Automated Melanoma Recognition in Dermoscopy Images via Very Deep Residual Networks

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Abstract: Automated melanoma recognition using image processing technique from the available dermoscopic images in deep learning is difficult task because of the contrast and variation of melanoma in skin. It is mainly a non-invasive method so that it cannot contact with skin more forcefully. To overcome these disadvantages this research work proposes a method using very deep convolutional neural networks (CNNs). For more accurate classification in this method we are using FCRN and CNN with the effective training limited data. Initially, Performance of Segmentation is done using residual networks using an image from the dataset followed by Classification by neural networks to check the abnormalities in skin. In this kind of classification technique the network has more specified features from the segmented portion alone. The proposed technique is mainly evaluated on datasets and experimental results that would show the performance in histogram and PSNR ratio.

1. Introduction:
Melanoma is actually a skin cancer, its initial stage is pigmenting on skin cells known as melanocytes. It can be cured easily at starting stages. The main cause for this disease is from ultraviolet radiation with lower levels of pigmentation of skin. Lesions are mostly smaller in size and initially look like small dot. Using the trained set of data, images get recognised and undergo FCRN which segments gradually and then using that enhanced image it will be introduced into classification to obtain the accurate results. Doing Preprocessing Techniques comprises of filtration, Enhancement. Performing Segmentation using FCRN and classification based on CNN. Showing any abnormalities while classification can be displayed at different levels.

2. Literature Survey:
In [1] Deep Learning is implemented equipped with GPU (Graphic Processing Unit). Non-dermoscopic images which are taken from digital cameras which is referred to as clinical images. Clinical Images also known as non-dermoscopic images from which dermatologists recognize melanoma lesions and detect skin cancer. The non-dermoscopic images may contain noise effects and other factors such as hair so that they are eliminated by the method known as Pre-processing. Further the Enhanced image or the output from the pre-processing unit is fed into CNN (Convolutional Neural Network). This would show the comparison between melanoma and benign form of skin lesions. The advantage of this is diagnosis of skin cancer through Computer and it is a type of automated analysis. But it requires sophisticated algorithms. This is only for professionals and cannot help non-specialists. He concluded that Non-dermoscopic images taken by digital cameras is main tool for the melanoma detection in telemedicine. In this paper a computational complex method based on deep learning was implemented that used clinical images. This system was capable of detecting melanoma cases from benign ones. We were able to increase the accuracy of the system by sending images through illumination correction that increased the discrimination capability of the system. For training, we used an available small dataset.

In [2] a method for melanoma detection based on the segmentation by 19-layer. Networks that is trained end-to-end and does not rely prior knowledge of the data. A novel loss function based on jaccard distance to eliminate the need of sample re-weighting is designed. Our method is general
enough and the technology only needs a certain preprocessing, which allows its adoption in a variety of medical image segmentation task. The advantageous of its effectiveness and efficiency. The challenging task due to the low contrast between lesion and the surrounding skin, time consuming, complex. It is prone to suffer from inter and intra-observer variabilities. Several effective training strategies were implemented to tackle the challenges that training a deep Network may face when only limited training data is available. The results in [2] clearly demonstrated that the proposed method is very robust to various image artifacts and imaging acquisition conditions while using processing.(both stages).

In [3] an automated melanoma recognition system based on deep learning method combined with so called hand crafted features and local binary patterns derived from Convolution Neural Network has been proposed. A combination of both types of features to be used for skin lesion classification problem. The main outcomes is this dataset demonstrates high classification accuracy, sensitivity and specificity compared with other dataset. Dataset contains hundreds of images. One of the problems is that correct skin lesion recognition is a difficult task.

In [4] the RGB color space is converted so that the color information contained in the images can be used effectively to differentiate normal skin and skin lesions. Quantitative analysis on 250 dermoscopic images showed that the novel algorithm outperformed other algorithms. Also, using comparative data, the reliability and the implementation issues of the approach are discussed in this work. A straight-forward method to segment the skin lesions is to discard the color information and convert the color dermatoscopic images to gray-scale images, in such a way the image intensity of each pixel is calculated through a weighted combination of the three RGB channels. This novel approach is robust against the noise, and provides an effective and flexible segmentation. The main outcome of this work is that, the major part of the segmented region remains unchanged both qualitatively and quantitatively.

In [5] an easy and effective preprocessing method for melanoma classification by using cytological properties, the major part is aligned axis of tumor in simultaneous direction and convolutional neural network (CNN) classifies with 5-folded cross validation. The main advantage is to attain better performance even without the property of the target. Complexity is they require a minimum amount of trained datasets.

