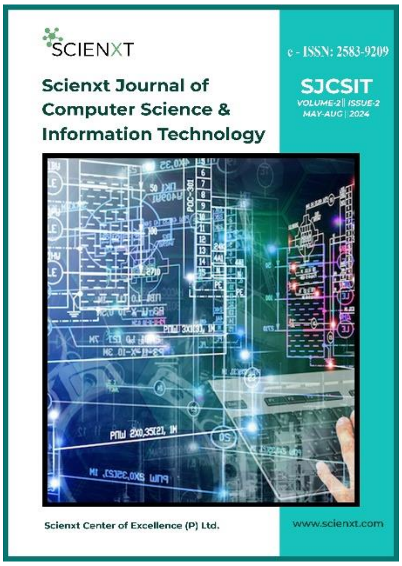

Scienxt Journal of Computer Science & Information Technology
Volume-2 || Issue-2 || May-Aug || Year-2024 || pp. 1-11

Skin disease detection system

***[1]Shivani Singh, [2]Shreya, [3]Er. Kaushlendra Yadav, [4]Dr. Vibha Srivastava**

*[1]Student, Department of Information Technology, Shri Ramswaroop Memorial College of Engineering and Management, Lucknow, Uttar Pradesh

[2]Student, Department of Information Technology, Shri Ramswaroop Memorial College of Engineering and Management, Lucknow, Uttar Pradesh

[3,4]Professor, Department of Information Technology, Shri Ramswaroop Memorial College of Engineering and Management, Lucknow, Uttar Pradesh

**Corresponding Author: Shivani Singh*

Abstract:

Skin diseases are quite prevalent and can be caused by various factors such as fungal infections, bacteria, allergies, or viruses. While advances in laser and Photonics-based medical technologies have improved the speed and accuracy of skin disease diagnosis, the associated costs consequently, image processing remain high. Emerged as a valuable tool for creating automated dermatology screening systems at Feature extraction is a critical an early stage. Component in classifying skin diseases effectively, and computer vision techniques are integral to this process.

This research contributes to the field of skin disease detection by proposing an image processing-based - approach. This method begins with a color image of affected skin area and utilizes image analysis to detect the specific type of disease present. What sets our proposed approach apart is its simplicity, speed, and minimal equipment requirements - only a camera and a computer are necessary.

The process starts with a color image input, followed by resizing to extract features using a pre- trained convolutional neural network. These features are then classified using a Multiclass Support Vector Machine (SVM). The results, including the disease type, extent, and severity, are presented to the user. Impressively, our system is capable of accurately detecting three distinct types of skin diseases, achieving a 100% accuracy rate

Keywords:

Skin Diseases, Image Processing, Machine Learning.

1. Introduction:

Skin diseases are indeed more prevalent than many other health conditions, with causes ranging from fungal infections and bacteria to allergies and viruses. They can manifest as alterations in skin texture or color. Skin diseases are often chronic, infectious, and in some cases, they can progress to potentially serious conditions like skin cancer. Early diagnosis is crucial to mitigate their progression and spread, as the diagnosis and treatment of skin diseases can be time-consuming and financially burdensome for patients.

In many instances, individuals may not recognize the type or stage of a skin disease, which can lead to delayed treatment and exacerbation of the condition due to limited public awareness of skin conditions. Even dermatologists, specialists in skin health, may sometimes encounter challenges in diagnosing specific skin diseases, necessitating costly laboratory tests for accurate identification.

The advancement of medical technology utilizing lasers and photonics has significantly improved the speed and precision of skin disease diagnosis.

Nevertheless, the cost of such diagnosis remains high and is inaccessible to all. To address these challenges, we propose an image-processing-based approach for skin disease diagnosis. This method involves capturing digital images of affected skin areas and then employing image analysis to determine the specific type of disease. What sets our approach apart is its simplicity, speed, and cost-effectiveness, as it only requires basic equipment, namely a camera and a computer. The sample skin disease images are shown in Fig. 1.

