IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 5, November 2024

A Systematic Approach for Skin Disease Detection & Prediction by using CNN

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Abstract: *Skin is the like powerful protection of important organs in the human body. It acts as a shield to protect our internal body to get damaged. But this important part of the human body can be affected by serious infections caused by some fungus or viruses or even dust too. Due to acne problems to eczema people suffer a lot. A proper diagnosis can result in proper medication that can degrade the miseries of the people suffering. The goal of this system is to develop a prototype to detect skin diseases using neural networks. In the choice of neural networks, we have chosen CNN (Convolutional Neural Network). In this application picture handling strategies are used. Users have to take a photo of the contaminated region of their skin and transfer it to the system. The transferred pictures of illness will be handled in the focal server and it will answer with the disease name. Convolutional neural network (CNN) have been applied in this study for the identification of skin diseases.*

Keywords: Disease detection, CNN (Convolutional Neural Network)

I. INTRODUCTION

The largest organ of human body is “Skin”, an adult carry 2 square meters and around 3.6 kg of it. Skin acts as a waterproof, insulating shield, guarding the body against extremes of temperature, damaging UV lights, and harmful chemicals. With the rate of 10-12, the population affected across India from skin disease is estimated at nearly 15.1 Crore in 2013 and which increases to 18.8 crores by 2015[3]. According to statistics provided by the World Health Organization [4] around 13 million melanoma skin cancer occurs globally each year, which shows skin diseases are growing very rapidly. Therefore many factors responsible for a disease to occur such as UV lights, pollution, poor immunity, and an unhealthy lifestyle. There are two significant categories in which the lesions (spot) of skin disease are classified; benign and malignant skin lesions. Most of the skin lesions are
benign in nature which is gentle and non-dangerous, whereas those which are dangerous for patient’s health and evil in nature are malignant skin lesions such as melanoma skin cancer.

However, the cost of such diagnosis is still limited and costly. The Deep learning models [4,5,6,7] are comparatively efficient in performing the classification process from the images and the data. It has been a demand in the field of healthcare diagnosis in precise identification of the abnormality and classifying the category of the disease from the X-ray, Magnetic Resonance Imaging (MRI), Computer Tomography (CT), Positron Emission Tomography (PET) images, Electroencephalogram (EEG),and the signal data like the Electrocardiogram (ECG), and Electromyography(EMG)

This study used a dataset consisting of seven skin diseases: Melanoma ,Melanocytic nevi, Benign keratosis- like lesions, Vascular lesions, Dermatofibroma, Actinic keratoses, Intraepithelial carcinoma and Basal cell carcinoma. This dataset contains more than 2,000 dermatoscopic images. A random (rand) function is applied to split the data into the training data (1224) and validation data (255). The considered dataset is almost imbalanced because some skin diseases are more, and some are less in number. To conquer such problems, we used data augmentation, and this technique balances the data and generates more images either by rotations Or transformations from the existing data.

DOI: 10.48175/IJARSCT-22443

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II. LITERATURE REVIEW / DISCUSSION

In paper [1] author designed to detect disease using image.An automated computer-based system for skin disease identification and classification through images is needed to improve the diagnostic ac curacy as well as to handle the scarcity of human experts. Classification of skin disease from an image is a crucial task and highly depends on the features of the diseases considered in order to classify it correctly. Many skin diseases have highly similar visual characteristics, which add more challenges to the selection of useful features from the image. The accu rate analysis of such diseases from the image would improve the diagno sis, accelerates the diagnostic time and leads to better and cost-effective treatment for patients. This paper presents the survey of different meth ods and techniques for skin disease classification namely; traditional or handcrafted feature-based as well as deep learning-based techniques.

