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Skin Disease Recognition using AutoML and CNN

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Abstract

Skin diseases seriously affect individual's life and health. Current research proposes an effective way to dealing with and recognizing only singular type of skin diseases. It is important to create programmed techniques to expand the precision of analysis for multi-type skin diseases. In this model skin disease could be recognized by new recognition technique. Skin images were pre-processed to remove noise and irrelevant background by filtering and transformation. The texture and color features of various skin infection pictures could be acquired precisely. At the end, using the AutoML model and CNN model skin infections were distinguished and results are compared. The test results exhibit the adequacy and attainability of the proposed technique.

Keywords: *CNN, AutoML, Melanoma Detection,ML,GLCM,CBIR.*

1. Introduction

Skin is biggest organ of human body. It weighs in the range of six to nine pounds and covered over two square yards. It provides protection against bacterial infections and maintains temperature of body. Symptoms like swelling, burning, redness and itching, are produced from situations that change and damage the skin. Common skin problems like Dermatitis and Hives are produced by allergies. Some skin diseases affect look and also produce many types of cancers. Image processing is method is used to detect such diseases. For that it is necessary to convert an image into digital form. Segmentation, filtering, feature extraction etc., is perform to get an improved version of image or to get meaningful information from that image. The input is an image or video and output is also image with same characteristics as input. Fixed signal processing methods are applied to take input samples as 2-D signals in most image processing models. According to research, in UK around eight million people suffered from skin disease. Skin disease can have a greater impact on individual's life and resulting in destroying confidence of a person further turning into depression. The worst situation is that, it can even kill. It is an issue that needs to be controlled and dealt with seriously and identifying it in early stage and prevent it from spreading. Detection of a disease mainly depends upon many factors and parameters which are considered for detection. The generic steps in the whole process includes, taking an image and applying filters to remove noise from the image. Then segmentation of the image to extract meaningful information and feature extraction is done based on input parameters and finally classification of the diseases is performed by using appropriate classifier.

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2. Literature Review

Existing Systems:

1. [1] **Expert System for Diagnosis of Skin Diseases**

This paper states the implementation for medical diagnosis system which detects the skin disease and provides medical treatment. The aim is to provide a medical treatment for the diseases by examining the symptoms. In this system image processing and data mining is used. The whole system divided into three sections:

- Pre-processing, image segmentation and feature extraction.
- Classification and skin disease detection model. Suggestions or advice on medical treatment.

Various pre-processing techniques are perform over image for noise removal and image enhancement. Thresholding segmentation technique was used to segment the set of images under examination. At the end, data mining techniques were used to identify the skin disease and to provide recommendations to users. This system provides accuracy of 85%, 95% and 85% for diseases like Eczema, Impetigo and Melanoma respectively.

2. [2] **Online Children Skin Diseases Diagnosis System**

This model uses forward chaining inference engine with rule base d model are used which identifies the skin disease. By using this system, user identifies skin diseases in children via online interface and the system in return provides useful medical suggestions or timely advice. Diagnosis and management module are two main modules. Children's symptoms and conditions are identified based on answers given by the user in the diagnose module by asking questions. This system provides solution for detection of skin disease and symptoms related questions.

3. [3] **An automated system for recognizing disease conditions of skin**

Authors Anal Kumar Mittra and Dr. Ranjan Parekh have proposed a model to identify the condition of the skin disease by evaluating skin disease images by using grey normalized symmetrical simultaneous occurrence stencils (GLCM) method. The system uses relational databases for the storage of implying textual skin images. Same type of images directly over feature vectors are used.

4. [4] **Mobile-based Medical Assistance for Diagnosing multiple types of Skin Diseases Using Casebased Reasoning with Image processing**

The authors proposed a mobile-based medical assistance that can be used for diagnosing skin diseases by the use of CIBR (Color based image retrieval) and image processing. This model was developed for preexamining skin situation and check whether they have a disease or not. The proposed system was successfully implemented for detection of six different skin diseases with an 90% accuracy. Eczema – 88%; Psoriasis – 61%; Acne – 75%; Skin Cancer – 51%; Scabies – 43%; and Seborrhea Dermatitis – 34% these are other disease detection rate. In this method, the CBIR method and image tiling used to finding relationship between pixel and neighbour and finding to prepare a set of feature vector. Training and testing is done. Results showed that the model recognize multiple skin disease with a high accuracy . In training pure skin images were trained and in testing skin area were detected from non-skin part.

Advantages:

- Less computation.
- Less time complexity.
- Higher accuracy for all types of skin.
- Capable to identify multiple types of skin.