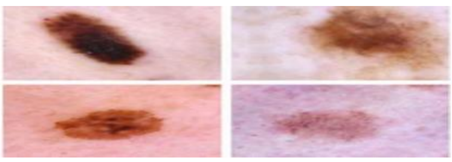

Figure. 1: Sample Skin Disease images

2. Related work:

Numerous researchers have introduced image processing-based techniques for the detection and classification of various skin diseases. Let's briefly examine some of these methods reported in the literature.

The researchers in the study titled "Skin Cancer Detection using VGG-16" by Kanneboina Manasa et al. [1] utilized VGG-16 and ResNet-50 for the purpose of skin cancer detection. The outcomes of their experimentation indicated that these models achieved accuracy rates of 80% and 87%, respectively. The conclusion derived from their findings was employing Convolutional Neural Network (CNN) architectures such as VGG- 16 and ResNet-50 could lead to an accuracy level of around 80%.

In the research paper titled "Diagnosis of skin diseases using a Convolutional Neural Networks" by Jainesh Rathod et al. [2], the authors developed a web application employing Convolutional Neural Networks (CNN) with softmax as the classifier. The model demonstrated an accuracy of approximately 70% according to their experimentation and analysis.

In the publication "Skin Disease Detection using Convolutional Neural Network" by Srujan S et al. [3], the authors employed the Convolutional Neural Network (CNN) approach for their development. The precision of the model fell within the range of 74% to 75%. The conclusion drawn from their study suggests that enhancing the accuracy may be achievable by carefully choosing a more appropriate dataset.

In the paper titled "Skin Disease Detection using Machine Learning" by Kritika Sujay Rao et al. [4], the researchers applied Convolutional Neural Network (CNN) using the Keras Sequential API. They achieved an accuracy of 93.35% for the developed model. The study concludes that the trained model could potentially perform comparably to dermatologists, especially with further improvements in models and the utilization of enhanced datasets.

In the study titled "Skin Lesion Classification using Convolutional Neural Networks" by Tareq Tayeh et al. [5], diverse CNN models, namely InceptionV3, ResNet152V2, VGG16, and TSM12, were employed to construct the model. The performance of each model was assessed, and ResNet152V2 and VGG16 emerged with the highest accuracies, reaching 82.14% and 88.54%, respectively.

In the publication titled "Detection and Classification of Skin Diseases with Ensembles of Deep Learning Networks in Medical Imaging" by A. Kalaivani et al. [6], the researchers employed an ensemble classifier named Random Forest Deep Convolutional Neural Network (RF-DCNN) in conjunction with Classical CNN. The model was formed by combining the Random Forest technique and Convolutional Neural Networks. The accuracy achieved by the Classical CNN model was 88%, while the RF-DCNN model demonstrated an improved accuracy of 90%.

In the paper titled "CURETO: Skin Diseases Detection Using Image Processing and CNN" by R.K.M.S.K. Karunanayake et al. [7], the researchers developed a mobile application utilizing Convolutional Neural Networks (CNN) for the detection of skin diseases. They implemented a custom sequential CNN model that achieved an accuracy of 79.55%. The authors outlined their future intentions to provide recommendations to dermatologists based on the output generated by the model.

In the research presented in "Derm-NN: Skin Diseases Detection Using Convolutional Neural Network" by Tanzina Afroz Rimi et al. [8], the model was specifically crafted for the detection of various skin diseases through the utilization of Convolutional Neural Networks (CNN). The achieved accuracy for the model was approximately 73%.

In the publication titled "Skin Diseases Prediction using Deep Learning Framework" by Padmavathi S et al. [9], the authors constructed the model employing Convolutional Neural Network (CNN) and ResNet. The resultant model is intended for making predictions on the provided data. The accuracy achieved by the CNN-based model is 77%, while the ResNet-based model demonstrated an accuracy of 68%.

