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DEEP CONVOLUTIONAL NEURAL NETWORK FOR SKIN LESIONS IMAGE CLASSIFICATION

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Abstract

Skin Cancer is a disease affecting the skin. Skin cancer can have two forms: malignant and benign. The formation of lesions that bleed is a symptom of malignant melanoma. One of most serious type skin cancer is malignant melanoma. It develops as a result of a malignant development in a pigmented skin lesion. It's named after the cell that it's thought to come from, the melanocyte. This condition can be cured if caught early enough. Melanoma is difficult to diagnose and necessitates the use of samples and laboratory procedures. Melanoma can spread throughout the body via the lymphatic system or the blood. Inflammation or even the spread of a lesion is frequently caused by laboratory samples. The precise identification of skin patches based on certain characteristics is one of the most important steps in early detection of skin cancer. In the proposed work, include the features extraction and classification. The features extraction includes HSV color features, Texture features. After that implement Convolutional neural network algorithm is used to classify the features as affected or normal. Without having to perform segmentation and feature extraction separately, CNN(Convolutional Neural Network) models may be utilised to classify the afflicted skin photos. The performance of the system can be compared with existing algorithm named as Support Vector Machine. Experimental results shows that the proposed CNN outperformance than the existing system.

Keywords: Skin cancer, malignant, melanoma.

INTRODUCTION

Skin cancer is a type of tumor that grows on the skin. It has been increased due to the growth of uncontrolled gene expression. These systems have the capability to spread throughout the body.[2] UV radiation exposure is important for more than 90percent on average of instances. UV radiation has a wavelength of 100 nm to 400 nm. Cancer comes as a result of repair Mechanisms damage to skin cells, which is mostly caused by UV radiation. Melanoma occurs when cancer cells form in moles on the skin, causing irritation in the epidermal layer, which depends on the temperature around it.[6] Skin infections are the most popular infections in humans, and their prevalence is on the increase. Therefore early diagnosing is a crucial issue. These most skilled doctor has been unable to classify skin problems and its origins, demanding the use of computer-assisted skin disease diagnosis to make recommendations for non-specialized user.[4] It is well-known that early finding and treatment of skin diseases can reduce the mortality and morbidity of patients.

RELATED WORK

J Abdul Jaleel [2013]:proposed Skin detection based on Maximum Entropy Threshold, feature extracted by using Gray Level Co-occurrence Matrix(GLCM), and c1assification using Artificial Neural Network(ANN). Back-Propagation Neural (BPN) Network is used for c1assification purpose.[1]

A.A.L.C. Amarathunga [2015]: This system used rule based and forward chaining approach to detect skin disease. Proposed system enables user to identify children skin diseases via online and provide useful medical suggestions. Used different data mining classification algorithms (AdaBoost, BayesNet, MLP and NaiveBayes) to predict and diagnose the skin disease. This only works for three skin diseases (Eczema, Impetigo and Melanoma) [8].

M.Chaithanya Krishna [2016]: This paper uses segmentation as various clustering technique, features can be extracted by using ABCD (Asymmetry Index Border Colour Index Diameter) method [7].

Mariam A.Sheha,Mai S.Mabrouk, Amr Sharawy[2012]: This paper presents an method for melanoma diagnosis applied on a set of digital images. Features extracted by using gray level Co-occurrence matrix (GLCM) and Using Multilayer perceptron classifier (MLP) to classify between cancerous and noncancerous images [9].

PROPOSED SYSTEM

Melanoma is the most dangerous type of skin cancer. Dermoscopy based early detection and recognition strategy is critical for melanoma therapy. So proposed system to extract the features based on color and texture. Segment the skin lesions using active contour based snake model. Finally classify the cancer using convolutional neural network algorithm with improved accuracy rate.

Advantages include the ability to extract all features, decreased dimensionality, improved classification accuracy, and automatic segmentation.