In paper [2] author has stated many automated facial skin diseases methods. These methods focused on diagnosis of acne and its classes and classification of the facial skin into normal and abnormal. They were based on many tech niques. Chang et al. used support vector machine based classifier to detect facial skin defects and classify them into acne, spots or normal skin. His method achieves high accuracy. Manita khongsuwan et al. detects acne using UV fluorescence. Their method provides good effciency but may cause damage of facial skin due to long exposure time to UVlight. Later, Dey et al. [4] used pixel based method for acne detec tion. His technique preserves the pixel details of the input. The proposed techniques were also based on the detection of the shape of acne such as the method proposed by Chantharaphaichit et al. . The accuracy in this method is affected by the form of acne and lighting. Other methods were proposed in order to detect acne based on Speeded Up Robust Features and K-Nearest Neighbors classification algorithm , and CNN network .

In paper [3] author explains an initial training gives the output accuracy of 70This can be definitely increased by increasing the training data set in the deep learning model.Five diseases were initial tested, which can be further increased in the future. A large data set can increase the accuracy to more than 90 percent.

In paper [4] authors workson the used prototype with a database of six common skin diseases, using which a patient can self-diagnose and get some prior knowledge of their skin disease before consulting a dermatologist. This prototype can be used in mobile hospitals in rural areas. These days everybody is connected through mobile phones. Thus, this prototype can be accessed even in the most remote locations in the country. The proposed proto type provides a non-invasive method of skin disease detection where the patient provides a picture of the infected area as an input to the proto type and any further analysis is done on this input image. No pricking or prodding of the skin is required

In paper [5] authors can used as an effective, low cost solution for skin diseases detection by a computer aided system is proposed to resolve difficulties that's created from challenges faced from the dermatologist to recognize the different skin diseases easily. Firstly applied enhancements to remove the noise, two noise reduction technologies were investigated. Enhancements to remove the noise, two noise reduction technologies were investigated.

III. METHODOLOGY

Algorithm & System Model:

In this system we are used CNN over image classification. To detect skin disease user have to upload an image of infected area of skin [6, 7]. Then disease analysis done by matching that image with previous trained dataset [8, 9]. Here we used the dermat dataset and some images of most common diseases are collected from the internet [10, 11].

This figure 3.1 depicts the operational framework of a skin disease detection system utilizing a Convolutional Neural Network (CNN) [12, 13]. The procedure initiates with the user capturing an image of the affected skin using a camera [14, 15]. This image is subsequently incorporated into a testing dataset for further examination [16, 17]. The CNN, a specialized machine learning model for image recognition, processes the captured image [18, 19]. It extracts relevant features through multiple layers, which include convolutional layers for pattern detection, pooling layers for dimensionality reduction, and fully connected layers for the classification task [20, 21].

The extracted features are then matched against patterns acquired from a pre-established training dataset that comprises labeled images of various skin diseases [22, 23]. This training dataset is crucial for the model's ability to learn and identify distinct characteristics of different diseases [24, 25]. In the completion of the processing, the system determines the specific type of skin disease and produces a classification result via the classifier engine, which is ultimately

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Volume 4, Issue 5, November 2024

presented to the user as the final output. This workflow exemplifies the application of artificial intelligence in medical diagnostics, enhancing the early detection and precise identification of skin conditions [26, 27].