In the paper titled "Skin Cancer Detection using VGG- 16" by Kanneboina Manasa et al. [10], the researchers utilized VGG-16 and ResNet-50 to detection of skin cancer. The accuracy rates obtained for these models were 80% and 87%, respectively. The inference drawn from their findings suggests that the utilization of Convolutional Neural Network (CNN) architectures such as VGG-16 and ResNet-50 can yield an accuracy level of around 80%.

In the research paper "Detection and Classification of Skin Diseases using Deep Learning" by T. Swapna et al. [11], the authors employed three pre- trained Convolutional Neural Network (CNN) models, namely ResNet, InceptionV3, and AlexNet, to identification of skin conditions. Among these models, ResNet achieved the highest accuracy score, reaching 88.83%.

After reviewing the aforementioned papers, the idea of incorporating a Convolutional Neural Network (CNN) model and an ensemble model utilizing VGG16, DenseNet, and Inception architectures was conceived. Five models were constructed, comprising a fundamental CNN, VGG16, DenseNet, Inception, and an ensemble model.

3. Proposed method:

In this section, we will outline the methodology of our proposed system for the detection, extraction, and classification of skin disease images. This system aims to play a crucial role in identifying conditions such as melanoma, eczema, and psoriasis. The overall architecture can be broken down into distinct modules, which include preprocessing, feature extraction, and classification. The block diagram of the system is shown in Fig 1.

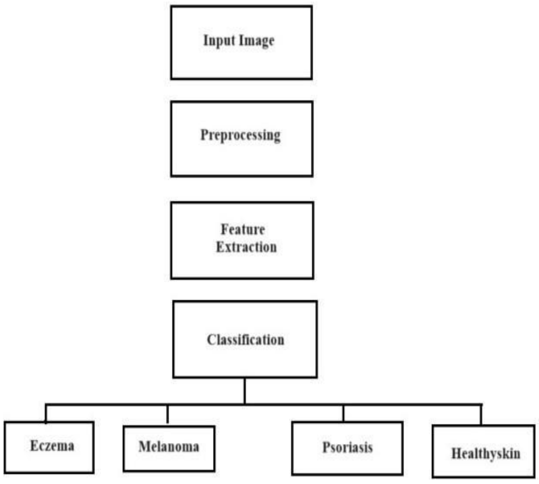

Figure. 2: The proposed system block diagram

The method consists of the following steps:

1) Preprocessing: To attain optimal performance in a skin disease detection system, several significant challenges must be addressed. These challenges encompass the creation of a comprehensive database and standardization of image dimensions. In the subsequent section, we have delve into the methodology employed for image resizing.

2) Feature Extraction: Initially, a Convolutional Neural Network (CNN) comprises a series of interconnected layers that encompass both nonlinear and linear operations. These layers are trained collectively. The fundamental components of a CNN model include convolutional layers, pooling layers, non-linear Rectified Linear Units (ReLU) layers linked to a conventional multilayer neural network known as a fully connected layer, and a loss layer at the end. CNNs are renowned for their remarkable performance in visual tasks and natural language processing applications.

3) Classification: Classification is a technique within computer vision. Once features are extracted, the purpose of classification is to categorize the image using a Support Vector Machine (SVM). An SVM can be utilized to train a classifier by using the extracted features from the training dataset.

4) Evaluation: We have evaluated the performance of the proposed method using a dataset.

4. Dataset description:

We've compiled a dataset of approximately 3000 images sourced from various places including hospitals and skin disease-focused websites. These images have been divided into training and test sets for the purpose of training and evaluating our model, respectively. The dataset encompasses a range of skin diseases, focusing initially on those with global prominence, while planning to expand to include additional diseases in future updates. The images are categorized based on the type of skin disease they depict. Utilizing Convolutional Neural Networks (CNNs), we aim to train our model to accurately classify these diseases. Following training, we validate the model's performance using the test set, assessing metrics such as accuracy and recall to gauge its effectiveness. Continuous refinement of the model, including fine-tuning and optimization, is undertaken to improve its accuracy. Ethical considerations regarding data privacy and consent are prioritized throughout the dataset collection and model development process. Ultimately, the goal is to deploy the model to aid dermatologists in diagnosing skin diseases swiftly and accurately.