BACKGROUND

Convolutional Neural Network for Image Classification

Artificial Neural Networks (Classifier) are made up of artificial neurons that are modelled after biological neurons in the brain. The CNN (Convolutional Neural Network) is a modified feed-forward neural network that is commonly used for image classification applications. Because CNNs comprehend translation invariance, they can recognise a specific thing even when it appears in multiple ways. This is a critical distinction that distinguishes CNN from feed-forward neural networks, which are incapable of understanding translation invariance. In layman's terms, feed-forward neural networks recognise an object only when it is exactly in the centre of the image, but they fail miserably when the object is slightly off-center or elsewhere in the image. In essence, the network only understands/learns one pattern. This is inconvenient because most datasets in the real world are unprocessed and raw.

Working of Convolution Neural Networks

The question that emerges is how CNN interprets translation invariance. Is it Machine Learning's magic? It all comes down to maths once more.

The following operations are the various layers/steps of the CNN are Convolution, Pooling, Flattening and Full Connection

Convolution

Convolution, the initial procedure, pulls significant features from the image. It's a mathematical process that necessitates two inputs, an image matrix and a filter or kernel. To obtain a feature map, the filter is traversed through the image and multiplied with the pixel values.The convolution operation is depicted in Fig 1.

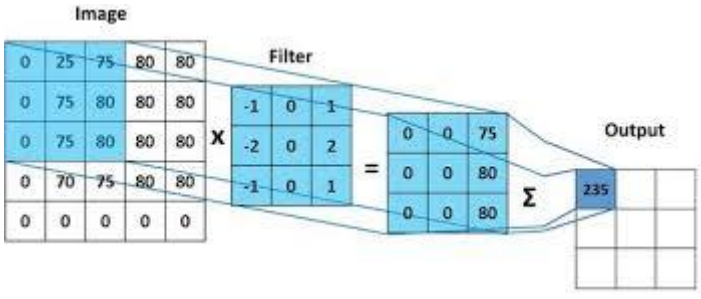

Fig 1 Convolution operation

Although convolution loses information, the goal is to reduce size and learn the essential information. Image sharpening, edge detection, blurring, and other image processing tasks can all benefit from convolution with various filters.

Pooling

When the image is quite huge, the pooling technique aids in reducing the number of parameters. Subsampling, also known as Spatial Pooling, reduces the dimensionality of each feature map while retaining important data.

Pooling is of basically divided into three types:i) Max Pooling ii) Sum Pooling and iii) Average Pooling. Max pooling is a discretization method based on samples. The feature map is created by applying a N × N max filter on the image, which selects the highest pixel value in each stride. The average and sum of pixel values are also taken into the feature map in average and sum pooling.The Max Pooling operation is depicted in Fig 2.

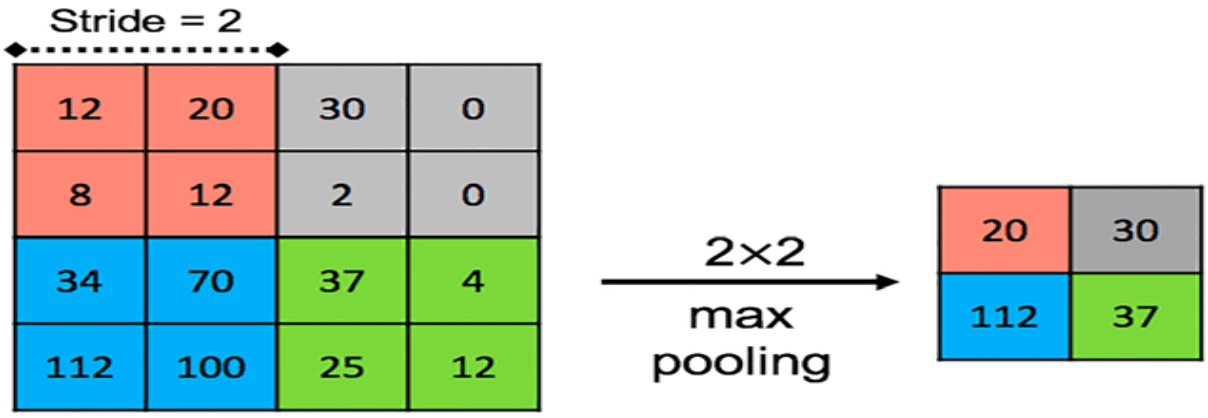

Fig 2 Max pooling operation

Flattening

We'll need a single column vector of picture pixels to feed our feature maps into the artificial neural network. We flatten our feature maps into column-like vectors, as the name implies.The flattening process is depicted in Fig 3.

