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Early Detection Of Skin Cancer Using Convolution Neural Network

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ABSTRACT

Skin is the most 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 so serious infections caused by some fungus or viruses or even dust too. Around the world, millions of people suffer from various skin diseases. From acne problems to eczema people suffer a lot. Sometimes a small boil on the skin can turn into a severe issue or even an infection that will cause a major health issue. Some skin issues are so contagious that one can be affected by another just with a handshake or using a handkerchief. A proper diagnosis can result in proper medication that can reduce the miseries of the people suffering create awareness. In this project we are using CNN (convolution neural networks) to classify skin diseases from images as CNN gain lots of success and popularity in the field of image classification. To train CNN we have used skin disease dataset which contains 9 different types of diseases such as 'Actinic Keratosis','Basal Cell Carcinoma', 'Dermatofibroma', 'Melanoma', 'Nevus', 'Pigmented Benign Keratosis', 'Seborrheic Keratosis', 'Squamous Cell Carcinoma' and 'Vascular Lesion'. After training CNN algorithm we can upload any test image then CNN will detect and classify disease from that image.

Keywords: Skin Disease Detection, CNN, machine learning techniques, Deep Learning, python.

1-INTRODUCTION

In today's real time scenario of daily life, computer vision methodology has attracted researchers due to its nature of providing efficient information for better visual and experimental analysis. In computer vision approach, image classification is also a promising technique which is used for various applications such as pattern recognition, remote sensing application, medical image processing etc. It is a process of pixel sorting from image and accumulating into individual classes. For classification, various methods have been developed to classify and recognize the image class efficiently

The Dermatology remains the foremost uncertain and sophisticated branch of science due to its complicacy in the procedures involved in diagnosis of diseases associated with hair, skin, nails. The variation in these diseases are often seen due to many environmental, geographical factor variations. Human skin is taken into account the most uncertain and troublesome terrains due to the existence of hair, its deviations in tone and other mitigating factors. The skin disease diagnosis includes series of pathological laboratory tests for the identification of the right disease. Skin diseases are one of the most commonly seen infections among people. Due to the disfigurement and associated hardships, skin disorders cause lots of trouble to the sufferers. Speaking of skin cancer, the facts and figures become more serious. In United States, skin cancer is the most common form of cancer. According to a 2012 statistics study, over 5.4 million cases of no melanoma skin cancer, including basal cell carcinoma and squamous cell carcinoma, are treated among more than 3.3 million people in America.In each year, the number of new cases of skin cancer is more than the number of the new incidence of cancers of the breast, prostate, lung and colon in combined.Research also shows that in the course of a lifetime, one-fifth of Americans will develop a skin cancer.

2-LITERATURE SURVEY

[1]**A. A. Cruz-Roa, J. E. A. Ovalle, A. Madabhushi, and F. A. G. Osorio**. A deep learning architecture for image representation, visual interpretability and automated basal-cell carcinoma cancer detection. In Medical Image Computing and Computer-Assisted Intervention–MICCAI 2013, pages 403– 410. Springer, 2021.
Skin diseases are very common in people's daily life. Each year, millions of people in American are affected by all kinds of skin disorders. Diagnosis of skin diseases sometimes requires a high- level of expertise due to the variety of their visual aspects. As human judgment are often subjective and hardly reproducible, to achieve a more objective and reliable diagnosis, a computer aided diagnostic system should be considered. In this paper, we investigate the feasibility of constructing a universal skin disease diagnosis system using deep convolutional neural network (CNN). We train the CNN architecture using the 23,000 skin disease images from the Dermnet dataset and test its performance with both the Dermnet and OLE, improve their health, and they are turning to natural remedies rather than pharmaceutical drugs more and more. As such, there have been countless studies performed on the therapeutic benefits and applications of various herbs and herbal extracts. another skin disease dataset, images. Our system can achieve as high as 73.1% Top-1 accuracy and 91.0% Top-5 accuracy when testing on the Dermnet dataset. For the test on the OLE dataset, Top-1 and Top-5 accuracies are 31.1% and 69.5%. We show that these accuracies can be further improved if more training images are used. We have investigated the feasibility of building an universal skin disease classification system using deep CNN. We tackle this problem by fine-tuning ImageNetpretrained models (VGG16, VGG19, GoogleNet) with the Dermnet dataset.

[2] **G. K. Jana, A. Gupta, A. Das, R. Tripathy, and P. Sahoo**. Skin diseases are most common form of infections occurring in people of all ages. Skin disorders due to its ugliness and associated hardships are one of the hardest ailments to get accustomed to especially when it is located in a place that is difficult to conceal like the face, even with make up. Most of the skin infections treatment take long time to show their effects. The problem becomes more worrisome if the ailment does not respond to skin disorder treatments. There are not many statistics to prove the exact frequency of skin diseases in this country, but general impression is 10-20 percent of patients seeking medical advice suffer from skin diseases. The skin conditions are prevailant across all parts of the world. Sun is one of the most prominent sources of skin cancer and related traumas.
Herbal supplements are more popular now than ever before. People are looking for new ways to
Much of this research presents strong evidence that taking herbal supplements in conjunction with a healthy diet and lifestyle can be beneficial. Therefore, many people use natural health supplements to treat various health conditions as

well as to promote general well-being.

