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Review on Skin Disease Detectionusing Machine Learning

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Abstract:

Nowadays skin disease have become common as many are affected by skin cancer. The skin related infections are caused because of numerousissues that manipulate humans likelifestyle, age and sex. Also a smaller amount or exposure to sunlight, bacteria, hot weather causes these types of skin diseases. Therefore detection of skin disease is more important and it is not easy to detect easier comparing to other diseases. So the main intent is to review previous methods and to find a new methof for skin disease classification.Hence many approaches such as ANN, CNN, SVM, KNN, Data mining and Image processing based algorithm have been used for detection of skin diseases. In this survey we have analyzed skin related disease classification using machine learning and image processing models. The detailed analyze of number of skin disaese are evaluated in this review with various techniques and their performances.

Keywords: Skin disease, Melanoma, Segmentation, Feature extraction, Classification, ANN, DNN and Image processing

1. Introduction:

The dermatology of the paediatric is the extremely dedicated subentity for the practice of dermatology. Skin diseases are the most important health issue in the children age group constituting about 30% of the entire outpatient appointment to the skin specialists. The skin problem for the children is differed from the adults with infections being the major familiar diseases such as psoriasis and eczema [2] [3]. The fast improvement in the computer expertise in the current decades along with the utilization of data mining skill participates in a critical role in the analysis of skin infections [4]. Skin diseases comprises ofordinary skin rashes to harshdermatological infections that happens owing to range of things, such as system disorders infections, medicines, allergens, and heat.

Table 1:*Evaluation of Humans with and without Skin Problem*

Parameters	Male		Female	
Total Numbers	144		196	
Condition	*With disease*	*Without disease*	*With disease*	*Without disease*
<10 years	19	26	21	28
11-59 years	37	25	47	36
>60 years	19	18	34	20

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Figure 1: *Sample images from Skin Disease Dataset*

There are many reasons that cause some problems in skin; it might contain lack of care in preserving the restless, skin, utilization of a few products which will not be altered to the skin or owing to little diseases. Frequently a variation in conditions of the climate that provides additional collision on the skin causes few problems. Thus, proper maintenance or testing precisely what type of problems occurred in the skin is very important to be sustained [1]. Melanoma is called as cutaneous melanoma or malignant melanoma which is the skin infection that contains cancer cells in the epidermis [12] [17]. Melanoma is a kind of skin cancer caused in accordance to prolonged exposure to ultraviolet light rays. Benign and malignant tumors are categorized under pigmented skin lesion wherein moles are benign and melanoma is of malignant and is one of the severe types of cancers. The most common diagnostic technique is visual inspection of candidates, which are abnormal shaped and coloured moles [8]. If we are not treating skin disease on time it may leads to complicated skin diseases. If we are treating on time then it will save human from these kinds of skin diseases [11]. The figure 1 depicts the dataset sample images from skin disease.

But the identification of skin disease is difficult. The skin disease is diagnosed by a choice of visual clues can be utilized like circulation of body site, morphology of individual lesion, lesion arrangement, colour and scaling. Analyze the component that is individual separately when the process of recognition is quite difficult [20] [21][23] [24]. From the images of dermascope there is a vast potential to identify the skin cancer that is impossible by an ordinary camera or microscopic images. The skin specialist utilizes various techniques such as CASH, 7-points checklist, ABCD rule and Menzies for the identification of melanoma. Up-to-dategrowths in the area of machine learning [36] andidentificationof pattern research have displayed the victoriousgrowth of learning algorithms that are able toidentifyvarious types of tedious diseases. If thesystem is accurate and the limitations of the issues are correctlypredetermined for the proficientmethod, the opportunity of exactlycategorizing these infections is elevated. The different types of skin diseases are as follows:

- *Systemic Disease*
- *Psoriasis*

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- *Nail Diseases*
- *Fungal infections*
- *Vascular Tumor*
- *Urticaria*
- *Acne and Rosacea*
- *Malignant Lesions*
- *Atopic Dermatitis*
- *Eczema*
- *Bacterial Infections*
- *Hair skin diseases*
- *Connective Tissues diseases*
- *Exanthems and drug eruptions*
- *Melanoma, Nevi and Moles*
- *Pigmentation Disorders*