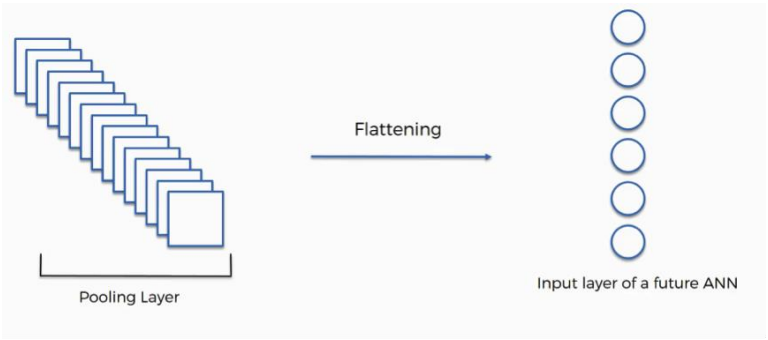

Fig 3 Flattening operation

Full Connection

The fully connected layer takes the input from the convolution/pooling layer before it and generates an N-dimensional vector, where N is the number of classes to be classified. As a result, the layer uses the probability of the neurons to identify which traits are most closely related to a certain class. The completely linked layer of a neural network is depicted in Fig 4.

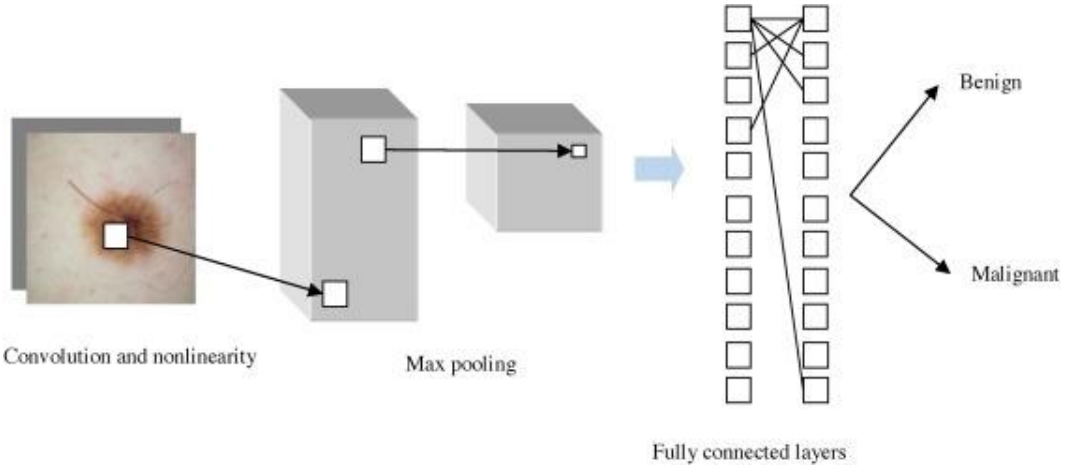

Fig 4 Full connected layers

Skin Lesion Classification Using CNN

According to previous study in this subject, CNN has a remarkable ability to classify skin lesions in competition with experienced dermatologists. Indeed, there have been times when CNN has surpassed professional dermatologists.

CNN has two methods for classifying skin lesions. In the first scenario, a CNN is used to extract image features, and another classifier is used to classify the photos. In the other situation, CNN is used to perform end-to-end learning, which can be separated into two types: learning from scratch and learning from a model that has already been trained. To address the issue of overfitting, a huge number of photos are required to train the CNN from scratch. Because the quantity of skin lesion images required for training is insufficient, CNN must be trained from scratch. A superior way is to train from a pre-trained model, which is known as Transfer Learning (TL). TL aids the model's ability to learn well even with limited resources.