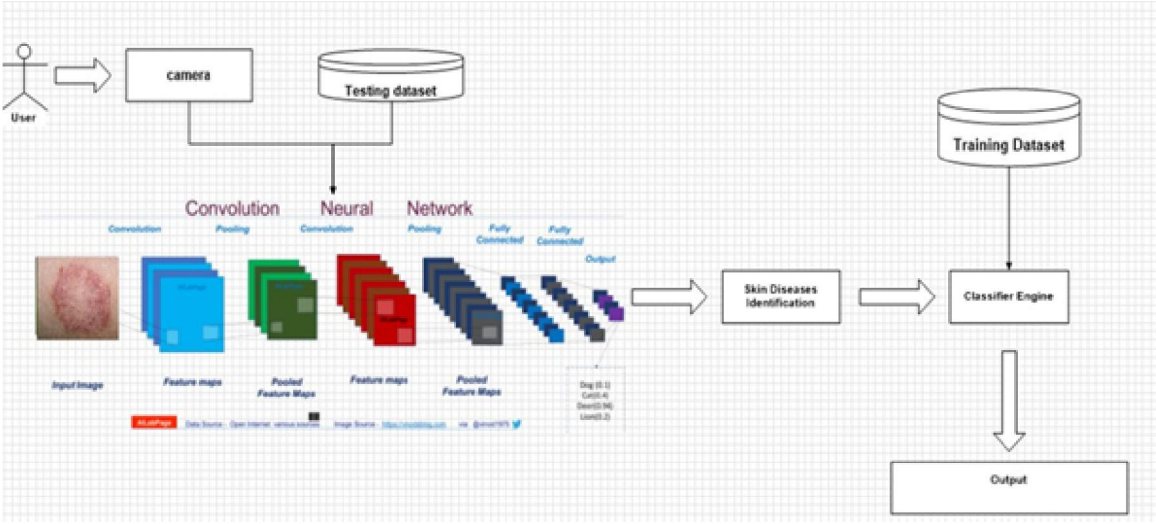

Fig.3.1System Architecture for Skin Disease Detection Using CNN

Working Methodology

The following are the stages that must be completed in order for our system proposed to be implemented [28, 29].

1. As input, the system will be take a dataset of picture data.
2. It increase the quality of the image and eliminate hairs from it, which was before is carried out before to printing.
3. A training file is formed as a consequence of the extraction of a number of features from the input image dataset.
4. In this experiment, the CNN classification approach is applied for both the newly constructed training file collection and the freshly created test input images, which were both made from scratch.
5. Melanomas are detected by using the CNN algorithm, which determines whether or not melanoma is present in the input test data set.

Finally, in order to determine the overall performances of the proposed technique and provide recommendations, a graphic evaluation is carried out at the conclusion [30, 31].

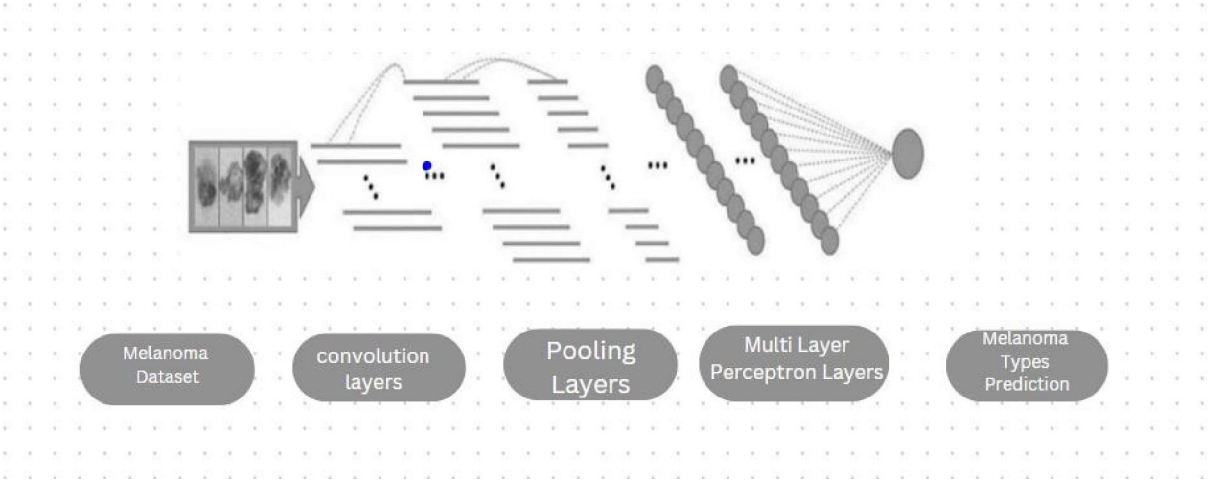

Fig. 3.2 CNN Architecture for Melanoma Detection

This figure 3.2 illustrates the methodology for predicting melanoma types utilizing a Convolutional Neural Network (CNN) [32, 33]. The process initiates with a dataset comprising images of skin lesions associated with melanoma [34, 35]. These images are input into convolutional layers, which are responsible for extracting significant features such as