3. Proposed System

A. Analysis:

Machine learning algorithms being utilized generally in biomedical fields for segmentation and diagnosis. These algorithms use features got from pictures as contribution to settle on a choice. There is an absence of data about machine learning algorithms for skin disease classification. To address this issue, Different combinations of features with popular ML algorithms were considered to compare classifier performances. As of recently, algorithms like ANN and were vigorously depended on and utilized for this reason however they had their restrictions. For instance, SVM could only perform bi-level classification. We break this pattern by utilizing CNN (Convolutional Neural Network) and a Google Cloud service AutoML Vision.

B. Algorithms:

[1] CNN:

A convolutional neural network is a type of deep neural networks, most generally applied to examining visual imagery. A convolution is the basic utilization of a channel to an info that outcomes in an actuation. Repeatedly using the similar filter to an input results in a map of activations called a feature map, indicating the areas and strength of a detected feature in an input, such as an image. The advancement of convolutional neural systems is the capacity to naturally get familiar with countless filters in parallel specific to a training dataset under the constraints of a specific predictive modelling problem, such as image classification. The outcome is highly specific features that can be identified anywhere on input images.

Advantages:

1) Convenient to use: This system is easy to use and very simple to handle.
2) Effective: Using this system user is able to recognize the skin disease.
3) Flexible: It is quite flexible and can be run on any system.

[2] AutoML:

AutoML Vision enables training of machine learning models to classify images according to our own defined labels.

- Train models from labelled images and assess their performance.
- Supports a human (manual) labelling service for datasets with unlabelled images.
- Use trained models to work via the AutoML API.

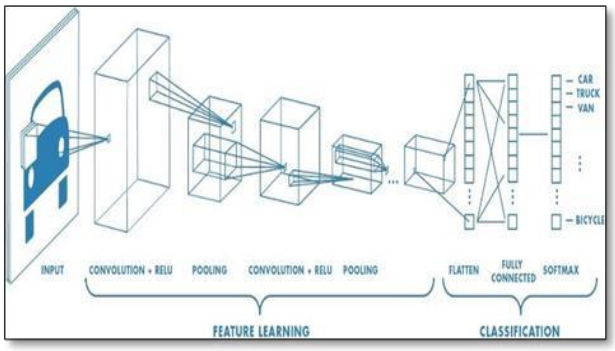

Figure 1 : CNN algorithm

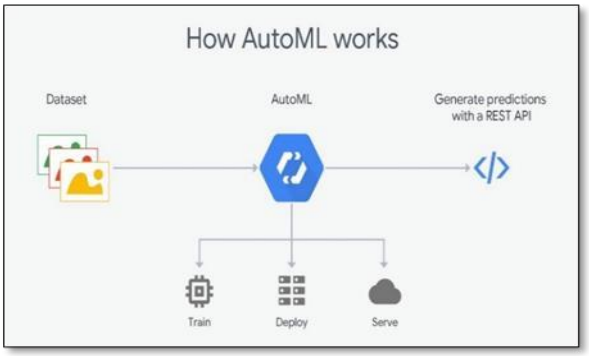

Figure 2 : AutoML vision working

C. Design details

Doctor and patient will use this system. Doctor will upload the image of affected area of skin. This image is the input to model. According to system problem statement, it uses two models- one is AutoML vision model and other is custom model, which suitable machine learning algorithm (i.e. SVM, CNN, etc.) Output of this model is the report regarding the type of skin disease. This report helps doctor as well as patient for detection of skin disease at early stage. This system also maintains the medical history for patient, which will use in case of changing the doctor.

Dataset:

The performance of proposed framework was evaluated on benchmark dataset ISIC 2016 by "International Symposium on biomedical images(ISBI) in the challenge of Skin lesion analysis towards Melanoma detection" [5]. In the database, 935 images were of class Benign and 994 images were Malignant.