METHODOLOGY

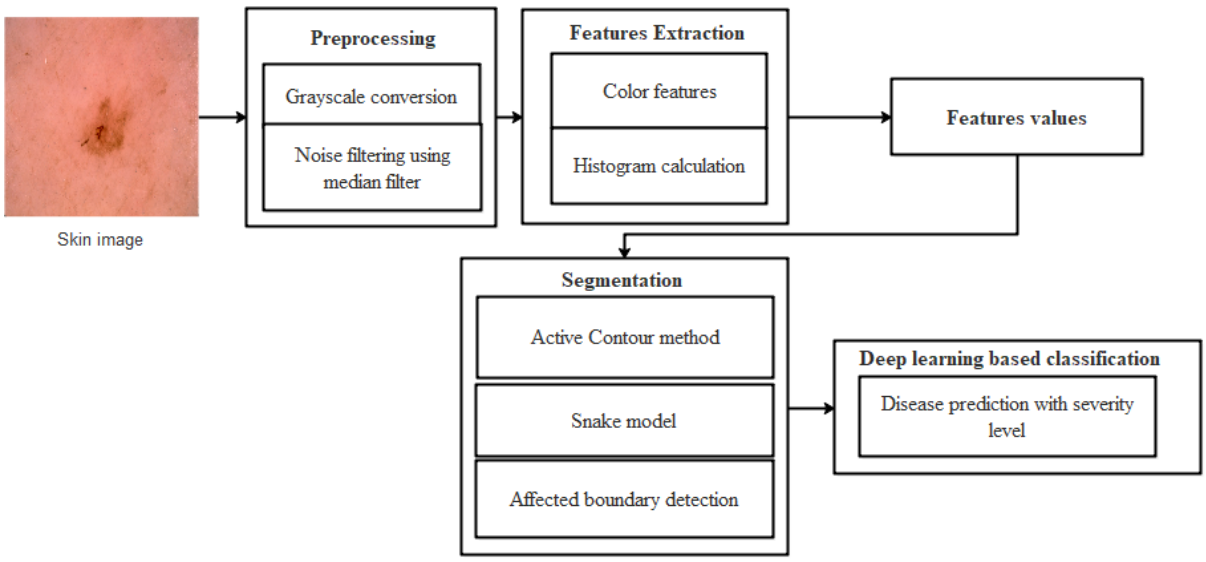

Fig 5 Methodology

• IMAGE ACQUISITION

This tool enables us to evaluate diseases by uploading dermoscopic skin images. A dermatoscope is used to evaluate skin lesions while dermatoscopy. It is also known as dermoscopy or epiluminescence microscopy, and provides for the research of skin lesions without being affected by skin surface reflections.

• PROCESSING

Pre-processing is a common name for operations with images at the lowest level of abstraction both input and output are intensity images. In this module, convert the RGB images into gray scale images.And also implement median filtering algorithm to remove the noises in images

• FEATURES EXTRACTION

Image segmentation is the process of decreasing the time and resources needed to accurately describe a huge set of data. Color and shape features are implemented in this module. Texture features including statistical information and HSV colour features are extracted.

• SEGMENTATION

Skin textures are segmented that use the snake model in this module. A snake is a malleable, energy-saving spline that is impacted by constrained and image forces that pull it towards object outlines, as well as internal forces that resist deformation. Snakes can be considered as a special case of the basic theme from using energy minimization to fit a deformable model to an image.

• CLASSIFICATION

The classifying is the system's final stage. Upon the structural analysis, each area was separately assessed for the chance of true positives. The Convolutional neural network approach is used to classify skin disorders. As a result, our suggested approach improves the accuracy of skin connection is provided by addressing irregular boundary separation.