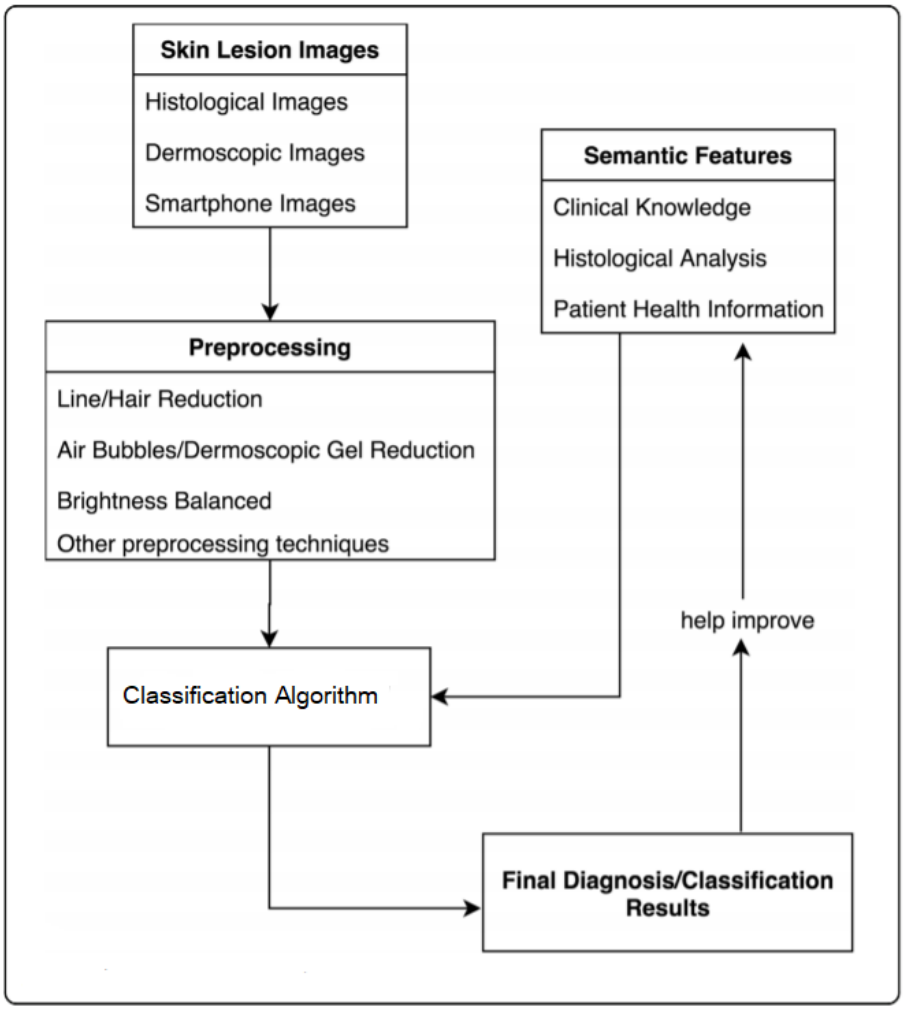

Figure 2: *Flow diagram of Skin disease detection process*

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2. Review of Existing Methods:

In this section,we have discussed about the different traditional Classification algorithms used more in to the Skin disease database images. The main process of skin disease classification is Pre-processing, Segmentation of Skin Lesions, Feature Extraction and finally Skin Disease categorization. The figure 2 shows the flow diagram/procedure of classification of skin disease. Nowadays skin disease have become common as many are affected. Therefore detection of skin disease is must and it is not easy to detect easier comparing to other diseases [27]. So the main intent is to review previous methods and to find a new methof for skin disease classification. Hence the classification of skin disease becomes more important and the cause for mis-classification is shown in figure 3

