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Skin Diseases Diagnosis Using Convolutional 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.

I. 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. These techniques are categorized as follows:

- Supervised image classification
- Unsupervised image classification
- Object based image classification

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.

1.1 Introduction

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 [13]. 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 [20]. 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 [24]. Research also shows that in the course of a lifetime, one-fifth of Americans will develop a skin cancer [19].

However, the diagnosis of skin disease is challenging. To diagnose a skin disease, a variety of visual clues may be used such as the individual lesional morphology, the body site distribution, color, scaling and arrangement of lesions. When the individual components are analyzed separately, the recognition process can be quite complex [6, 15]. For example, the well-studied skin cancer,

melanoma, has four major clinical diagnosis methods: ABCD rules, pattern analysis, Menzies method and 7-Point Checklist. To use these methods and achieve a good diagnostic accuracy, a high level of expertise is required as the differentiation of skin lesions need a great deal of experience. Unlike the diagnosis by human experts which depends a lot on subjective judgment and is hardly reproducible, a computer aided diagnostic system is more objective and reliable.

II. LITERATURE SURVEY

[1] J. Arevalo, A. Cruz-Roa, V. Arias, E. Romero, and F. A. Gonzalez. An unsupervised feature learning framework for ´ basal cell carcinoma image analysis. Artificial intelligence in medicine, 2015.

The paper addresses the problem of automatic detection of basal cell carcinoma (BCC) in histopathology images. In particular, it proposes a framework to both, learn the image representation in an unsupervised way and visualize discriminative features supported by the learned model.

[2] 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, 2014.

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.

[3] 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, 2013.

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.

[4] Y. Bengio, A. Courville, and P. Vincent. Representation learning: A review and new perspectives. IEEE Trans. Pattern Anal. Mach. Intell., 35(8):1798–1828, Aug. 2013.

The success of machine learning algorithms generally depends on data representation, and we hypothesize that this is because different representations can entangle and hide more or less the different explanatory factors of variation behind the data. Although specific domain knowledge can be used to help design representations, learning with generic priors can also be used, and the quest for AI is motivating the design of more powerful representation-learning algorithms implementing such priors. This paper reviews recent work in the area of unsupervised feature learning and deep learning, covering advances in probabilistic models, auto-encoders, manifold learning, and deep networks. This motivates longer-term unanswered questions about the appropriate objectives for learning good representations, for computing representations (i.e., inference), and the geometrical connections between representation learning, density estimation and manifold learning.

Existing Methods

Existing method includes Machine learning techniques. The machine learning techniques limitations is it work on less amount of data.

Existing Systems such as SVM, KNN, NB are used previously.

ML has profoundly impacted the world. We are slowly evolving towards a philosophy that Yuval Noah Harari calls "dataism", which means that people trust data and algorithms more than their personal beliefs. If you think this definitely couldn't happen to you, consider taking a vacation in an unfamiliar country. Let's say you are in Zanzibar for the first time. To reach your destination, you follow the GPS instructions rather than reading a map yourself. In some instances, people have plunged full speed into swamps or lakes because they followed a navigation device's instructions and never once looked at a map.

III. PROPOSED METHOD

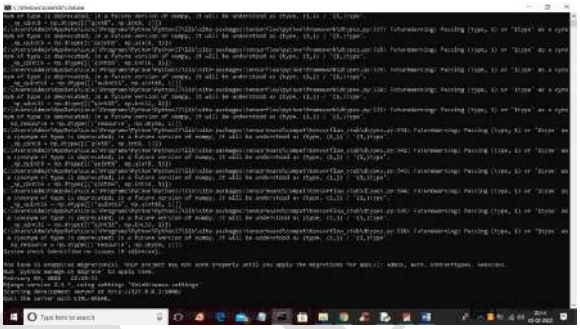
In this application, CNN (convolution neural networks) is used to classify skin diseases from images as CNN gain lots of success and popularity in the field of image classification. To train CNN we have used skin disease dataset which contains 9 different types of diseases such as 'Actinic Keratosis', '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.

There are following steps used in this project are,

1. Selection of input dataset
2. Image Preprocessing operations
3. Feature Extraction using CNN
4. Train and Test CNN model
5. Display the type of disease and check the performance

IV. RESULT

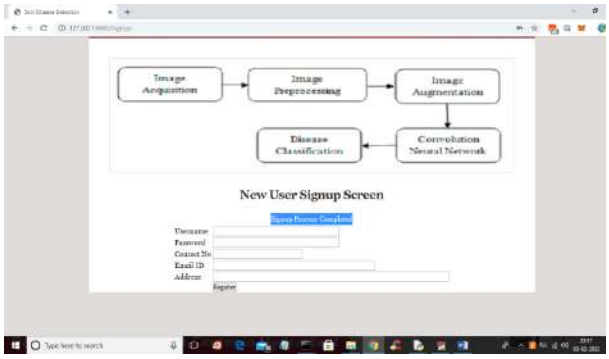
To run project double click on 'run.bat' file to start DJANGO web server and to get below screen