In [6] Chiranjeev Sagarl and Lalit gave their idea about melanoma as it is located in lesions which are detected. The melanoma detection can be done using colour spaces. With the help of color spaces most important and necessary information regarding lesions which is embedded colour channel makes way for segmentation of a digital image. It is performed in clinical images. The image from mobile cameras does not have proper clarity (enlighten background) compared to Dermoscopic images. The method used here is Colour channel based Segmentation. The main principle is to differentiate and extract the cancerous lesion from skin with 94% accuracy with preferred colour channel. Early diagnosis can cure melanoma in skin lesions and it is more accurate. Dermoscopic images not easy to get. Sophisticated algorithms are provided which is available only for professionals. This concludes a simple and computationally easy method based on modified histogram thresholding combined with morphological operations has been proposed. Color channels from different color space have been analyzed the differentiability between lesion and background skin. Skin images with lesion touching the boundaries or corners of the image have been discarded during image acquisition. The experimental results obtained by comparing manual area with the segmented lesion provide approximately 94% of accuracy for the L* RGB color channel derived from a digital image. The results suggests that proper manipulation of color channels from different color spaces can be utilized to design a simple yet highly competitive method comparable to well-known segmentation.
3. Proposed Methodology:

- Data Set
- Read Input Image
- Filtration
- Contrast Enhancement
- Segmentation-FCRN
- Classification-CNN

*Trained data* are the images which act as an input for the process. This dataset is based on the International Skin Imaging Collaboration (ISIC), which is publicly available collection of quality controlled dermoscopic images of skin lesions. As image processing technique accepts trained images so that it can communicate easily with computer in software. The data sets are nothing but a skin lesion pigmented which may or may not be a melanoma. Median filter is used for filtration. It is a simple, intuitive and easy to implement method of smoothing images, i.e. reducing the amount of intensity variation between one pixel and the next. It is often used to reduce noise in images, white noise in images. In this image processing, the pixels of a white noise image are typically arranged in a rectangular grid, and are assumed to be independent random variables with uniform probability distribution over some interval. So median filter is normally reduces salt and pepper known as black and white noises that increase pixel and enhance the contrast and also increase intensity. Here, Adaptive Histogram Equalisation is used to improve the contrast and over amplify images. It is the process of adjusting digital images so that the results are more suitable for display or further image analysis. This is pre step for segmentation of the proposed FCRN is that it can make pixel-wise predictions, which is of valuable significance for skin lesion segmentation task.

Further FCRN improves the segmentation and gives the portion of affected lesion. The trained datasets results in effective way more accurately in the CNN. Convolutional Neural network is used for classification which gives good and accurate result compared to conventional methods. After the segmentation it proceeds over the classification process, here the images undergoes upsampling and down sampling process through deeper networks and gives the accurate result through histogram representation.

4. Results and Discussion:

The main aim of the project is to recognize melanoma using Deep Learning Algorithm. Here Deep Learning Algorithm refers as a subclass of machine learning. Therefore FCRN (Fully Convolution Residual Networks). This is used in segmentation under deep layers for data representations. This experiment is carried on Intel Windows 7 MATLAB R2014b software. The Hierarchy starts from Pre-Processing methods, Segmentation followed by Classification of an input image. The dataset that was downloaded from the website: https://dataverse.harvard.edu.
This website contains ISIC (International Skin Imaging Collaboration) melanoma images to develop image analysis tools for the automated segmentation and diagnosis of skin lesions with the aim of accurate melanoma detection from dermascopic images.

A particular image (.tif,.jpg,.png) is taken as an input for process from the trained dataset for testing. Since the dimensions of the image are very enough large to fit into the Command Window so it is resize the image in the workspace. In order to reduce to number of pixels the input image (RGB 24 bit) is converted into greyscale image (8 bit). The greyscale image doesn’t have clarity in its appearance therefore, greyscale image is filtered using a Median filter which removes noise that results some visibility of pixels through our naked eye. With the filtered image, Contrast Enhancement is performed using Adaptive Histogram Equalisation that would enhance the interior portion of skin lesion and increased the contrast of the image.

Segmentation is performed using FCRN (Fully Convolutional Residual Networks) technique. The iterations goes up to 100 and enhanced for final segmentation. This segmented image is then classified using CNN (Convolutional Neural Network) based on abnormalities at different levels that is plotted in Histogram as final results.
5 CNN Output:

Histogram

Here, peak to signal ratio is measured from which it attains a peak value which is denoted by point.

Performance:
This contains training, validation, test and best levels at which the image is classified. Up to 4 epochs or duty cycle the classification takes place. This epochs or duty cycle can be changed based on the requirements.
It will denote the stages as early stage, Moderate and Severe based on the type of Melanoma images. Peak signal to noise ratio reading is shown in the command window.

6. Future Scope:
Further scopes of this include integrating probabilistic graphical models into our networks to further enhance the discrimination capability and improving our method on more applications.

7. Conclusion:
In this paper, we propose an image processing method based on very deep CNNs to meet the challenges of automated melanoma recognition which consists of two steps: segmentation and classification. We framed two steps that without interaction of manually operated. Compared with other convolutions the very deep CNNs can executes features with high discrimination and improve the performance of both segmentation and classification. We further construct a FCRN information integration scheme for accurate skin lesion segmentation. Very deep CNNs with effective training mechanisms can be used to solve complexity in analysis of medical problems, with help of limited training data. This will be more useful in easy detection and diagnosis of skin cancer also, identifying the type of skin cancer at an early stage for the society.

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