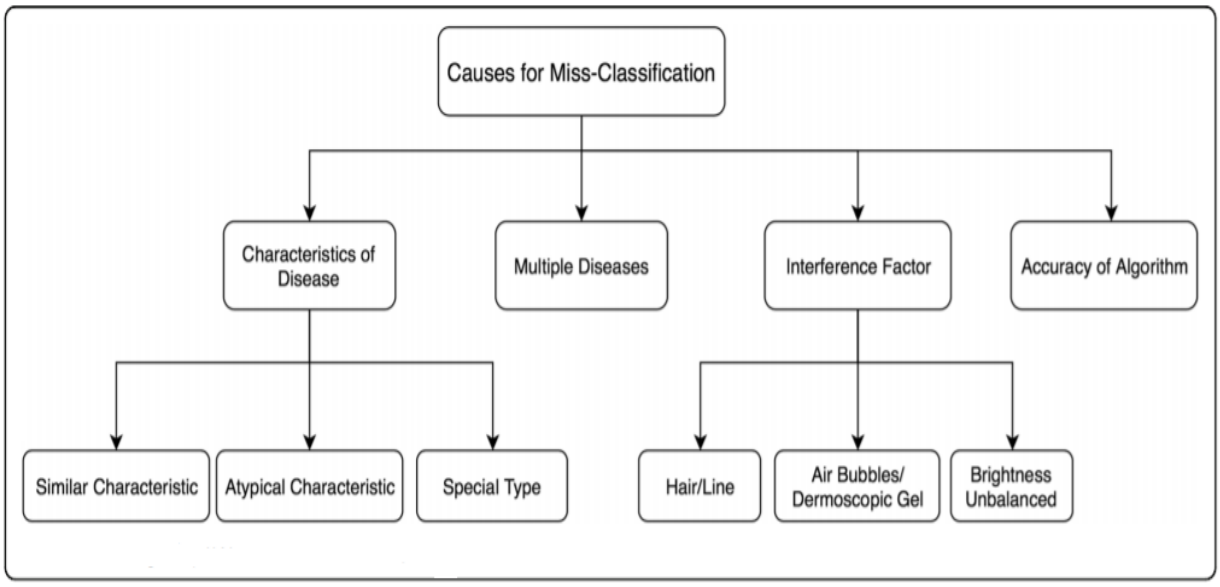

Figure 3: *Causes for Misclassification*

2.1 Support Vector Machine (SVM):

Avik Basu et al. [9] proposed SVM basedrecognition of skin disease like erythematous-squamous. The model was used to identify the type of skin diseases based on the threshold mentioned. Hence, SVM has widely employed for the best categorization of skin infections but for some advanced machine learning algorithms did not achieve best accuracy during the future stage process.

Maglogiannis et al. have proposed a smart process for categorization of Skin lesions from Dermnet database images. They have used thresholding for better classification accuracy. But the extracted features have not provided enough parameters for SVM to provide better recognition rate.

Table 2: *Evaluation and Comparison of SVM with types of skin disease*

Ref.	Type of skin Disease	Objectives	Classifier	Database	Evaluation Metrics	Drawback

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[6]	Herpes, Dermatitis and Psoriasis	To develop SVM for multi-skin disease	SVM	90 images of Psoriasis images	Recognition rate	Complexity
[9]	Erythemato-squamous	To classify the erythemato-squamous disease	SVM	UCI Data repository	Accuracy Incorrect Classification	Low accuracy

2.2 Artificial Neural Network (ANN):

Chakraborty et al. have proposed Network based approach for recognition of two skin diseases like skin angioma and basel cell carcinoma. The features are extracted using SIFT feature extraction. Later classification is processed using neural network method. They have used precision, recall and accuracy for performance evaluation metrics and the results shows that the system has not achieved better accuracy.

Kabari and Bakpo have developed an efficient artificial neural network (ANN) for the diagnosis of Skin Disease depends on the symptoms of patients' and causalhuman beings. ANNbuilds utilizing the architectural plan of feed-forward neural network was displayed to be proficient for indentifying the certain skin infections in the hot areas like Nigeria by the accuracy of 90%.

Zingade et al. [26] have presented a method which detects the skin diseases using ANN for identifying the skin diseases. This scheme normally identifies various kinds of skin infections and comprises of three stages processing, training and detection. For the stages of image processing we use algorithms such as conversion of RGB to HSV, conversion of grey scale to the input image. Once the values of HSV are obtained the disease regarding to the input images are detected by the ANN process.

Patnaik[30] proposed the methods of computer vision-based to identify severaltypes ofskin infections. For the extraction of feature numerous kind of image processing methods are utilized, for training and testing purpose feed forward ANN is utilized. This scheme works on two stages- first one pre-processing the skin images for colour to remove features and then recognizes the infections..