Diseases of the skin account for a great deal of misery, suffering, incapacity and economic loss. Besides this, they are a great handicap in the society, because they are visible.

Fortunately, however, due to recent advances, cutaneous scars can be successfully removed by plastic planning, laser therapy and skin grafting. This review article has highlighted the role and utilities of some medicinal plants on different skin diseases.

[3] **Y. Jia, E. Shelhamer, J. Donahue, S. Karayev, J. Long, R. Gir- shick, S. Guadarrama**, and T. Darrell.Caffe: Convolu- tional architecture for fast feature embedding. arXiv preprint arXiv:1408.5093, 2021.

Caffe provides multimedia scientists and practitioners with a clean and modifiable framework for state-of-the-art deep learning algorithms and a collection of reference models. The framework is a BSD-licensed C++ library with Python and MATLAB bindings for training and deploying generalpurpose convolutional neural networks and other deep models efficiently on commodity architectures. Caffe fits industry and internet-scale media needs by CUDA GPU computation, processing over 40 million images a day on a single K40 or Titan GPU (≈ 2.5 ms per image).

Byseparating model representation from actual implementation, Caffe allows experimentation and seamless switching among platforms for ease of development and deployment from prototyping machines to cloud environments. Caffe is maintained and developed by the Berkeley Vision and Learning Center (BVLC) with the help of an active community of contributors on GitHub. It powers ongoing research projects, large-scale industrial applications, and startup prototypes in vision, speech, and multimedia.

Many cases of skin diseases within the world have triggered a requirement to develop an efficient automated screening method for detection and diagnosis of the world of disease .

In this system, a study of the role of color information in detecting the edges of images was conducted. Therefore another color space (HIS) is implemented. Several edge detection

[4] **J. Arroyo and B. Zapirain.** Automated detection of melanoma in dermoscopic images. In J. Scharcanski and M. E. Celebi, editors, Computer Vision Techniques for the Diagnosis of Skin Cancer, Series in BioEngineering, pages 139–192. Springer Berlin Heidelberg, 2022.

The incidence of malignant melanoma continues to increase worldwide. This cancer can strike at any age; it is one of the leading causes of loss of life in young persons. Since this cancer is visible on the skin, it is potentially detectable at a very early stage when it is curable. New developments have converged to make fully automatic early melanoma detection a real possibility. First, the advent of dermoscopy has enabled a dramatic boost in clinical diagnostic ability to the point that melanoma can be detected in the clinic at the very earliest stages. The global adoption of this technology has allowed accumulation of large collections of dermoscopy images of melanomas and benign lesions validated by histopathology. The development of advanced technologies in the areas of image processing and machine learning have given us the ability to allow distinction of malignant melanoma from the many benign mimics that require no biopsy.

[5] **C. Barata, J. Marques, and T. Mendonc¸a**.

Bag-of-features classification model for the diagnose of melanoma in dermoscopy images using color and texture descriptors. In M. Kameland

A. Campilho, editors, Image Analysis and Recognition, volume 7950 of Lecture Notes in Computer Science, pages 547–555. Springer Berlin Heidelberg, 2023.

The identification of melanomas in dermoscopy images is still an up to date challenge. Several Computer Aided-Diagnosis Systems for the early diagnosis of melanomas have been proposed in the last two decades. This chapter presents an approach to diagnose melanomas using Bag-of-features, a classification method based on a local description of the image in small patches. Moreover, a comparison between color and texture descriptors is performed in order to assess their discriminative power. The presented results show that local descriptors allow an accurate representation of dermoscopy images and achieve good classification scores: Sensitivity = 93% and Specificity = 88%. Furthermore it shows that color descriptors perform better than texture ones in the detection of melanomas.

3-Methodology

Figure. 4.1 shows the overall architecture of the proposed system. The system can be broadly classified into Data Collection. Image Processing, Feature Extraction and Image Classification modules