Table. 1: Skin Disease Dataset

Disease	Sample Images	Number of Images
Eczema		200
Melanoma		100
Psoriasis		500
Onychosis		150
Acne		300
Corn		150

5. Result:

To start improving the skin images, we use some image processing techniques to clean up the background. This helps us focus on the affected areas. One method we employ is called histogram equalization, which helps enhance the contrast of the image by adjusting the intensity levels. However, it's important to note that this doesn't always make the contrast better; sometimes, it can make it worse. In those cases, it might even reduce the contrast. By using histogram equalization, we can figure out which parts of the skin are infected and which ones are healthy. We represent this visually by drawing a diagram that highlights the differences in colors on the skin. This helps us clearly see where the infections are located.

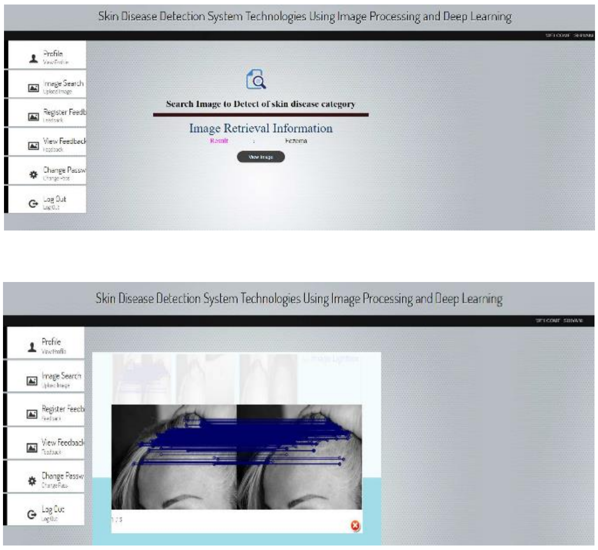

Figure. 3: Result Screen

After feeding the images into our model, we get results showing how well the model detects diseases. Each of the six types of diseases shows a different detection rate, which can vary depending on the characteristics of the image. Essentially, this means that some diseases might be easier for the model to detect in certain images compared to others.

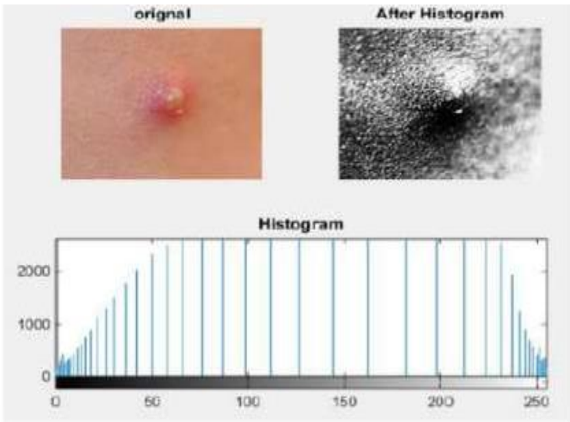

Figure. 4: Image Optimization

The result is based on a pre-trained model and a little modification into it.

Table. 2: Rate of Disease Detection

Disease	Number of Images	Detected Images	Detection Rate
Eczema	10	10	100%
Melanoma	10	10	100%
Psoriasis	10	8	80%
Onychosis	10	7	70%
Acne	10	8	80%
Corn	10	9	90%

