%
	Feature Extraction	**sym2**	**sym3**	**sym4**	**sym5**	**sym6**	**sym7**	**sym8**
SVM Classification	**R _Color**	57	20	86	53	32	34	56
	G _Color	53	65	53	75	64	24	74
	B _Color	86	77	54	73	53	46	69
	Mean_ Value	85	43	68	32	46	57	67
	SD_Value	74	65	67	75	47	85	54
	Entropy	29	64	25	75	46	56	53
	Ellipticity	83	85	53	56	49	53	45
	Intensity	63	54	85	68	52	86	76
	Coefficient with Correlation	76	84	36	85	85	84	87
Overall Accuracy Using SVM Classification								
		sym2	**sym3**	**sym4**	**sym5**	**sym6**	**sym7**	**sym8**
Basal Disease Accuracy (%)		77%	50%	79%	**85 %**	83%	76%	56%
Squamous Disease Accuracy (%)		34%	79%	60%	69%	54%	83%	60%

Table 1 shows the analysis of diagnosed patient's records with skin disease problems using wavelet analysis (SYMLET families) using classification techniques with the type of skin disease detection. Features extracted are color-based features RGB, mean standard deviation, entropy, ellipticity, intensity,

coefficient with Correlation. These are the feature considered for the detection of skin diseases using wavelet analysis SYMLET analysis family. Based on results it is clear that the KNN classifier works well in the identification of skin diseases with an accuracy of 91.2 % using sym 5 with the basal disease.

Table 2- Skin Disease Detection using KNN Classifier

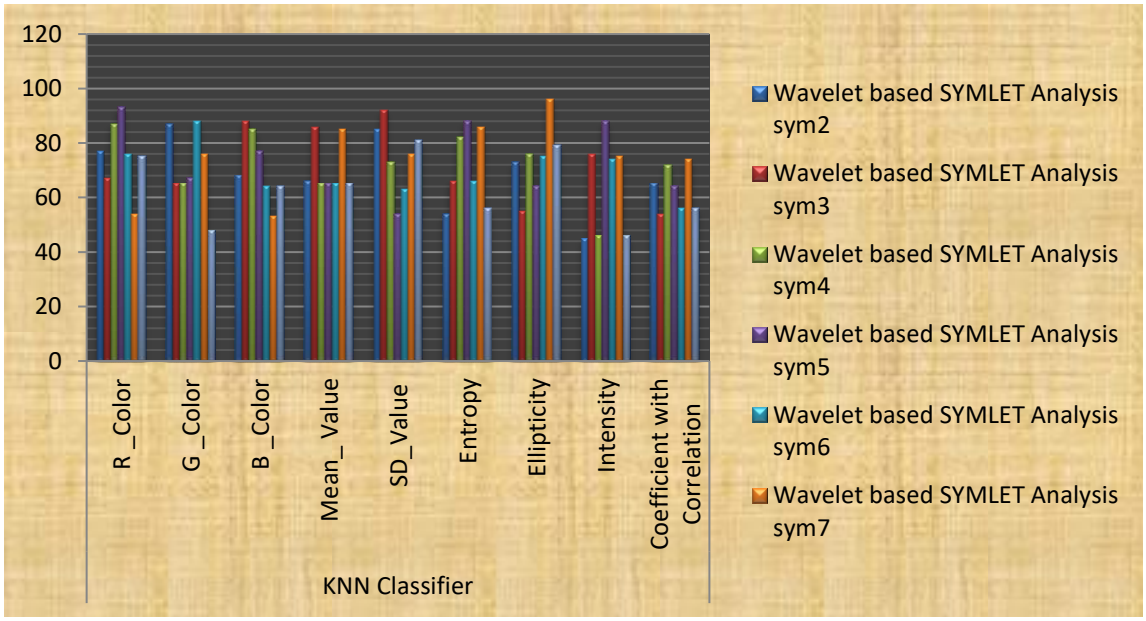


Table 2 shows the analysis of diagnosed patient's records with skin disease problems using wavelet analysis (SYMLET families) using KNN classification techniques with skin disease detection with an accuracy of 91.2% with basal skin disease.

