Image Segmentation using Deep CNN to Intelligently Detect and Access Vitiligo: A survey

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Abstract **- Vitiligo is a disease that causes when pigment cells stop functioning. People having low vitamins will have a high chance of getting vitiligo. The national vitiligo Foundation has calculated that 0.5 to 2% of general people have vitiligo. Treatment for vitiligo is unsatisfactory. Recently, image processing is playing a key aspect in the medical field and popularly used for skin disease detections. This paper was Determining the vitiligo lesion segmented skin with the help of machine learning algorithms and convolutional neural networks (CNN'S), here Introducing a convolutional neural network that can quickly and robustly perform vitiligo skin lesion segmentation. In this paper, it presents the survey of various vitiligo detection techniques using machine learning algorithms that is based on image processing, detection, recognition of vitiligo.**

Index Terms **- Vitiligo, Detection, CNN, Treatment, Machine learning algorithms.**

INTRODUCTION

Vitiligo is a skin disorder where pale or white patches develop due to the lack of absence of melanocytes. When melanocytes are damaged, it will cause the non-existence of melanin, i.e., pigment cells in the damaged places of the skin. Vitiligo is an autoimmune disease and also called leucoderma. Vitiligo can affect patients quality of life. Treatment for vitiligo is unsatisfactory. Different treatments present for vitiligo, i.e., Phototherapy, Systemic therapy, Surgical Treatment of stable vitiligo, Depigmentation therapy.

Repigmentation therapy is also one of the Treatment for vitiligo. This is a time-consuming process; this process takes 3-6 months or more than that and has several sittings per week or per month based on the patient's vitiligo type. And we are not able to determine the changes in the patch. By the Physician's Global Assessment (PGA) scale, we can able to estimate the progression report of patients treatment.

Repigmentation Accuracy	scale	colour
0-25%	Mild	Pale white
26%-50%	Moderate	pinkish
51-75%	Good	Cream shaded brown
76%-100%	Excellent to complete	Near to Skin colour

To dig out the response of vitiligo, certain image processing-based techniques are developed using machine learning algorithms. This technique is capable of detecting vitiligo affected area and shape variation later gone through the Treatment and repigmented to skin colour. Detecting the place of vitiligo repigmentation is mostly succeeded in dark shaded skin people. The skin cannot be repigmented in pure white or light-skinned people, coming to the area of the vitiligo finding out where lesion skin present, I.e., face, neck, hands, legs. More than other body parts, face is more successful in repigmentation.

Deep learning is satisfyingly workable in the medical field for image processing techniques and attained impressive performance, which supports to achieve vitiligo a brilliant analysis. Algorithms like support vector machines and KNN's furthermore be helpful to extract patient data from image classification methods.

LITERATURE SURVEY

Vitiligo is a disease that causes when pigment cells stop functioning. Vitiligo is in the colour of pale white [1]. The faded places on the body practically get more comprehensive with time. This state of skin disorder can affect any portion of the body. It could also influence hair and within the mouth. Repigmentation is well-heeled, mainly on the face more than other body parts, I.e., hands, feet, Areas with white hair answering not well [1]. Compared to long term patches, new ones are more hopefully answering back to medical treatments. This follows up of this paper encapsulates the present study on vitiligo and aims to give an outline of the future in vitiligo treatment.

Vitiligo is an autoimmune disease; Autoimmune diseases are chronic, multifactorial conditions. In the field of machine learning [10], it is viable to extract patterns in patient details and undertake these patterns to determine patient outcomes for improved medical administration. Algorithms like support vector machines (SVM) can be used to extract patient data from image processing methods. ML models are used in multiple scenarios [10]. Available models for vitiligo lesion segmentation will expect physical involvement, but unfavourably it is time taking process. When a convolutional neural network appears, image recognition achieves a successful development cause CNN has a strong ability of feature extraction and image classification. Designing a CNN model will correctly detect photographic images of vitiligo [2]. So, developing a convolutional neural network (CNN) model will rapidly and intensely execute the vitiligo skin lesion segmentation process. Our CNN has a U-Net architecture with an adapted contracting path. The U-Net architecture will shift the contracting path with a segmentation neural network, which acts as a feature extractor. And We use CNN to generate an early segmentation of the lesion skin then filter it by processing the watershed algorithm on high confidence pixels [4]. In this paper, proposing a method based on three identical CNN models are trained with three different colour-space images (YCrCb, RGB and HSV) for the same vitiligo dataset. This method gives better results [6].

The Classification established as a learning-based approach to solving the trouble of classifying Vitiligo lesions using convolutional neural networks (CNN's) was employed [4]. At the technical facet, the author has used four pre-trained models for feature extraction, namely, Inception-V3, VGG-16, VGG-19, and SqueezeNet. By using these pre-trained models, the authors also trained four classification models are Logistic-regression, KNN (k-nearest neighbours), convolutional neural network (CNN), support vector machine(SVM) for finding the accuracy [6]. Inception-V3 provides maximum accuracy of 98.0% on Logistic Regression and 96.5% on Neural Network.