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

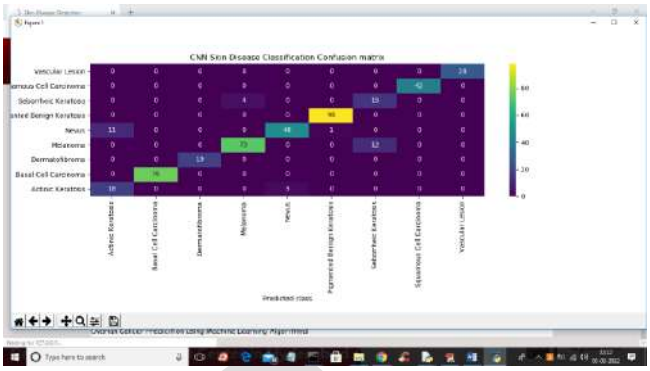
In above screen user is enter signup details and then press 'Register' button to complete signup process and to get below output



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

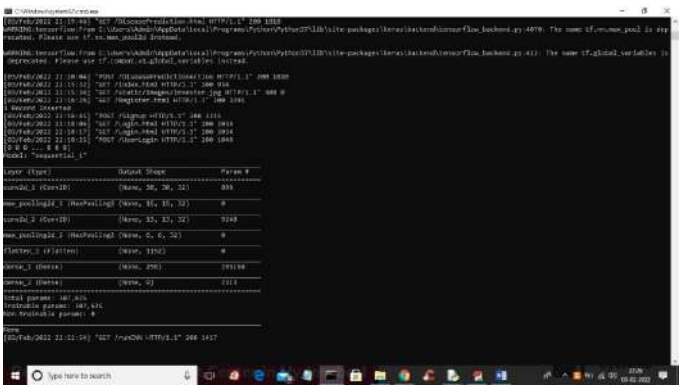
In above screen user is login and then click on 'Login' button to get below screen

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

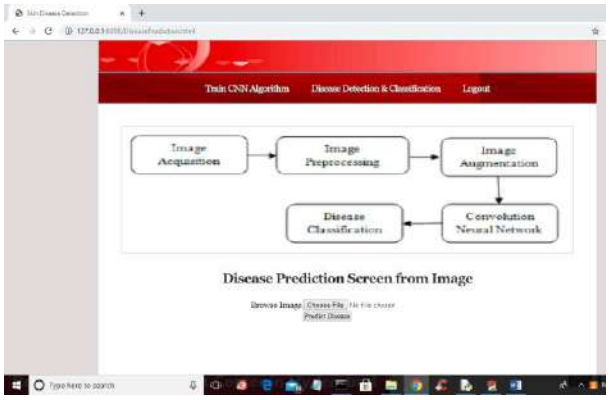


In above CNN confusion matrix graph we can prediction on test data and in above graph x-axis represents predicted disease names and y-axis represents original test classes and in above all values in diagnol boxes are the correct prediction and value > 0 which are not in diagnol are the wrong prediction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

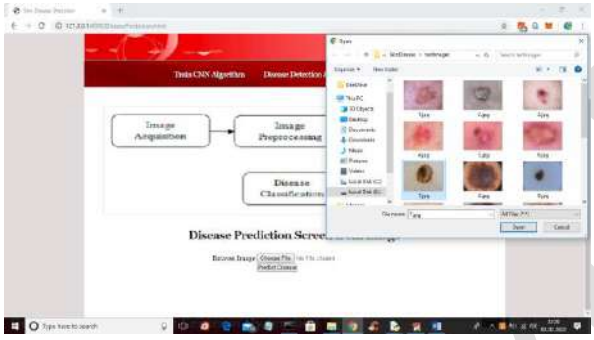
In above screen we got CNN accuracy as 93% and in below screen we can see CNN architecture



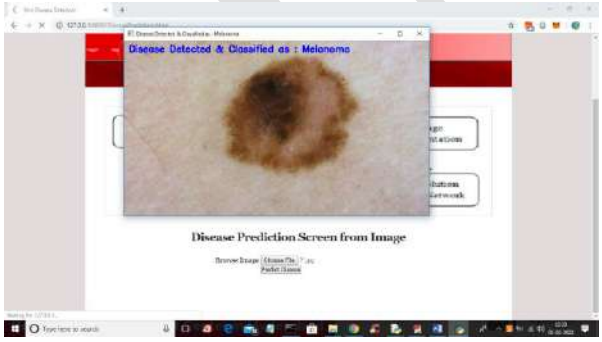
In above CNN architecture we have designed multiple layers with different image sizes such as 30 X 30, 15 X 15 etc. Now go back to output application and then click on 'Disease Detection & Classification' link to get below output



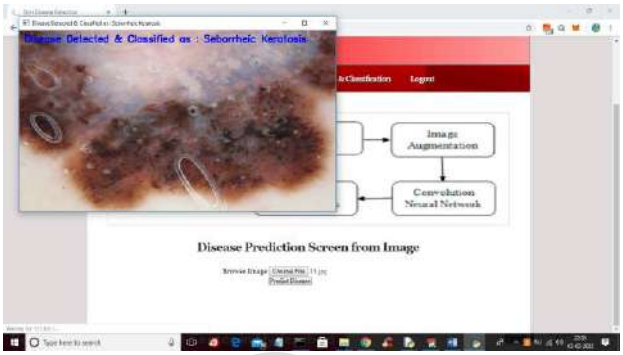
In above screen click on 'Choose File' button to upload skin diseases images from 'testImages' folder and then click on 'Predict Disease' button to classify disease



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



V. 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.

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[4] Jainesh Rathod, Vishal Waghmode, Aniruddh Sodha, Dr. Prasenjit Bhavathankar, "Diagnosis of skin disease using Convolutional Neural Networks", ICECA IEEE Conference Paper,2018