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edges, textures, and patterns that are characteristic of melanoma [36, 37]. Subsequently, the extracted features are processed through pooling layers, which serve to diminish the data's dimensionality while preserving the most critical information, thereby enhancing the model's computational efficiency [38, 39]. The refined data is then directed into multi-layer perceptron layers, which include fully connected nodes that evaluate and integrate the features to generate predictions [40, 41]. Ultimately, the output layer determines the specific type of melanoma present in the input image [42, 43]. This workflow underscores the significance of deep learning in the realm of medical diagnostics, facilitating precise and efficient classification of melanoma types based on image analysis [44- 46].

Software Requirements (Platform choice)

The software requirements for this system specify the use of Windows 7 or higher as the server-side operating platform, with Python 3.5.3 as the programming language. The implementation relies on several key Python libraries, including NumPy and Pandas for data manipulation, OpenCV for image processing, Matplotlib for data visualization, Scikit-learn for machine learning algorithms, Mahotas for image analysis, and the deep learning frameworks Keras and TensorFlow for building and training neural networks.

Other Specifications

The system has several advantages, such as enabling accurate detection of diseases, providing appropriate diagnostic suggestions, and offering reliable skin disease predictions based on the dataset. However, there are limitations, including the need for UV sensing with a compatible camera and the requirement for basic knowledge of handling the equipment. The primary applications of this system include detecting various types of diseases and predicting skin diseases efficiently.

IV. RESULTS

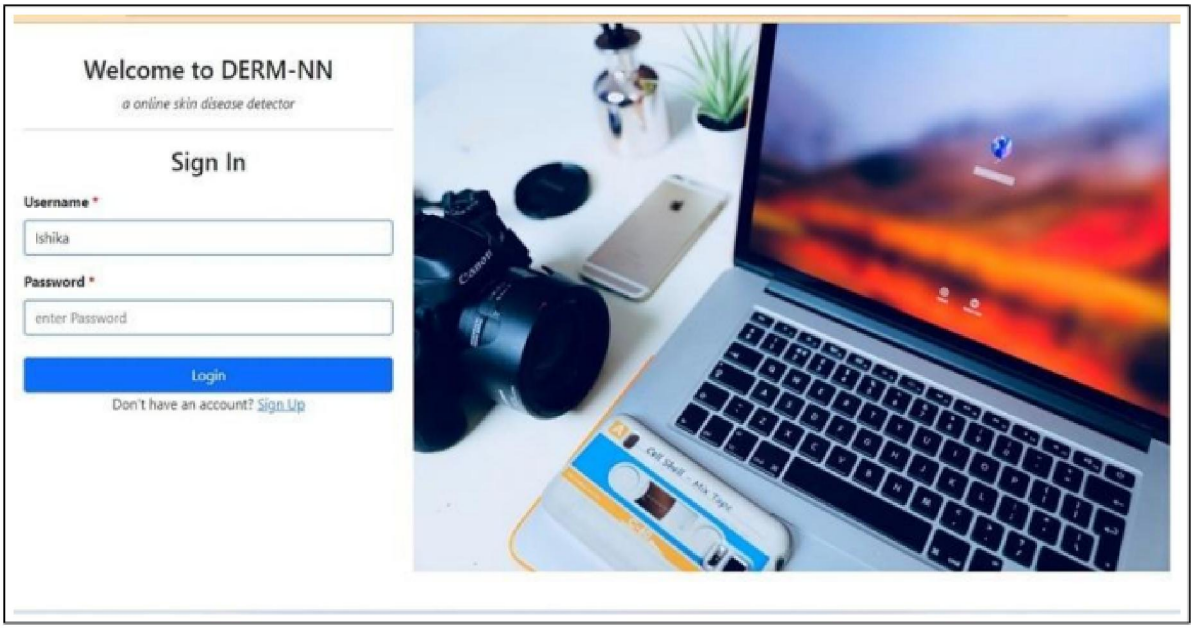

Fig. 4.1: Login page

The figure 4.1 shows the login interface of the application which includes Username and Password.