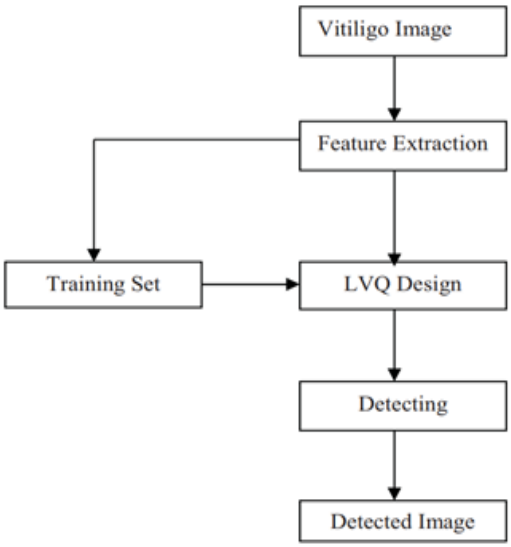
Comparisons of various algorithms and neural networks:

S.no	Algorithm/Neural Networks	Description	Accuracy
1.	Support-vector machine (SVM)	The SVM algorithm creates a hyperplane or a line that separates the data into classes. It maximizes the margin around the separating hyperplane [6].	96.5%
2.	K-Nearest Neighbours (KNN)	Knn clustering algorithm was used for detecting the k nearest neighbours for finding the distance of the patch [6].	98.2%
3.	Logistic Regression	It will help to predict the accuracy of the lesion skin and will find the probability. It is a supervised learning algorithm [6].	98.0%
4.	Saliency propagation	It will extensively adopt for identifying the most attractive object in an image. The spatial relationships of image regions govern the propagation sequence generated by	70.2%

		existing saliency detection methods, i.e., the saliency value is transmitted between two adjacent values [2].	
5.	Learning-vector Quantization (LVQ)	LVQ is a neural network used for a combination of clustering and Classification [3].	92.22%
6.	U-Net Architecture	The U-Net architecture will substitute the contracting path with a segmentation neural network, which]h acts as a feature extractor [4].	73.6%
7.	Convolutional Neural network (CNN)	Cnn will classify the images in the form of different layers, which will help to detect the dissimilar object in the image [4].	94.9%
8.	Image Segmentation	In vitiligo, image segmentation used to find boundaries of segmented lesion skin, which is helpful in noticing the size of the patch [2].	98.0%

LVQ DESIGN

The Learning Vector Quantization (LVQ) uses for combination and Classification. It is one type of a neural network. This neural network has three layers, I.e., input layer, hidden layer and output layer.



LVQ will do clustering in between the input layer and hidden layer that means feature extraction, and in between the hidden layer and output layer, LVQ applies Classification for detecting the segmented skin area.

VITILIGO SKIN SEGMENTATION

The image segmentation will use deep learning methods or region-based methods, or thresholding methods for lesion pigmented skin. Deep learning methods are edge-based methods that are utterly popular in these ages, which has shown high wealth in image segmentation, recognition, or detection stuff in low contrast colour conditions. Region-based methods and thresholding methods will generate a segmentation process. These techniques will perform only under image-level categories. By using these methods, we can classify a convolutional neural network and pooling layer for feature extraction. So, that will get a perfect classification layer without selecting particular features. CNN, including the Keras framework, which will reduce the development time cause it has many pre-trained models, I.e., Resnet50, exception, vgg16, Iceptionv3. This is a simple and powerful framework of a convolutional neural network. After the trials of pre-trained models, Resnet50 will be showing better performances than other models for the vitiligo dataset.

Vitiligo is a type of epidermal skin disease that will lead to a loss of partial or total skin colour. In 2015, Mithun et.al; developed a KL divergence agglomerative clustering algorithm approach based on a bottom-up agglomerative clustering algorithm which will work for shading image of vitiligo skin lesion segmentation [8]. This method requires an RGB channel image for obtaining superpixel images to generate a shaded image. By comparing these results with another bottom-up algorithm for accuracy parameters.

CONCLUSION

This paper shows an accurate description of detecting techniques for vitiligo using image segmentation algorithms based on convolutional neural networks (CNN) and deep machine learning algorithms and different kinds of segmentation techniques applied for

the detection of vitiligo. The comparison of various machine learning algorithms and neural networks. These methods for image segmentation models and better performing with pre-trained models in CNN frameworks. In future, the implementation of deep learning algorithms for digital image processing to detect vitiligo can be done; reduction of vitiligo and following vitiligo feature extraction methods using machine learning algorithms can be identified.

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