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14. Image Processing with Machine Learning Proving to be Helping Tool for Detection and Cure of Skin Diseases

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Introduction

People's lives and health are seriously impacted by skin diseases. A new method for identifying a specific form of skin illness has been proposed by researchers. Diagnostic accuracy for a wide range of skin diseases must be improved through the use of automated approaches. A new way of identifying three types of skin illnesses, including herpes, dermatitis, and psoriasis, has been described in this research. Filtering and alteration of skin photos was used in the beginning to remove noise and unimportant background. In order to segment photos of skin diseases, the GLCM approach (gray-level co-occurrence matrix) was first applied. Images of various skin diseases' textures and colours could be precisely analysed. Three categories of skin illnesses were found using the support vector machine (SVM) classification method. This method's effectiveness and feasibility have been demonstrated through experiments[1].

What are Skin Diseases

When it comes to protecting your body, your skin is the largest organ you have. Your skin serves a variety of purposes. It works to:

- Prevent dehydration by keeping fluids in your body.
- Aid in the perception of physical feelings, such as heat or discomfort.
- Do not allow any bacteria, viruses, or other infectious agents to enter.
- Make sure you're not overheating.
- Vitamin D is synthesised (created) as a result of sun exposure.

All disorders of the skin that cause clogging, irritation, or inflammation are referred to as "skin diseases." Rashes and other changes to the look of the skin are common symptoms of skin illnesses.

What are the Most Common Types of Skin Diseases?

Minor disorders of the skin exist. Others have extremely harmful effects. Dermatological conditions that are frequently encountered include: :

- **Acne**, blocked skin follicles that lead to oil, bacteria and dead skin buildup in your pores.
- **Alopecia areata**, losing your hair in small patches.
- **Atopic dermatitis (eczema)**, dry, itchy skin that leads to swelling, cracking or scaliness.
- **Psoriasis**, scaly skin that may swell or feel hot.
- **Raynaud's phenomenon**, periodic reduced blood flow to your fingers, toes or other body parts, causing numbness or skin color change.
- **Rosacea**, flushed, thick skin and pimples, usually on the face.
- **Skin cancer**, uncontrolled growth of abnormal skin cells.
- **Vitiligo**, patches of skin that lose pigment[2].

Role of Image Processing for Skin Detection Diseases

Medical science can greatly benefit from image analysis tools, particularly in the field of skin protection. The following drives may benefit from image analysis. :

A. To notice patch on body.
B. To quantify precious area by disease.
C. To find the boundaries of the precious area.
D. To fix the color of the affected area.
E. To determine size & shape of diseased portion.
F. To identify the portion correctly.

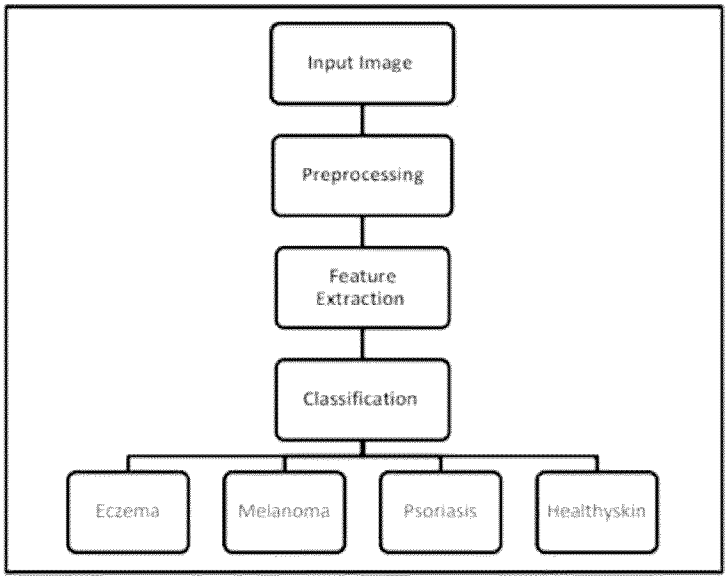
Methodology

The proposed system for detecting, extracting, and classifying photos of skin disorders is presented in detail. Melanoma, eczema, and psoriasis will all benefit greatly from the new method. Pre-processing, feature extraction, and classification are just a few of the components that make up the architecture as a whole. The system's block diagram is presented in Fig 1.

Pre-processing: It is necessary to overcome significant obstacles in order to achieve excellent performance in the identification of skin illness. Creating a database and standardising image dimensions are two examples of this. Image resizing is covered in detail in the following section of the article.