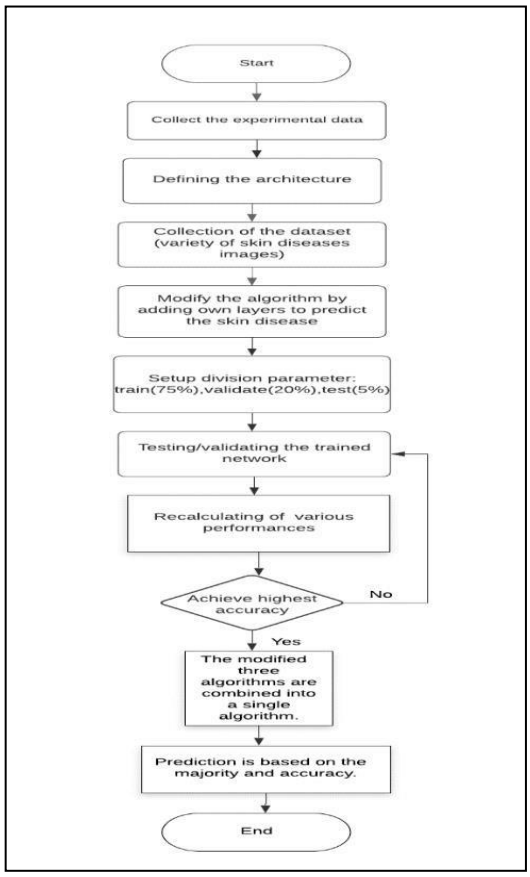

Fig 3 : Methodology

4. Prediction and Analysis

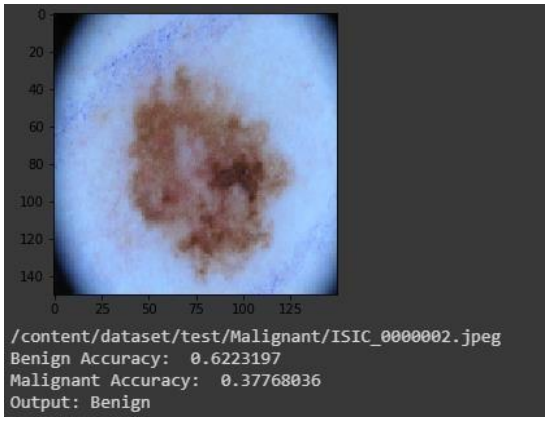

Figure 4: CNN sample result (a)

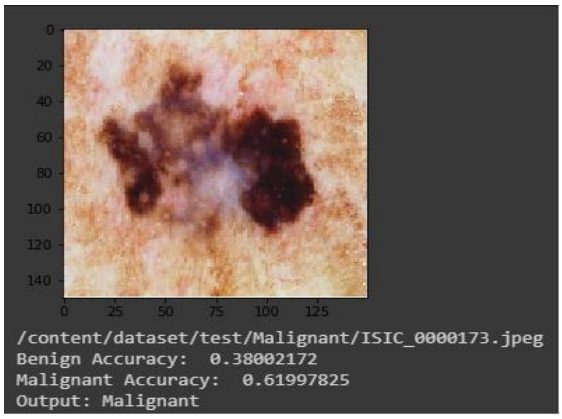

Figure 5: CNN sample result (b)

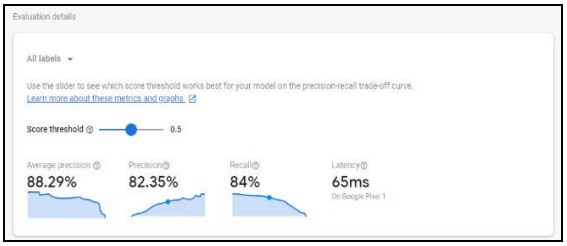

Figure 6 : AutoML prediction analysis

Figure 7 : AutoML prediction evaluation

The two classes considered were Benign (not infected) and Malignant (infected). In the database, 935 images were of class Benign and 994 images were Malignant. Features are compared in both color and texture combined. Out of these images, 75% is used for training, 20% for testing and 5% for validation. The CNN successfully classified the testing images with an accuracy of 88.87%. The AutoML model on other hand gave an accuracy of 82% for the same dataset.

Performance Comparison:

Method	*Precision*	*Recall*	*Accuracy*	*F score*
AutoML	82.35	84	82	83.17
Proposed Method	87.87	88.67	88.87	88.27

Applications:

- It is a web based application which provides the functionality of uploading images of diseases by doctors for examination and generating accurate reports regarding the same.
- The user interface is more user friendly and using patient can see medical history.
- It is developed using custom model which uses CNN machine learning algorithm. Results are compared with AutoML model so it gives more accurate result.

6. Conclusion and Future Scope

In this paper, we proposed a novel a technique based on CNN and AutoML for efficient precise and automated Melanoma region segmentation within dermoscopic images. Our method constitutes of three steps: skin image refinement, localization of infected region, and finally segmentation of Melanoma. In contrast with AutoML based classification, the CNN is capable to compute deep features with good representation of Melanoma, and hence improves the segmentation performance. It can detect multiple skin diseases of same patient as well as various diseases of different patients with efficient training mechanism and subject to sufficient training data. Moreover, our method can be applied to solve complex medical image segmentation problems. In future, classification models can be tested with different image quality, quantity and features to achieve better classification accuracy. Large feature dimension is a reason for low classification accuracy. Therefore, the feature combinations that give better performance should be chosen. Similarly, use of multilevel or hybrid classifier will also help in improving the classification accuracy.

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