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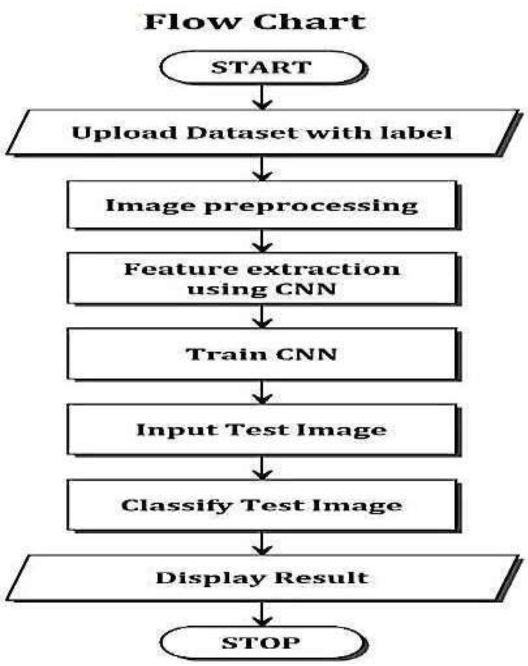
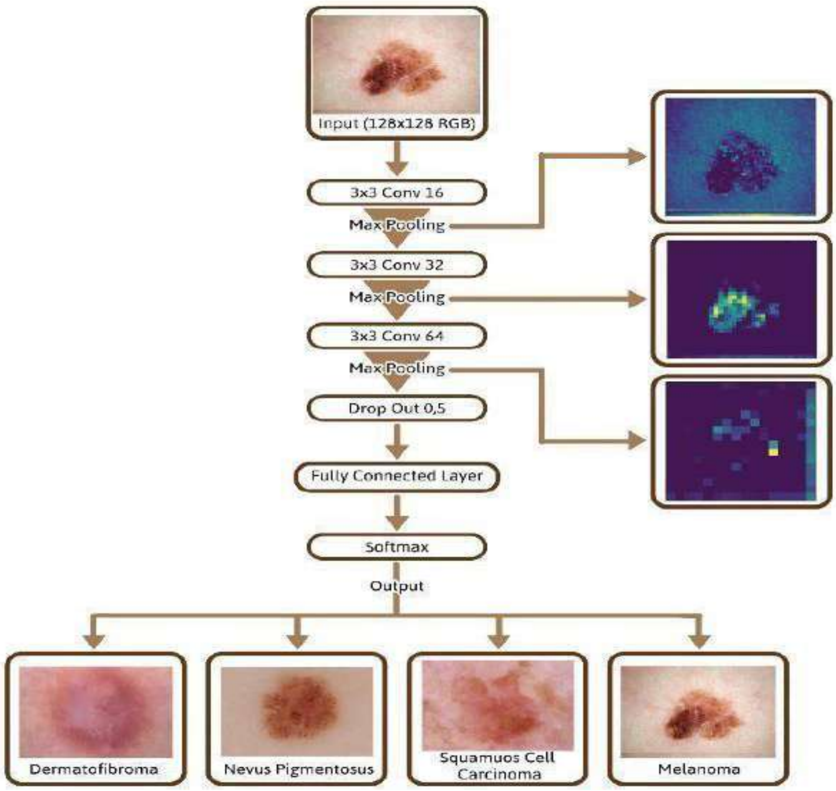


Figure 4.1: Flow diagram of the system

Block Diagram



Proposed Method

1. Proposed method uses CNN (Deep learning technique)

In this application, CNN (convolution neural networks) is used to classify skin diseases from images as CNN gain lots of success and popularity in the field of image classification. To train CNN we have used skin disease dataset which contains 9 different types of diseases such as 'Actinic Keratosis', 'Basal Cell Carcinoma', 'Dermatofibroma', 'Melanoma', 'Nevus', 'Pigmented Benign Keratosis', 'Seborrheic Keratosis', 'Squamous Cell Carcinoma' and 'Vascular Lesion'. After training CNN algorithm, we can upload any test image then CNN will detect and classify disease from that image.

5-ADVANTAGES, DISADVANTAGES AND APPLICATIONS

Advantages

1. High Accuracy: CNNs have shown high accuracy in detecting skin cancer, even surpassing human dermatologists in some studies.
2. Generalization: CNNs can generalize well to new, unseen data, which is crucial in detecting various types of skin cancer across different patients and conditions.
3. Early Detection: CNNs can detect skin cancer at an early stage, when it's more treatable.

Disadvantages

1. Data Dependency: CNNs require a large amount of labeled data for training, which can be challenging to obtain, especially in the medical field where labeled datasets may be limited.
2. Complexity: The architecture and training of CNNs can be complex and require expertise in

machine learning, making them less accessible to healthcare professionals without a background in data science.

3. Interpretability: CNNs are often considered "black box" models, meaning it can be difficult to interpret how the network arrives at its decisions, which may be a concern in critical medical diagnoses.