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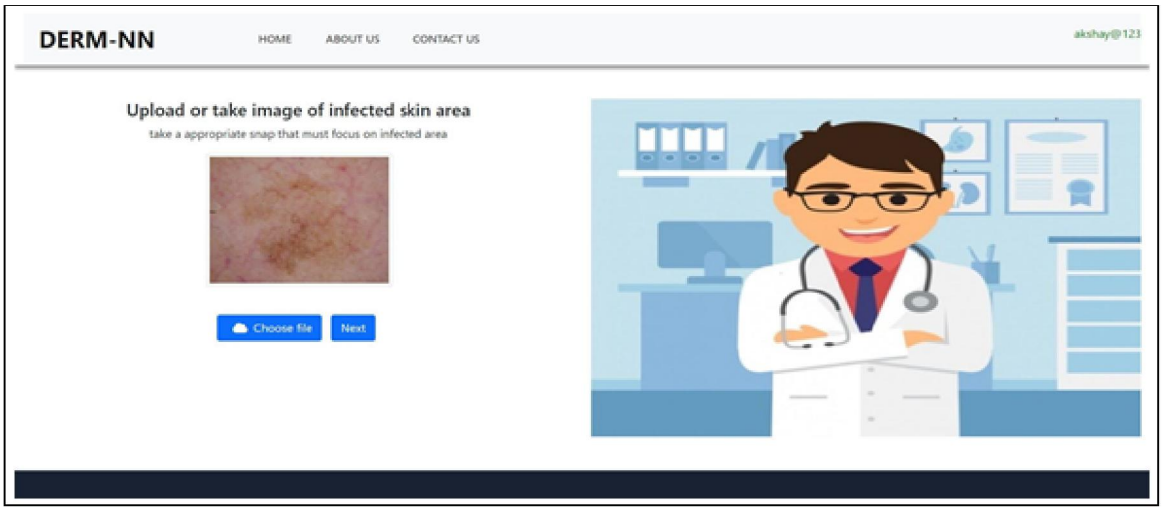

Fig 4.2: Image upload

The figure 4.2 is the next page after login to allow users to upload or capture an image of an affected skin area for analysis.