Table 3- Skin Disease Detection using SVM Classifier

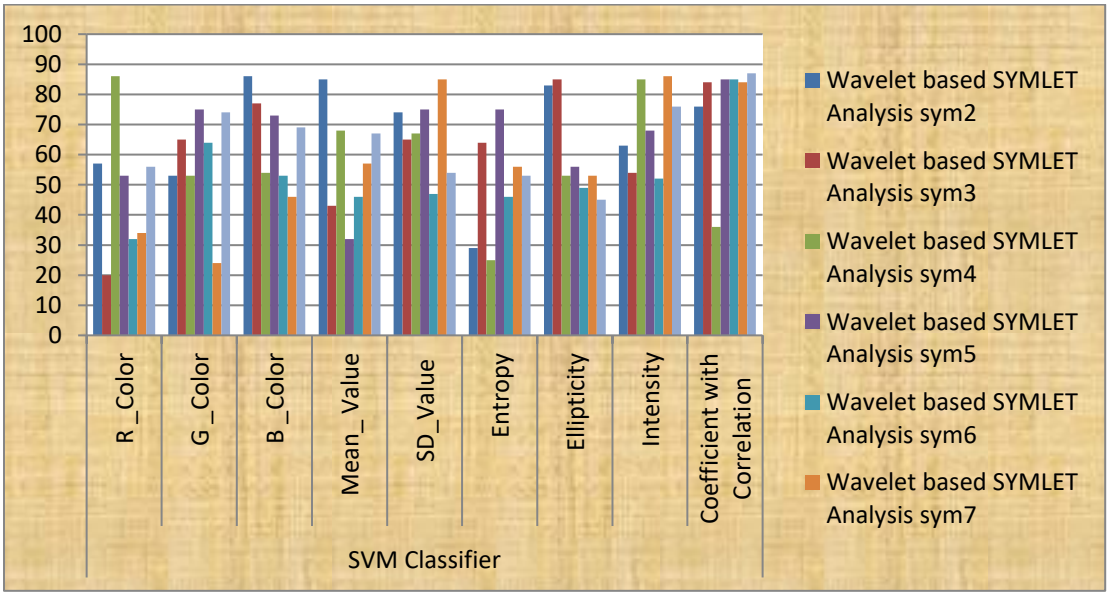
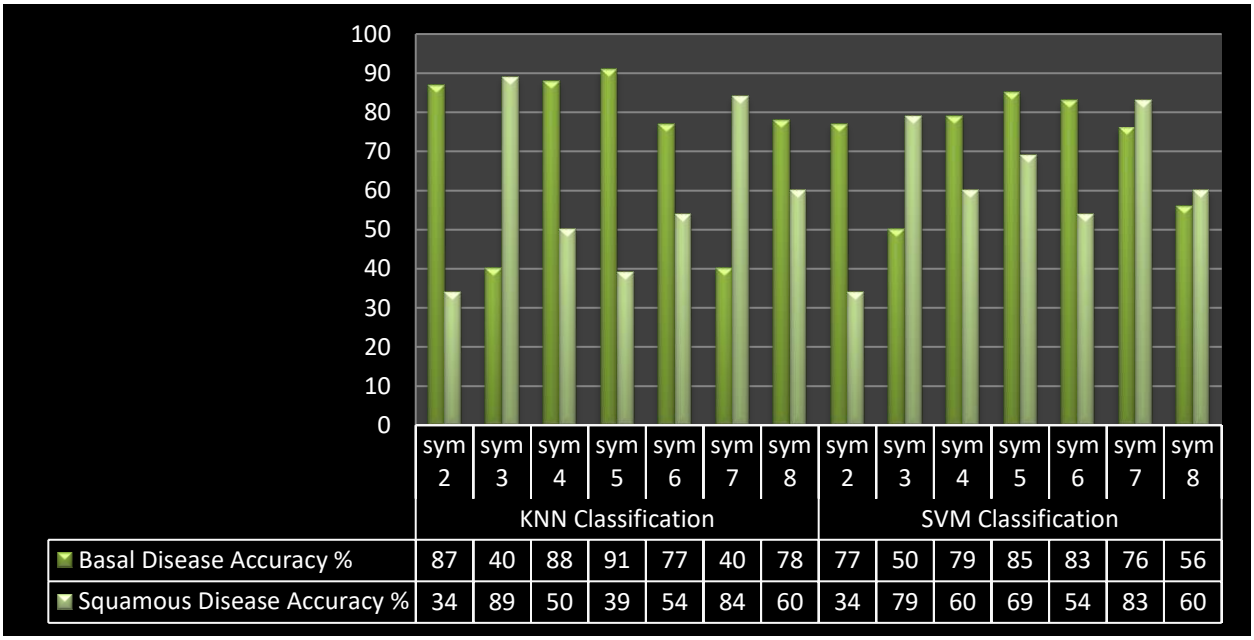


Table 3 shows the analysis of diagnosed patient's records with skin disease problems using wavelet analysis (SYMLET families) using SVM classification techniques with skin disease detection with an accuracy of 85% with basal skin disease.

Table 4 – Compared results of Skin Disease Detection using KNN & SVM Classifier



	KNN Classification							SVM Classification						
	sym 2	sym 3	sym 4	sym 5	sym 6	sym 7	sym 8	sym 2	sym 3	sym 4	sym 5	sym 6	sym 7	sym 8
Basal Disease Accuracy %	87	40	88	91	77	40	78	77	50	79	85	83	76	56
Squamous Disease Accuracy %	34	89	50	39	54	84	60	34	79	60	69	54	83	60

Table 4 shows the analysis of diagnosed patient's records with skin disease problems using wavelet analysis (SYMLET families) with KNN & SVM classification techniques for skin disease detection with an accuracy of 91.2% using KNN classifier with basal skin disease.

Conclusion

In this research advanced study of skin disease detection using image processing methods is considered. As we know skin diseases vary accordingly from symptom and severity. They can represent permanent or temporary or painful or painless based on affected disease. Some diseases have a genetic cause or some situational. Some diseases can be found life threatens or some minor based condition. But as per the survey report, many skin diseases become a serious issue. So it is very important to continuously monitor and detect skin disease to provide proper treatment and faster recovery protocols. In this investigation, advance study of skin disease detection using fuzzy clustering with machine learning methods KNN and SVM classification algorithm with wavelet analysis is tested with 50 sample images. The results represent the KNN classification algorithm works well compared to the SVM classification technique with an accuracy of 91.2%. The algorithm also identifies the type of skin disease using classification methods.

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