Another method that significantly enhances supporting systems of computer-aided quality is the deep CNN. But owing to the issues of creating timely and reliable outcomes, computer aided systems for the diagnosis is clinically adopted was now restricted. Fresh study on the informatics denotes that machine learning algorithms want to be merged with adequate clinical skill to obtain the best outcome. Xinyuan Zhang et al. [31] projected deep learning algorithms to assistdetect four familiar cutaneous diseases depends on dermoscopic images. To make easy of decision-making process and the accuracy is enhanced, wesummarized classification/diagnosis scenarios are summarized that depends on specialist skill for the field and semantically characterized in a hierarchical order.

Table 3: *Evaluation and Comparison of ANN with types of skin disease*

Ref	Type of skin Disease	Objectives	Classifier	Database	Evaluation Metrics	Drawback
[15]	Psoriasis, Melanoma and Eczema	To develop an automated and to predict the types of	ANN	813 images of Psoriasis and Eczema database	Accuracy	Prediction rate was low

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		skin diseases				
[19]	Psoriasis and Acne	To develop an intelligent scheme to classify the skin Disease	ANN	Database image of Psoriasis and Acne	Recognition rate	High cost and time complexity
[30]	Eczema and Acne	To identify different skin diseases	ANN	Data's collected from Sir Salimullah Medical College and Mitford Hospital	Accuracy	Accuracy rate varies for various kind of skin diseases

2.3 Image processing-based Techniques:

Arnal Barbedo [7] reviewed differentschemes for categorization to detect the illness from humans as well as plant skins. The indications of infection are obtained from stem or leaf utilising newmethodsemploying image processing technique. The chiefaim of the scheme is to identify, measure and to categorize the infection by increasing the rate of detection. But the scheme was unable to identify disease whereas utilising a larger number of infections.

Skin diseases which may be of the bacterial, fungal, allergies, enzyme etc. were very harmful for the skin and could spread throughout if not detected accurately as early as possible. So becomes necessary to identify the typedisease accurately in early stage and control it by taking proper precautions was demanding now days. So, theautomatic image analysis method could work really well in this way and was the heart of image processing.Especially in medical field it becomes useful for providing the quantitative information related with the skindisease. So, proved as an early warning tool for future problems during the treatment. Now a day's there was a needto perform the detection of disease accurately without any penetration in the body that's why simply digitalimages of affected skin region were captured by the camera could be processed by using image processing tools.There were many sub techniques of image processing tools were work and played important role in the area ofresearch. In this Megha Tijare [13] have developed an efficient algorithm classification of diseases by image processing tools. While doingthe segmentation it uses various color spaces like RGB, Ycbcr, HSV etc. Manish kumar and Rajiv kumar [19] have proposed a method for detection of skin disease using KNN. The KNN have been used in many areas and verified to be one of the most excellent. While applying for skin disease detection they have showed the recognition rate is poor comparing to other approaches like SVM, CNN and ANN. They have applied this KNN in to many databases to show the performance evaluation. The system successfully classified the skin diseases for two set of diseases, while failed to achieve accuracy for more than two set of skin diseases.

Table 4: *Evaluation and Comparison of Various Classifier with types of skin disease*

Ref.	**Type of skin Disease**	**Objectives**	**Classifier**	**Database**	**Evaluation Metrics**	**Drawback**
[29]	Pigmented Skin Lesion	To develop an automated skin disease	Multilayer perceptron Classifier	PSL images from DSSA	Detection rate	High cost and time complexity

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[13]	Allergies and Enzyme	To detect the skin disease by accurate skin segmentation	KNN	Camera Captured Images	Accuracy	Poor detection rate

Adria Romero Lopez et al. have analysed the consequences on skin disease categorization. The authors divided the premature melanoma by employing deep learning method. This method is utilised to assist human to acquire a conclusionsimply. The majorpurpose of author is to offeranprecisescheme for the identification of skin disease. This method uses CNN for the training and classification of diseases exactly but the method did not achieve the best accuracy owing to improper feature removal.They have proposed the classification of Skin disease by machine learning approach. They have used Artificial Neural Network to detect the skin disease precisely. They have used two phase-based method for better classification such as feature extraction and classification. The system has achieved better accuracy for skin disease classification but it takes more time for training though utilising a greater number of images

Zghal et al. [18] proposed a detection of skin cancer depends on image processing method. This method caught images with the help of camera on the smart phone. The stages such as pre-processing as well as segmentation wereachieved on individual image. Then segmentation was done at the identification of skin lesion. The extraction of feature was very significant for applications of predictive modellingfor better recovery. After feature extraction, classification of images could be completed. The captured images are compared by the method with database of training in the image processing technique. Hameed et al [22] proposed the classification of skin disease utilising machine learning technique. First the process is pre-processing, feature extraction and last classification process by utilizing machine learning approach for skin infections. The metrics for the performance evaluation achieves better outcomes in accuracy, but the drawback is high complexity.