Applications

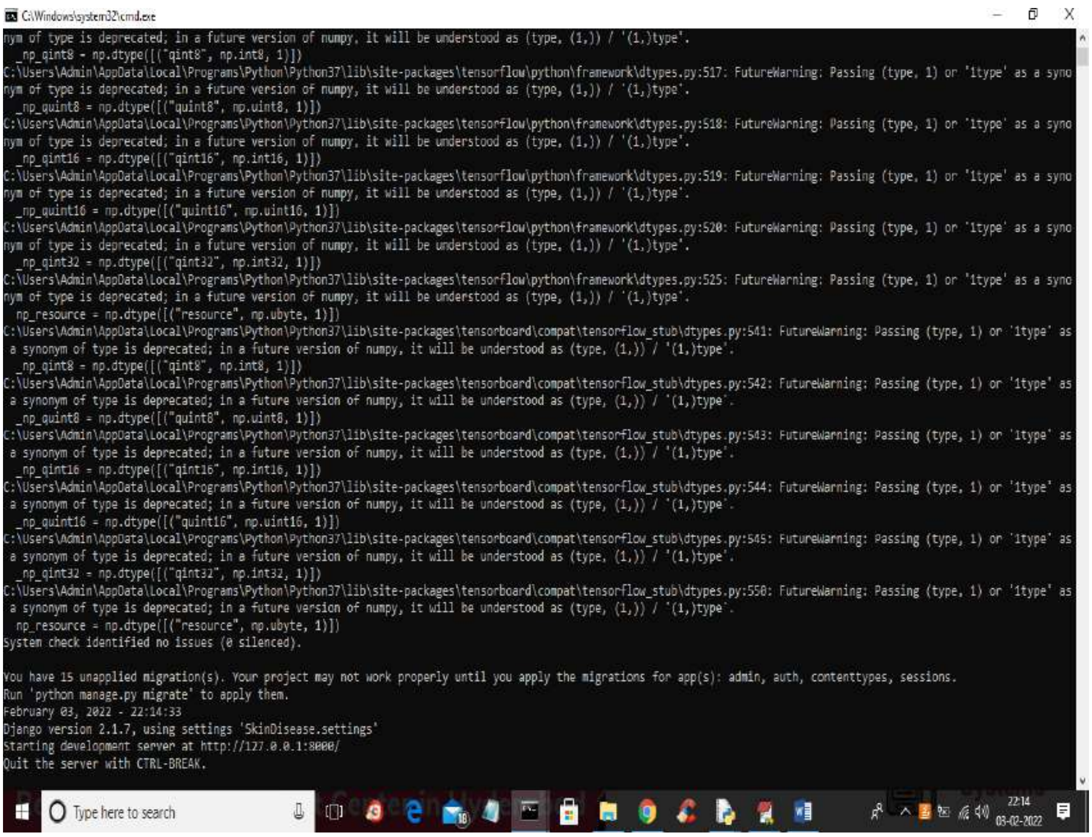
1. Image Recognition: CNNs are widely used for image recognition tasks such as object detection, facial recognition, and scene understanding in applications like autonomous vehicles and surveillance systems.

2. Medical Imaging: Apart from skin cancer detection, CNNs are used in various medical imaging tasks, including diagnosing other types of cancer, detecting abnormalities in X-rays, and analyzing MRI scans.

3. Image classification: CNNs can classify skin lesions into different types, such as melanoma, nevus, or seborrheic keratosis.

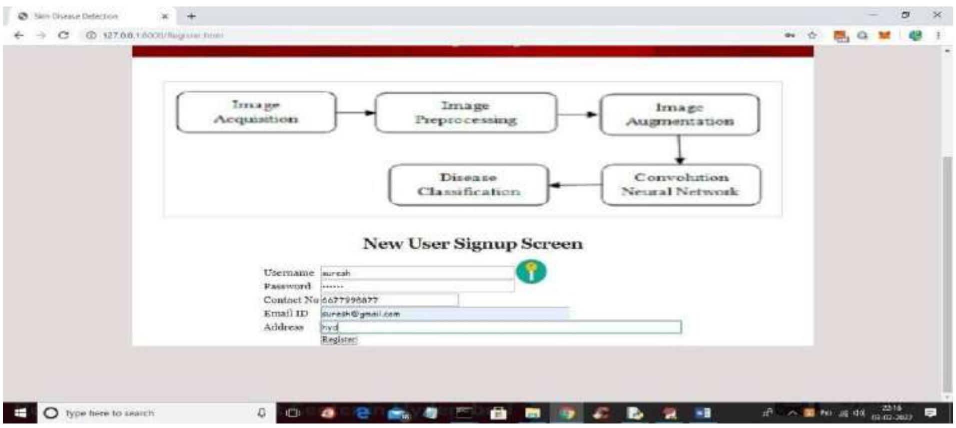
6-RESULT

To run project double click on 'run.bat' file to start DJANGO web server and to get below screen

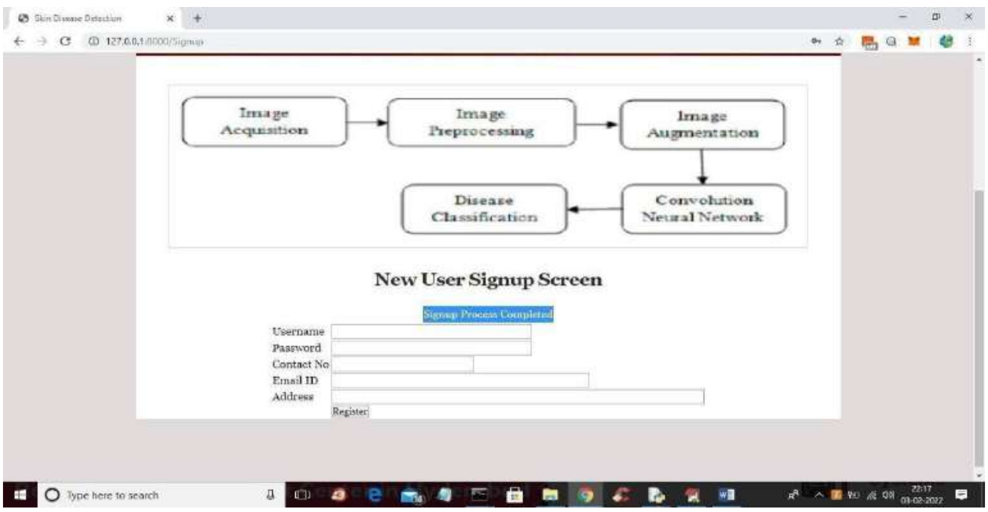


In above screen DJANGO server started and now open browser and enter URL as http://127.0.0.1:8000/index.html and press enter key to get below screen