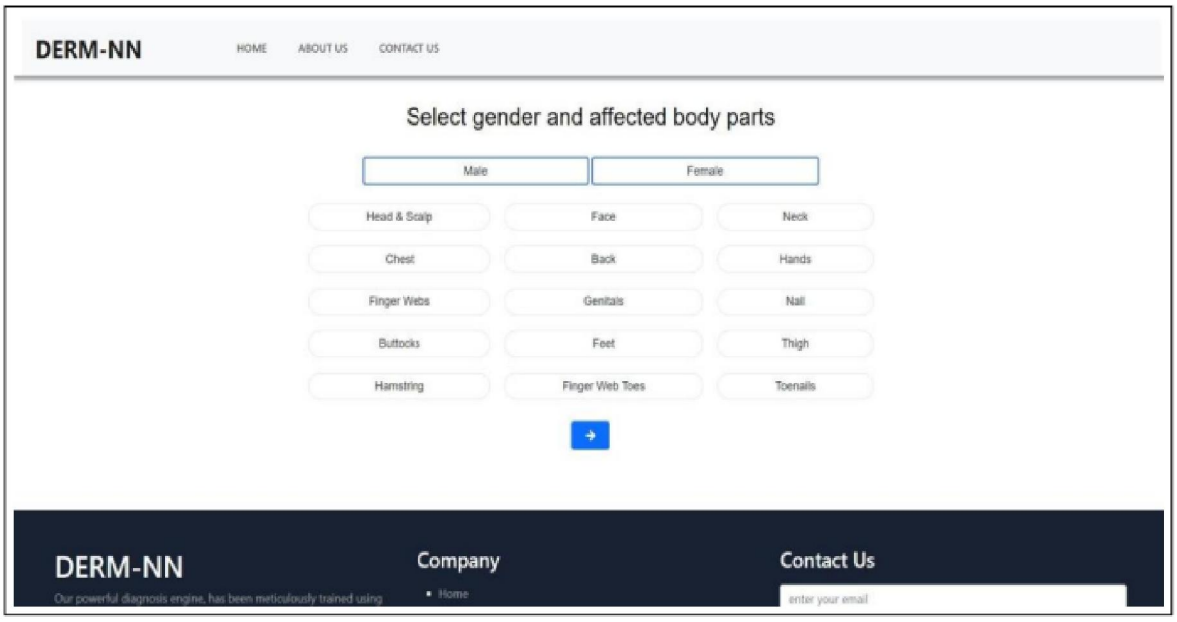

Fig 4.3:**Select Body Part**

The figure 4.3 is next page for helps narrow down the potential conditions by correlating symptoms with gender and the affected body part. It improves the precision of the system's analysis by providing context to the uploaded image.

Gender – Users are prompted to choose either "Male" or "Female." This helps tailor the analysis, as certain skin conditions may vary between genders.

Affected Body Parts – Users can select the specific areas of the body where symptoms or infections are observed. The list includes: Head & Scalp, Chest, Finger Webs, etc.

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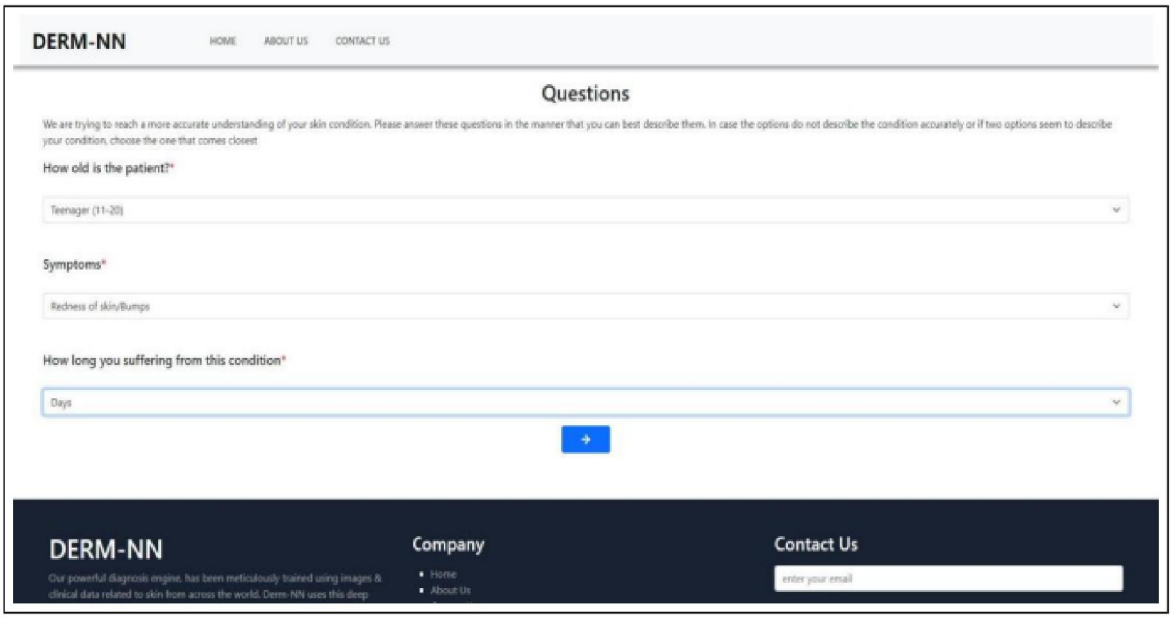

Fig. 4.4:Questions

The figure 4.4 is next page to reach more accurate understanding of your skin Condition.
How old is the patient?: A dropdown menu with options for age ranges (e.g., "Teenager (11–20)").
Symptoms: A required field asking users to describe their symptoms, such as "Redness of skin/rashes."
How long you suffering from this condition?: A required field for users to input the duration of their condition.