RESULT

Only one metric, such as Accuracy, can adequately evaluate the overall model efficiency in a classification task. As a result, for each class of skin lesion condition, we assess Accuracy, Precision, Recall and Support. The true positive situation is when the skin lesion image is labelled with melanoma and the model also predicts melanoma. This is the case if the image is labelled with melanoma but is classed as one of the other six classes.

DISCUSSION AND RESULTS

The experiments for image segmentation and classification are described first. Following that, investigations on image categorization and feature extraction of skin lesions are presented.

Segmentation and classification of the image:

The acquired segmentation findings were subjected to a subjective review. As a result, a specialist's visual assessment of the segmented regions determined whether each lesion in the 408 photos was accurately segmented or not. Figure 6 Examples of segmentation results achieved by applying the developed segmentation algorithm to the original photos are presented. The segmentation results produced using our method were compared to the threshold-based segmentation results acquired using method. According to the visual assessment conducted by the professional, our strategy produced much better outcomes than the threshold-based method.

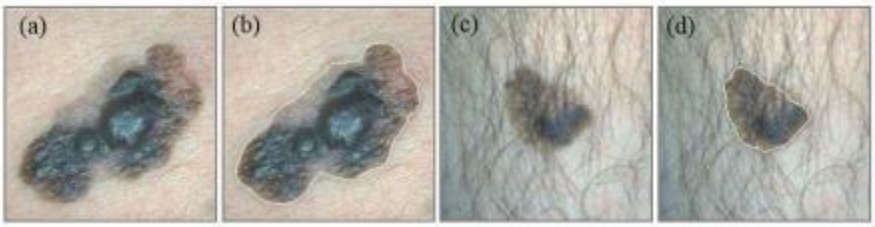

Fig 6 Original images (a and c), as well as original photos with identified borders (white contours) overlapped (b and d).

An example of segmentation results achieved using the computational approach developed: Original images (a and c), as well as original photos with identified borders (white contours) overlapped (b and d). According to the professional dermatologist, 59 images were melanocytic nevi, 75 images were seborrheic keratosis, and 251 images were melanoma from the 385 accurately segmented images. The lesions were symmetric in 124 photos and asymmetric in 261 images, according to the asymmetry criterion. The lesions had regular borders in 69 photos and irregular borders in 316 images, according to the border criterion. The lesions had uniform colours in 31 photographs and non-uniform colours in 354 images, according to the colour criterion. The lesions had regular texture in 219 photographs and uneven texture in 166 images, according to the texture criterion. Following that, the successfully segmented photos were employed in the classification process, with the results.

Feature extraction and classification of the image :

Experiments with several classifiers and feature selection methods were used to analyse the retrieved features for image classification in benign and malignant lesions, ensuring the efficiency of the presented technique. The ensemble classification models were also applied on the set of images and the best classification accuracy results are presented in more details in Figure 7 illustrates the variation in accuracy for each ensemble classification model as a function of ensemble size. The best created classification model's classification results were compared to those acquired utilising ensemble techniques. a higher level of accuracy than other classification methods in the literature.

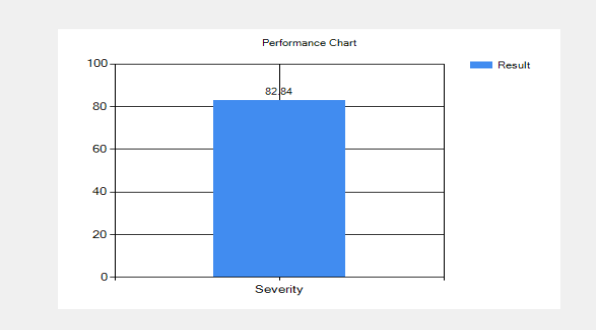

Fig 7 Classification Accuracy

CONCLUSION

Deep learning algorithm using the concept of Convolutional neural network is proposed. A CNN is introduced based on a learned model of normal skin and lesion textures. Representative texture distribution and color distributions are learned from the image itself and CNN algorithm is used to classify the skin cancer. The features are extracted based on HSV color and statistical features.

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