In above screen click on 'Register Here' link to get below signup screen

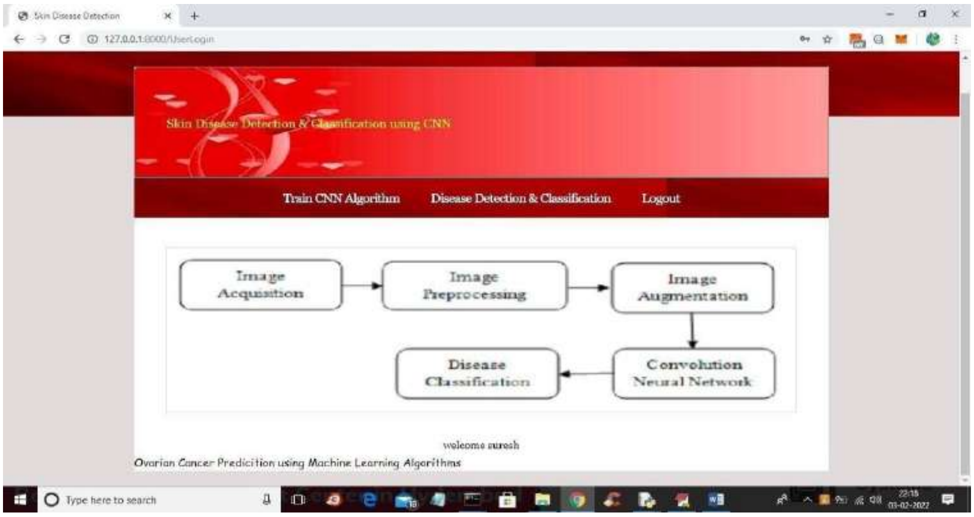


In above screen user is enter signup details and then press 'Register' button to complete signup process and to get below output

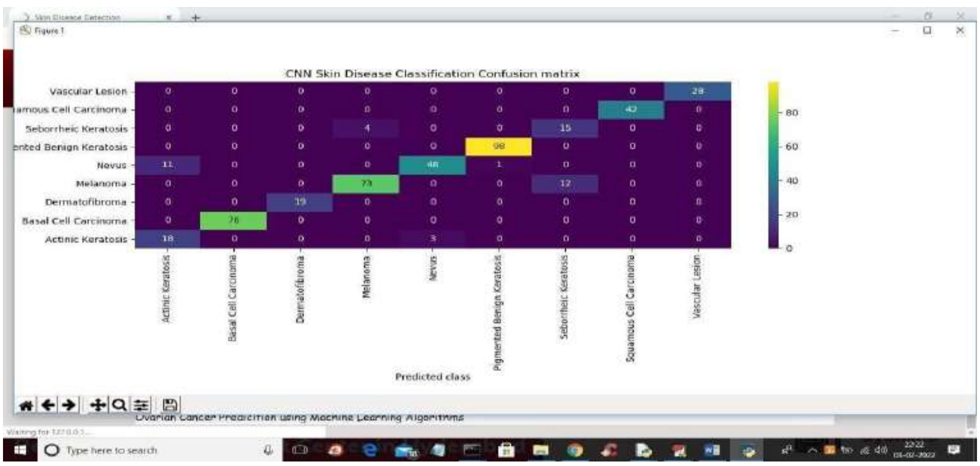


In above screen in blue colour text we can see signup process completed and now click on 'Login' link to get below screen

In above screen user is login and then click on 'Login' button to get below Screen



In above screen user can click on 'Train CNN Algorithm' link to train CNN and to get below output