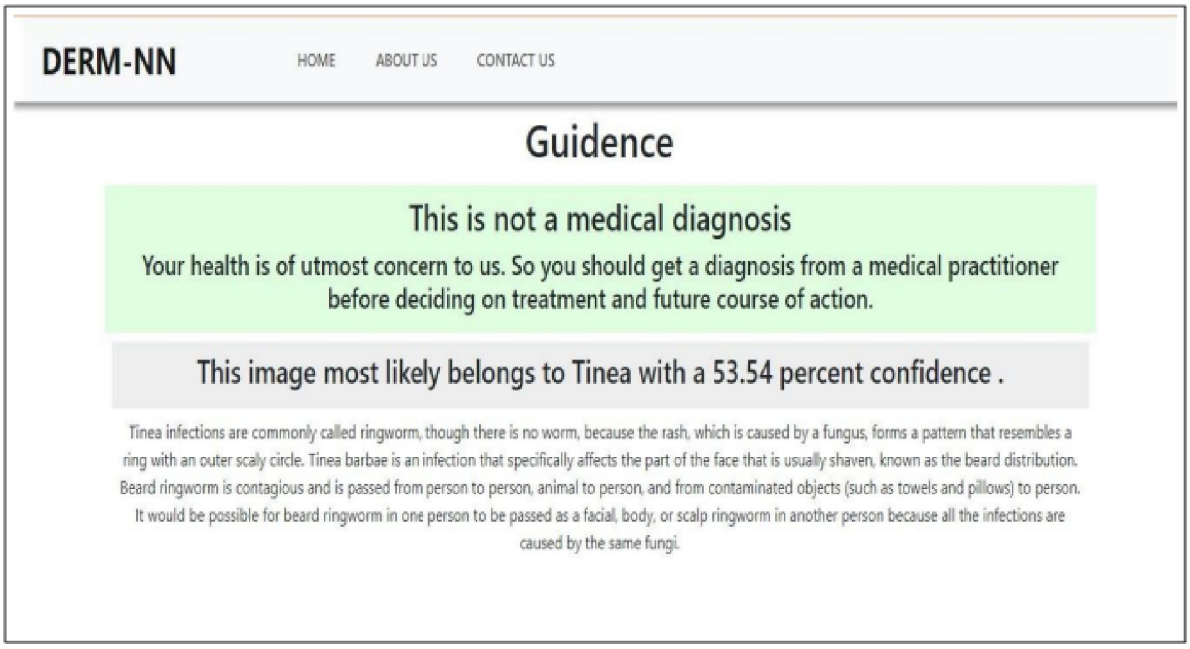

Fig. 4.5:Result

The figure 4.5 is the result page of the application. After receiving the user's input about their skin condition, the system analyses it. The application provides a medical disclaimer, advising users to consult a physician for a diagnosis in order to make an informed treatment and decision. Then, with a percentage of confidence, the image most likely belongs to which disease? Finally, the condition's description, which offers more details about that skin condition

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V. CONCLUSION

In this work, we observe that the CNN model is quite accurate, and with better data, careful analysis and close examination, it can become even more accurate. We saving the model's results in an H5 file format, in this we can efficiently store its parameters, weights, and architecture, making it easy to access for future use. We develop software that rapidly predicts skin issues when users upload a photo of their skin problem, providing quick and reliable predictions. This software will process the images, analyse them using the CNN model, and provide fast and dependable predictions about the detected skin conditions. The application of Convolutional Neural Networks (CNNs) for skin disease detection in Python is a powerful and promising approach. By collecting a diverse dataset, training a CNN model, and developing user-friendly software, we can create a tool that provides rapid and predictable predictions for various skin conditions. It has the potential to assist in precocious diagnosis, aiding both individuals seeking to monitor their skin health and healthcare professionals in their evaluation. However, it's crucial to continuously update and improve the model and software to maintain correct and ensure user data privacy and security. Skin disease detection using CNNs is a significant step toward more accessible and effective healthcare solutions.

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IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 5, November 2024

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