Al-Masni et al. [28] have presented identification of skin disease. Aftercapturing image Pre-processing and segmentation would perform on the captured image. Feature extractionmethod was used to capture basic structures with shape, color and texture for retrieval of images. After feature extraction, classification of features could be done. In classification, the classifier is utilized on the classified skin lesions for the categorization of skin diseases by CNN. Damilola et al. [29] have presented an approach to design andmodel Skin lesion-based detection. They have used computational; intelligence method for detecting the images. The pigmented skin lesion is life threatening disease which should be carefully monitored and so they have used intelligence-based approach for better accuracy but the system generated very less recognition rate comparing to other existing protocols.

2.4 Convolutional Neural Network:

Haofu Liao [16] have presented an automatic process for recognition of Skin disease utilising CNN. They have trained CNN using Dermnet database and train the architecture of CNN utilising the images of 23,000 skin disease from the datasetimages of 20,000 skin infections. Also, they have compared the system performance with OLE database. The system achieved better accuracy for a smaller number of training images and poor accuracy while training using a greater number of images This in terms causes time complexity which

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is the main drawback of this system. Hence, they should improve the accuracywhile traininga greater number of images.

Table 5: *Evaluation and Comparison of CNN with types of skin disease*

Ref.	Type of skin Disease	Objectives	Classifier	Database	Evaluation Metrics	Drawback
[5]	Melanoma	To identify Melanoma skin disease	CNN	ISIC 2018	Accuracy	Classification output is low
[10]	Melanoma	To classify the skin lesion as malignant or benign	CNN	ISIC Archive Dataset	Sensitivity, Specificity, and Accuracy	Skin lesion classification problem
[16]	Melanoma	To classify melanoma skin disease	CNN	OLE, Dermnet Database	Accuracy	Accuracy varies for different types of images
[25]	Melanoma	To detect Melanoma skin disease	CNN	Dermnet Database	Accuracy	Poor accuracy

Jainesh Rathod et al. [25] proposed detection of skin disease using CNN. At first, the mentioned classification algorithm is used for forecast the featuresby removing the noise using filtering method by enhancing the skin images from database. The feature extraction and classification of algorithm is processed using CNN and SoftMax classifier to generate better output. The system achieved better accuracy for a smaller number of training images and poor accuracy while training using a greater number of images This in terms causes time complexity which is the main drawback of this system

3. Analysis of Results:

In this phase weintroduce a nonexclusive correlation of certain calculations recently referred. A presentation correlation between calculations from every class is broke down beneath. The accompanying figures clarifies that, assessment proportions of existing investigates 2000 to 2018. The comparison of skin disease identification methods for several parameters such as accuracy, time and complexity is shown in table 6 [14].

Table 6: Comparison of Skin disease identification methods

Reference	Accuracy	Time	Complexity	Total No. of Disease detected
[32]	High	High	Low	7
[33]	High	Medium	Medium	1
[34]	High	High	High	1