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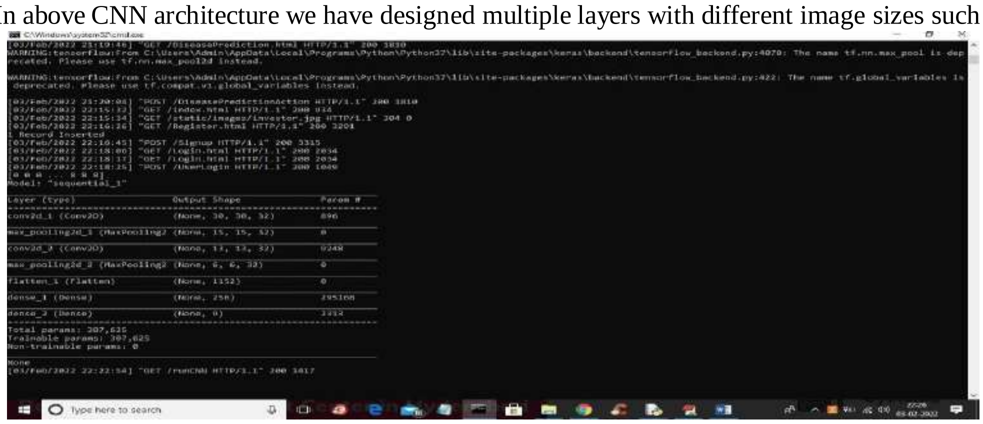
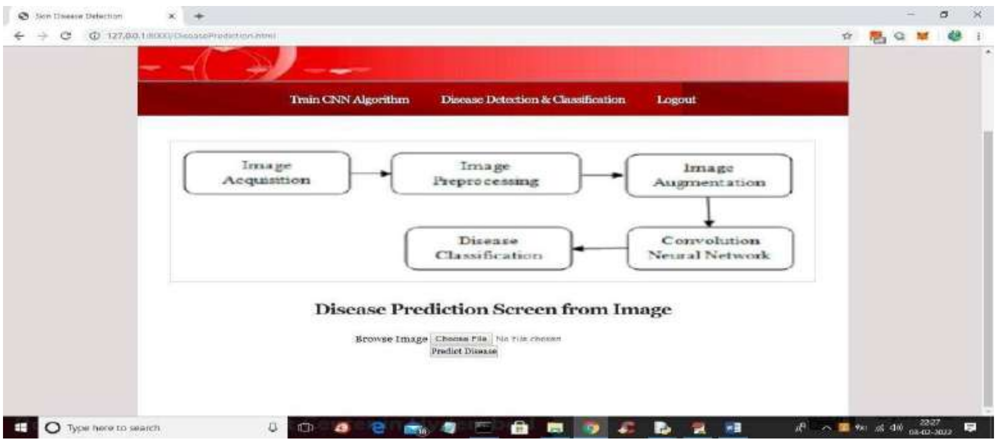
In above CNN confusion matrix graph we can prediction on test data and in above graph x-axis represents predicted disease names and y-axis represents original test classes and in above all values in diagnol boxes are the correct prediction and value > 0 which are not in diagnol are the wrong prediction and we can see only few records are wrongly predicted. Now close above graph to get below CNN accuracy

In above screen we got CNN accuracy as 93% and in below screen we can see CNN architecture

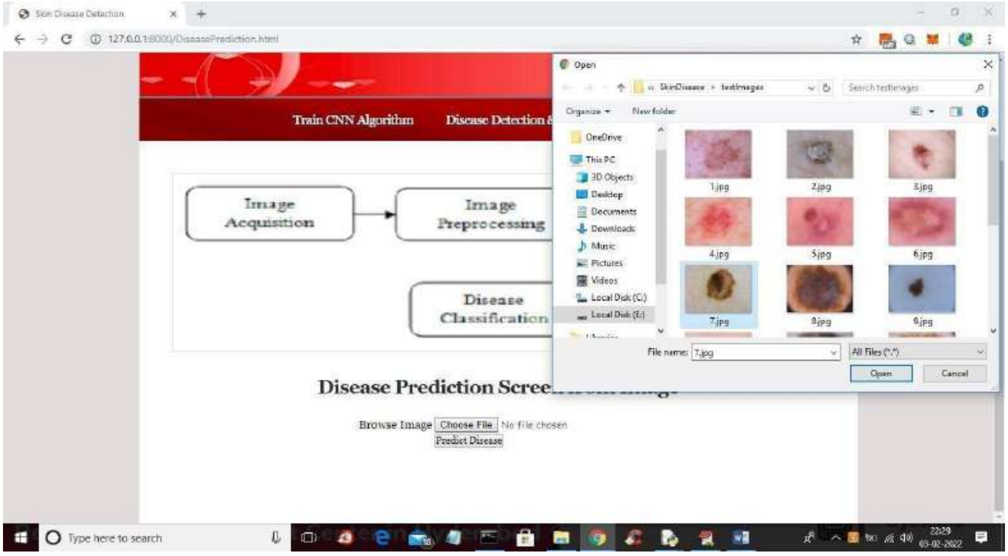
In above CNN architecture we have designed multiple layers with different image sizes such as 30 X 30,



15 X 15 etc. Now go back to output application and then click on 'Disease Detection & Classification' link to get below output



In above screen click on 'Choose File' button to upload skin diseases images from 'testImages' folder and then

