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Melanoma Cancer Detection using Deep Learning

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ABSTRACT

Now a days, skin cancer is well known reason for human death. abnormal skin cells growth is known as skin cancer ,these skin cells generated on human body which exposed to the sunlight, it can generate anywhere on the human body. At early stage, most of the cancers are curable. Hence, it is required to detect skin cancer at early stage to save patient life. It is possible to recognise skin cancer at early stage with advanced technology. Here we present a novel framework using deep learning method and a local descriptor encoding strategy for recognition of dermoscopy image. In particular, the deep representations of a rescaled dermoscopy image first extricated through an exceptionally deep residual neural network, which is pre-trained on a large natural image dataset. After that, local deep descriptors are collected by order less visual statistic features depends on fisher vector encoding to build a global image representation. At last utilized the fisher vector encoded representations to arrange melanoma images utilizing a convolution neural network (CNN). This proposed system is able to generate more discriminative features to deal with large variations within melanoma classes as well as small variations among melanoma and non-melanoma classes with limited training data.

Keywords : Dermoscopic Image Recognition, Cnn Algorithm, Melanoma Detection, Segementation.

I. INTRODUCTION

It is difficult task even for experienced dermatologists to predict skin lesions because of a little difference between encompassing skin and injuries, the visual likeness between skin sores, stupefied lesion outskirt, and so forth. To diagnose cancerous skin lesions at the earliest stage an automated computer-aided detection system with given images can help clinicians. The advancement in deep learning consist of dilated convolution known to have enhanced accuracy with the similar amount of computational complexities as compared with traditional CNN.

To give proper treatment recognition of skin lesion is important. Hence, the survival rate is increased due to early recognition of melanoma in dermoscopic images. The accurate detection of melanoma skin lesions is possible to highly trained dermatologists. Therefore, it is very challenging task to detect melanoma due to little difference among lesions and skin, visual similarity between melanoma and non-melanoma lesions, etc. As expertise is in limited supply, reliable automatic detection of skin tumours i.e. a system that can automatically analyse skin lesions, will be very advantageous to enhance the accuracy and efficiency of pathologists.

Overall, to tackle these issues, here presented a framework to locate the challenges for automated and accurate melanoma detection in dermoscopy images. The contributions of this study is two-folded. Based on the deep CNN and feature encoding strategy proposed an efficient framework. Is helpful to

generate representative features for more accurate melanoma recognition under limited training data.
The proposed framework utilises segmentation for extracting the feature and CNN for analysing melanoma and non-melanoma images. Then lots of experiments carried on to compare proposed approach with existing CNN based methods utilizing the public ISBI 2016 skin lesion data.

The organization of this document is as follows. In Section 2 (Literature Survey), we enlisted details of all research existed. In Section 3 (System Architecture), present architecture of proposed system. In section 4 (Result and Discussion) discussed experimental setup and dataset used is discussed. In section 5 (Conclusion) discussed conclusion and future work required to improve our system.

II. LITERATURE SURVEY

In this study [1], author used the MED-NODE dataset. From the segmented part colour feature are extracted and for performance checking of system author used three classifiers : Naïve Bayes, Decision Tree and KNN. Proposed methodology consists of following steps:

1. Preprocessing: The digital images contains artifacts .Thresholding algorithm is used for removing artifacts.
2. Segmentation: To find the region of interest segmentation is used.
3. Feature Extraction: Colour feature are extracted from segmented part
4. Classification: For classify the image whether it is melanoma or benign author used three classifiers.

82.35% accuracy is obtained by decision tree which is greater among this three classifier.

In this paper [2], Andre Esteva et al given a fully automatic method for skin lesion segmentation by optimal utilization of a trained 19-layer deep convolutional neural networks (CNNs) that is not based on prior knowledge of the data. They perform a set of strategies to ensure effective and efficient learning with limited training data. A novel loss function depends on Jaccard distance to diminish the need of sample re-weighting is also generated, because of the strong imbalance among the number of foreground and background pixels as typical procedure when utilizing cross entropy as the loss function for image segmentation. Author utilized two publicly available database such as ISBI 2016 and the PH2 to calculate the effectiveness, efficiency, and generalization capability of the proposed framework. Experiments conducted by author concluded that the proposed method exceeds other state-of-the-art algorithms on these two databases.

In this research paper [3], author proposed a Convolutional Neural Network model for melanoma classification and also comparing its performance with existing models. Author says that their developed architecture is simple and requires a modest number of parameters. In this study we show that the proposed system can achieve comparable results in terms of accuracy and specificity by using standard convolutional neural network with few parameter. Lequan yu et. al. developed a model with and without segmentation module for classifying ISBI 2016 challenge dataset. To provide accurate segmentation convolutional neural network is used. Here tow classifiers is used for classification work i.e. softmax classifier and support vector machine classifier. The average results are found from this classifier. Rotation, shifts are data augmentation applied on the input image. The paper shows that the classification results of with or without segmentation are close. With segmentation 85.5% of classification accuracy is found and without segmentation is 82.8% is found.

In this research [4], author proposed a new method for recognition of melanoma using deep convolutional neural networks (CNNs) and it is compared with existing methods. Author says that their system,

substantially deeper networks can accomplish prosperous and more discriminative features for more accurate and exact recognition. To exploit profound systems, author proposed a lot of plans to guarantee viable preparing and learning under constrained training information. The technique applies following advances:

a) Apply the leftover figuring out how to adapt to the corruption and over fitting issues when a network goes further. It will guarantee the presentation gains accomplished by expanding network depth.
b) Construct a completely convolutional residual network (FCRN) for precise skin lesion segmentation, and further improve its capacity by consolidating a multi-scale contextual information integration scheme.
c) Finally, coordinate the proposed FCRN (for segmentation) and deep residual networks (for classification) to shape a two-stage framework.