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[35]	Low	Medium	High	3

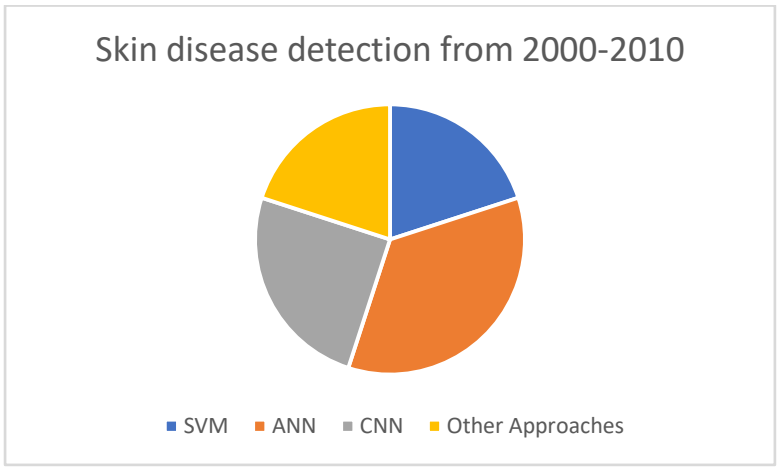

Figure 4: Comparison of skin disease detection approaches used from 2000-2010

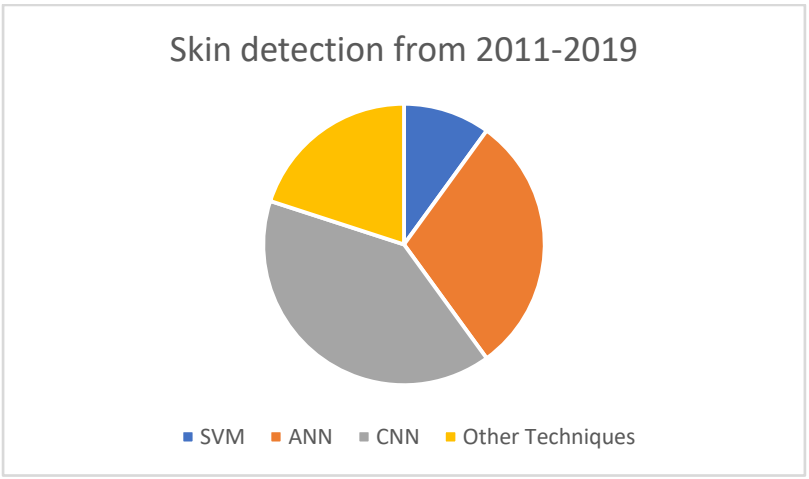

Figure 5: Comparison of skin disease detection approaches used from 2011-2019

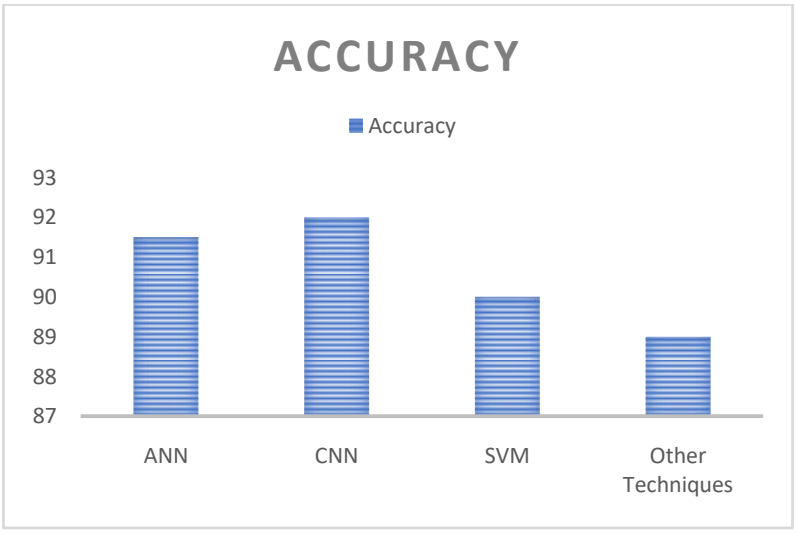

Figure 6: Comparison of Accuracy achieved for ANN, SVM, CNN and other technique

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The chart shows the comparison of skin disease detection from 2000-2010. From this chart it is clear that the SVM, ANN and other approaches have been used in many researches and have not reached better accuracy which is exposed in figure 4. The figure 5 illustrates the comparison of skin disease detection approaches used from 2011-2019. Hence many new algorithms have been presented and still lack to achieve better results in terms of accuracy.

Summary: Therefore, we have reviewed Skin disease detection for various techniques such as ANN, KNN, CNN, Data mining-based approaches and Image processing-based approaches. These approaches show the significant change in terms of accuracy, time and complexity over the years. Since the lack of achieving better recognition rate is still challenging. Hence, we intend to propose DNN based approach, Adaptive machine learning algorithm to achieve better accuracy for the identification skin diseases.

4. Conclusion:

This survey reviews various techniques such as ANN, KNN, CNN, Data mining-based approaches and Image processing-based approaches. These approaches show the significant change in terms of accuracy, time and complexity over the years.Thus we have planned to proposeDeep NeuralNetworks in future to classify the type of skin cancer. Therefore, an automatic classification of skin related disease can be detectd using DNN based approach. Also by using this innovative technique the system can able to enhance the accuracy also it reduce the time and complexity during identification of skin diseases.

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