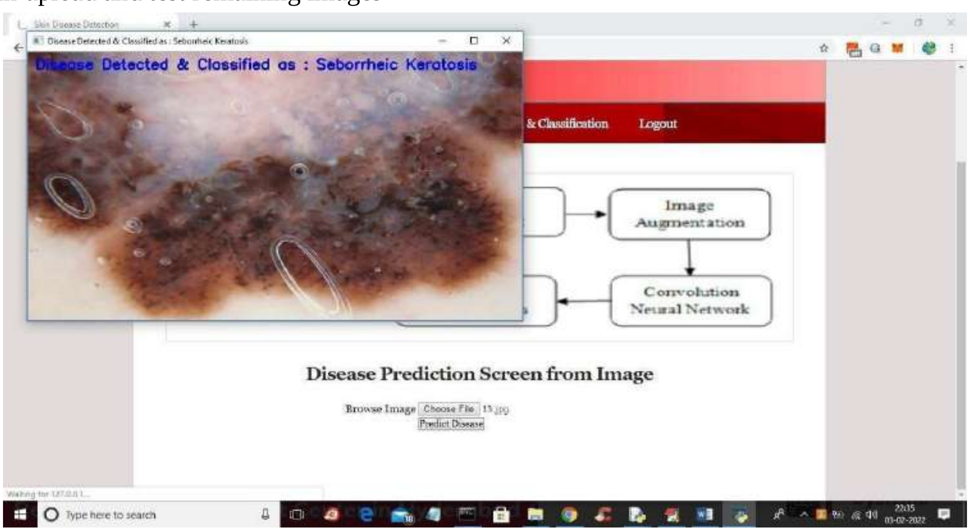


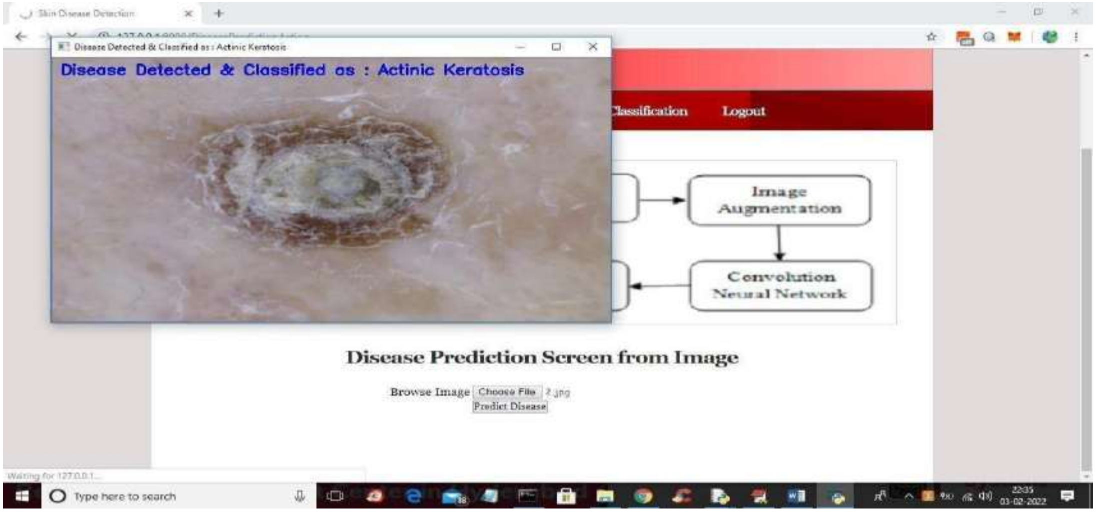
click on 'Predict Disease' button to classify disease

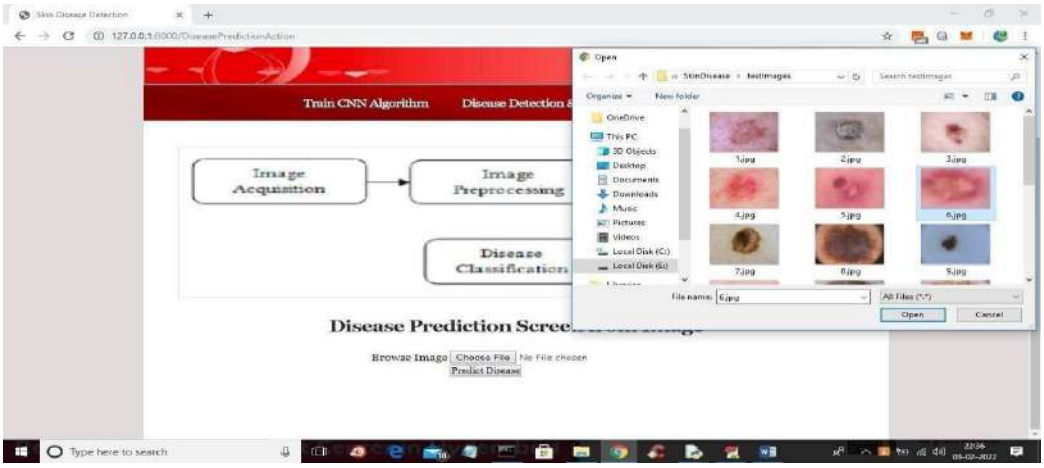
In above screen selecting and uploading '7.jpg' and then click on 'Open' button to load image and then click on