- *Image Resizing:* If the database contains images of varying dimensions, an image can either be increased or decreased in size. The same number of features will be extracted

from all images if the image size is standardised. Reducing the image's size also speeds up the computer's processing. The original image, seen in Figure 3, has a resolution of 260 by 325 pixels. Resized to 227x227 pixel, the image is shown in Fig 4.

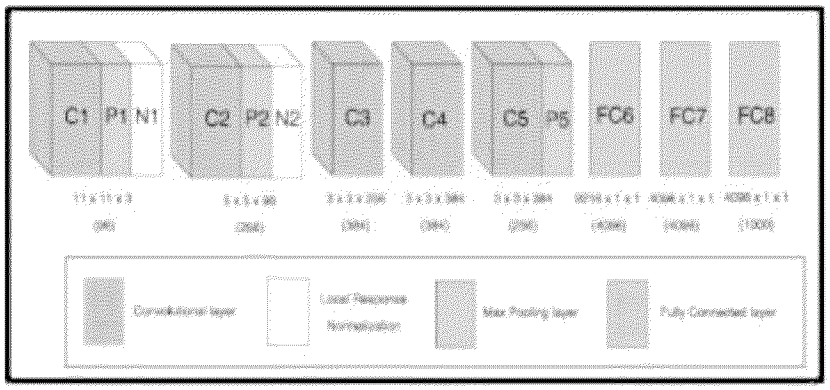


- ***Feature Extraction:*** There are both nonlinear and linear processes involved in the early stages of the Convoluted Neural Network (CNN). In order to learn these layers, you must work together. Convolutional layer, pooling layer, nonlinear Rectified Linear Units (ReLU) layer coupled to a normal multilayer neural network called fully connected layer, and a loss layer at the backend are the building pieces of any CNN model. Natural language processing and visual tasks have long been CNN's areas of expertise[3].

  Deep CNN model AlexNet was built by Krizhevsky et al. to model the 2012 ImageNet dataset for the Large-Scale Visual Recognition Challenge (LSVRC) (ILSVRC-2012). A nonlinear ReLU layer is layered after each of AlexNet's five convolutional layers. Layers one, two, and five, as seen in Figure 5, all contain maxpooling layers. Two normalisation layers follow the first and second convolutional layers, respectively. A softmax layer is followed at the top of the model, there are two totally connected layers. . There were more than 1.2 million photos in AlexNet's training set that came from 1000 different classes. Features extracted from a pre-trained convolutional neural network. Pretrained deep learning networks can be used in a simple and robust manner with this method.

Fig. 2: This is an original photograph from the Eczema database.

Fig. 3: An example of scaling an image from the Eczema database.

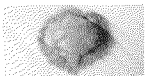
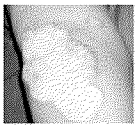
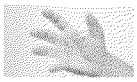


Krizhevsky et al. created the deep CNN model AlexNet for the Large Scale Visual Recognition Challenge in 2012. (ILSVRC-2012). A nonlinear ReLU layer is layered after each of AlexNet's five convolutional layers. Layers one, two, and five, as seen in Figure 5, all contain maxpooling layers. Two normalisation layers follow the first and second convolutional layers, respectively. A softmax layer is followed by two fully-connected layers at the top of the model. There were more than 1.2 million photos in AlexNet's training set that came from 1000 different classes. Pretrained convolutional neural networks can be used to extract features. Pretrained deep learning networks can be used in a simple and robust manner with this method.

Classification: One of the most commonly used computer vision techniques is the classification of images. Support Vector Machines (SVMs) are used to classify images after they have been extracted characteristics (SVM). Extracted features from the training set can be used to train an SVM classifier.

Conclusion

Skin illness detection is a critical step in lowering death rates, disease transmission, and skin disease progression. Clinical approaches for diagnosing skin diseases are both costly and time-consuming. At the outset, image processing techniques aid in the development of an automated dermatology screening system. The classification of skin diseases relies heavily on the extraction of features. Pretrained convolutional neural networks (AlexNet) and SVM were used to build the detection method in this study. Finally, we must remember that this research is useful in detecting skin disorders in Saudi Arabia, which has a highly hot climate due to the existence of deserts, indicating that skin diseases are widespread. This study backs Saudi Arabia's medical efficiency.

Disease Name	Sample Image	Total Image	Disease detected	Detection rate %
Eczema		5	5	100%
Melanoma		5	5	100%
Psoriasis		5	5	100%
Healthy skin		5	5	100%

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Footnotes

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2. Skin Diseases: Types of, Symptoms, Treatment & Prevention (clevelandclinic.org)
3. main.pdf (sciencedirectassets.com)