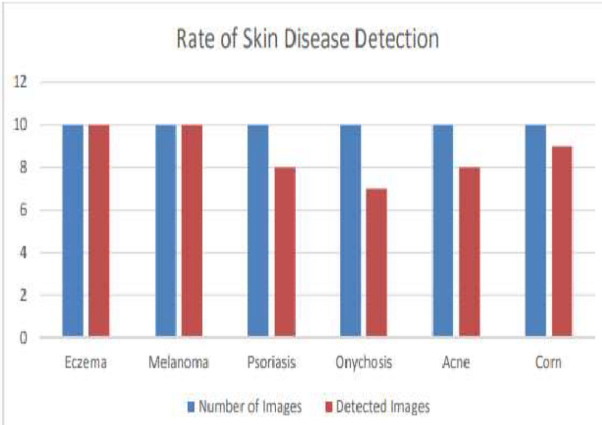

Figure. 5: Rate of Skin Disease Detection

6. Conclusion:

Skin diseases rank as the fourth most common cause of human illness, yet many people still do not seek medical advice from doctors. We have introduced a robust and automated method for diagnosing dermatological conditions. Early detection of skin issues leads to more effective and less disfiguring treatments. It is important to emphasize that our system is not intended to replace doctors, as no machine can fully replace the human element of analysis and intuition. Recent research from the European Society of Medical Oncology has, for the first time, demonstrated that certain forms of artificial intelligence and machine learning outperform experienced dermatologists.

Identifying diseases can really make a difference in controlling the spread of skin problems and offer a more effective way to address skin issues. It's especially important because it allows for quicker and cheaper medical treatment without unnecessary delays.This technology is particularly beneficial in rural parts of India where access to basic medical facilities is limited.

7. Limitation and future scope:

One of the limitations inherent in this project is the availability of a diverse and extensive dataset on skin diseases. The accuracy of the machine learning models may be constrained based on the quality and quantity of the dataset used. Another constraint arises when dealing with input images containing multiple diseases, leading to conflicts as the system currently detects only one disease. Additionally, the system cannot function appropriately when presented with a skin image devoid of any disease, as it has not been trained in such cases.

Moreover, the system is presently limited to detecting only seven specific skin diseases. It encounters difficulty in accurately detecting diseases beyond this predefined set. In the future, an avenue for improvement lies in integrating skin disease detection through machine learning models into telemedicine platforms. This integration could potentially offer patients an initial diagnosis before they physically visit a healthcare professional. Enhancing the accuracy of machine learning models can be achieved by incorporating a superior dataset.

While the current project concentrated on a specific subset of skin diseases, there exists an opportunity for expansion in terms of the variety of skin diseases that the machine learning models can accurately detect. This expansion could be facilitated by incorporating additional images into the dataset and training the models accordingly.

8. Reference:

(1) Kanneboina Manasa et al. “Skin Cancer Detection using VGG-16”, EJMCM, 2021.

(2) Jainesh Rathod et al., “Diagnosis of skin diseases using Convolutional Neural Networks”, IEEE Xplore ISBN: 978-1-5386-0965-1, 2018.

(3) Srujan S et al., “Skin disease Detection using Convolutional Neural Network”, IRJET, July 2022.

(4) Kritika Sujay Rao et al., “Skin Disease Detection using Machine Learning”, IJERT, ISSN: 2278-0181, 2021. .

(5) Tareq Tayeh et al., “Skin lesion classification using convolutional neural networks”, IEEE Xplore, 2020.

(6) A. Kalaivani et al., “Detection and classification of skin diseases with ensembles of deep learning networks in medical imaging”, International Journal of Health Sciences, July 2022.

(7) R. K. M. S. K Karunanayake et al., "CURETO: Skin Diseases Detection Using ImageProcessing and CNN", IEEE Xplore, 2020.

(8) Tanzina Afroz Rimi et al., "Derm-NN: Skin Diseases Detection Using Convolutional Neural Network", IEEE Xplore, ISBN: 978-1-7281-4876-2, 2020.

(9) Padmavathi S et al., "Skin Diseases Prediction using Deep Learning Framework",IJRTE, 2020.

(10) Kanneboina Manasa et al. "Skin Cancer Detection using VGG-16", EJMCM, 2021.

(11) T. Swapna et al., "Detection and Classification of Skin Diseases using Deep Learning", The International journal of analytical and experimental modal analysis, ISSN NO: 0886-9367, 2021.