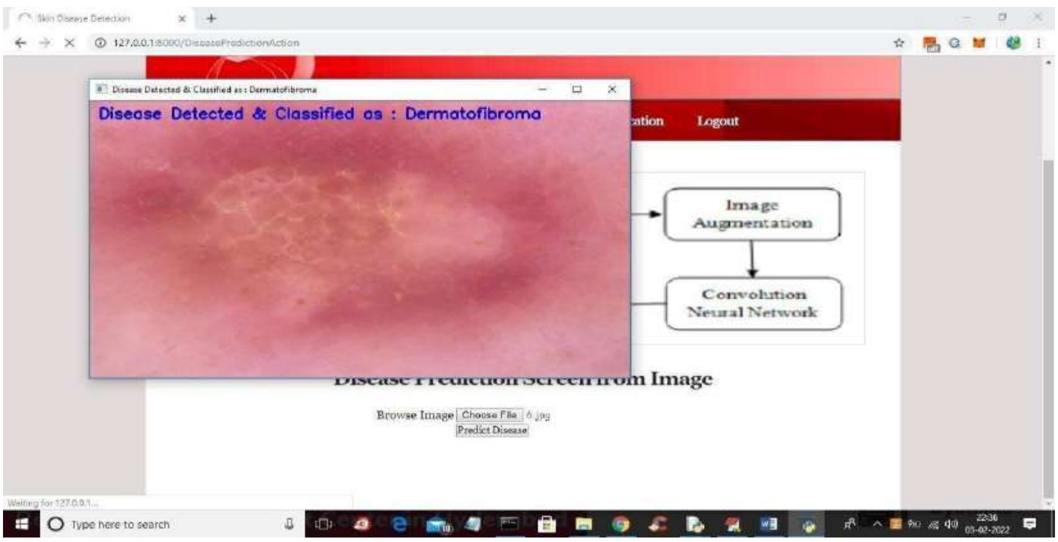
'Predict Disease' button to get below output

In above screen in blue colour text we can see CNN classify disease on image as 'Melanoma' and similarly you can upload and test remaining images




Skin Disease Detection
Disease Detected & Classified as : Actinic Keratosis
Disease Detected & Classified as : Actinic Keratosis
Classification
Logout
Image Augmentation
Convolution Neural Network
Disease Prediction Screen from Image
Browse Image
Choose File
Predict Disease
Type here to search


Skin Disease Detection
127.0.0.1:8000/DiseasePredictionAction
Train CNN Algorithm
Disease Detection &
Image Acquisition
Image Preprocessing
Disease Classification
Open
Disease Prediction Scree
Browse Image
Choose File
No File chosen
Predict Disease
File name:
Open
Cancel
Type here to search


Skin Disease Detection
127.0.0.1:8000/DiseasePredictionAction
Disease Detected & Classified as : Dermatofibroma
Disease Detected & Classified as : Dermatofibroma
Logout
Image Augmentation
Convolution Neural Network
Image
Browse Image
Choose File
Predict Disease
Type here to search

7-CONCLUSION

The above discussed image processing and deep learning algorithms are used to efficiently classify the skin diseases. Major advantage of the system is the saving of time and effort involved in feature engineering. CNNs learn features on their own. Hence skin diseases can be diagnosed using CNN and also be classified using the same. Using advanced computational techniques and large dataset, the system can match the results of a dermatologist thus improving the quality standards in the area of medicine and research.

Early detection of skin cancer using Convolutional Neural Networks (CNNs) presents a promising approach to improving patient outcomes by enabling timely diagnosis and treatment. CNNs are highly effective in image classification tasks due to their ability to automatically learn features from raw image data, which makes them ideal for detecting skin cancer from dermoscopic images. With appropriate training on large, well-labeled datasets, CNNs can achieve high accuracy in distinguishing between benign and malignant skin lesions, outperforming traditional diagnostic methods in some cases.

Moreover, incorporating CNNs into clinical practice could reduce the workload for dermatologists, assist in the decision-making process, and make skin cancer screening more accessible, particularly in underserved areas. However, challenges remain in ensuring model generalization, managing biases in training data, and integrating AI systems into healthcare workflows. Addressing these issues, alongside continued advancements in CNN architectures and training methods, will further enhance the reliability and effectiveness of CNN-based skin cancer detection systems.

REFERENCE

[1] Egyptian Journal of Medical Human Genetics: "Artificial intelligence-driven enhancedskin cancer diagnosis: leveraging convolutional neural networks with discrete wavelet transformation" (2024).

International Skin Imaging Collaboration (ISIC) dataset: "A skin disease classification system was created to differentiate between skin cancer and skin benign tumors. Thesystem utilized deep learning with the PNASNet-5-Large architecture, achieving an outstanding performance accuracy of 76%." (2022).

[2] Studies in the field of computer vision: "Recent years have seen the implementation of hierarchical approaches, conditional random fields (CRF), Random Forest (RF), and Markov Random Fields (MRF) to detect skin cancer." (2022).

[3] Studies in the field of computer vision: "Several other studies have employed CNN for skin disease detection, yielding notable performance accuracies of 80.52%, 86.21%, and 87.25%." (2022).

[4] International Skin Imaging Collaboration (ISIC) dataset: "Utilizing the CNNapproach with random modifiers, an impressive accuracy of 97.49% was attained in effectively differentiating distinct skin disorder lesions." (2021).