This system empowers the classification network to extricate progressively representative and explicit features dependent on segmented outcomes rather than the entire dermoscopy pictures, further lessening the deficiency of training data. For assessment, reason author utilized ISBI 2016 Skin Lesion Analysis towards Melanoma Detection Challenge dataset.

Here [5], the deep learning system is implemented on computer with GPU. The clinical images are used instead of dermoscopic images. The input clinical images contains noise effects and illumination , these effects are preprocessed to enhance the images using preprocessing. These images are fed to CNN classifier(Convolutional Neural Network) for the classification purpose. Proposed System is consist following methodology:

1. Preprocessing : The clinical images taken by digital cameras contains noise and illumination. In this technique these effects are reduced to enhance the image.
2. CNN Proposed : The clinical images of training dataset after removal of noise are fed to the proposed CNN. The CNN method is used to detect the melanoma from clinical (non-dermoscopic images).

Result shows that the proposed method is superior in terms of diagnostic accuracy in comparison to other methods.

In this study [6], author proposed a deep Siamese CNN (SCNN) architecture; this is trained with only binary image pair information to learn image representations with less supervision involved. The main aim is that most of the studies limit their technique in a single supervised convolutional neural network (CNN). Author assess the learned image representations on a task of content-based medical image retrieval utilizing a publicly accessible multiclass diabetic retinopathy fundus image dataset. The results of the experiment shows that author's system i.e. deep SCNN is comparable to the existing single supervised CNN, and that needs much less supervision for training.

In this paper [7], the author used the support vector machine for classification. For accurate and fast evaluation of lesion the automatic image analysis tool provides the techniques like non- invasive medical computer vision or medical image processing. Proposed System involves following steps :

1. collect the image dataset. This images are captured by using dermoscope.
2. Preprocessing
3. segmentation is done by using thresholding
4. Statistical feature extraction is done by Gray level co-occurrence matric(GLCM) and ABCD(Asymmetry, border, colour, diameter) rule., etc.
5. select the feature by using principal component analysis(PCA).
6. calculate the total dermoscopy score.

7. and then classification is done by using Support vector machine. To classify the images the SVM is used.
8. 92.1 % accuracy is achieved by using this classification methodology.

In this paper [8], author presents study on feasibility of constructing a universal skin disease diagnosis system utilizing Deep Convolutional Neural Network (CNN). System firstly train the CNN architecture by using the 23,000 skin disease images taken from the Dermnet dataset and tested its performance based on the Dermnet and OLE, another skin disease dataset, images. Experimental results show that, proposed mechanism can accomplish as high as 73.1% Top-1 accuracy and 91.0% Top-5 accuracy when testing on the Dermnet dataset. The test on the OLE dataset, Top-1 and Top-5 accuracies are as 31.1% and 69.5%. Author also concludes that accuracies can be further enhanced if utilize more training images.

The spread of melanoma occurred via metastasis hence it is proven that to be very fatal. As per statistical proof or evidences the most of deaths occurred due to skin cancer are as a result of melanoma.

The DBSCAN clustering algorithm, is utilized for finding clusters in large spatial databases with noise. In this study [9], a modified version of prominent density based clustering algorithm, DBSCAN with the pre-processing step. This approach is a fast density based lesion detection (FDBLD) which eliminated redundant computations in DBSCAN by selectively picking querying points and core points. In this research, the focus is on FDBLD to further enhance the accuracy of the algorithm for detection of lesion border in dermoscopy images. FDBLD is highly depended on pre-processing step. The main aim of this study is two-fold: first, eliminating dependency of FDBLD in the pre-processing step; thus, utilizing color information, and second, enhancing accuracy of the results. To accomplish this, new distance measure is incorporated in to FDBLD.

In this research [10], presented a new hair-restoration algorithm is, which is capable of preserving the skin lesion features such as color and texture and able to segment both dark and light hairs. Proposed system is depending on three major steps:

a) Segmented the rough hairs utilizing a matched filtering with first derivative of Gaussian (MF-FDOG) with Thresholding that generate strong responses for both dark and light hairs.
b) Processing of hairs by morphological edge-based techniques, which repaired via a fast marching in painting method.
c) Used Diagnostic accuracy (DA) and texture-quality measure (TQM) metrics depends on dermatologist-drawn manual hair masks that were utilized as a ground truth to calculate the performance of the system.

Their experimental results show that the proposed algorithm is highly accurate, robust and is capable to restore hair pixels without damaging the lesion texture. This approach is fully automatic and can be easily integrated into a CAD system.

III.SYSTEM ARCHITECTURE

Following fig. 1 shows the proposed framework design. The system includes various modules such as input dataset, pre-processing, image segmentation, feature extraction, training and testing using cnn algorithm. In our work we used CNN algorithm for classification of melanoma and non-melanoma images.

Following are the steps involves in execution of our proposed system.

1. Input image dataset to the system.
2. Pre-processing is performed to enhance image quality and removal of hairs from image.

3. Several features are extracted from input image dataset from which training file is generated.
4. Generated training file dataset and new test input images are pass to CNN classification algorithm.
5. The output of CNN algorithm is melanoma detection i.e the input test show melanoma or not.
6. At the end graphical evaluation is perform to check the performance of proposed system.

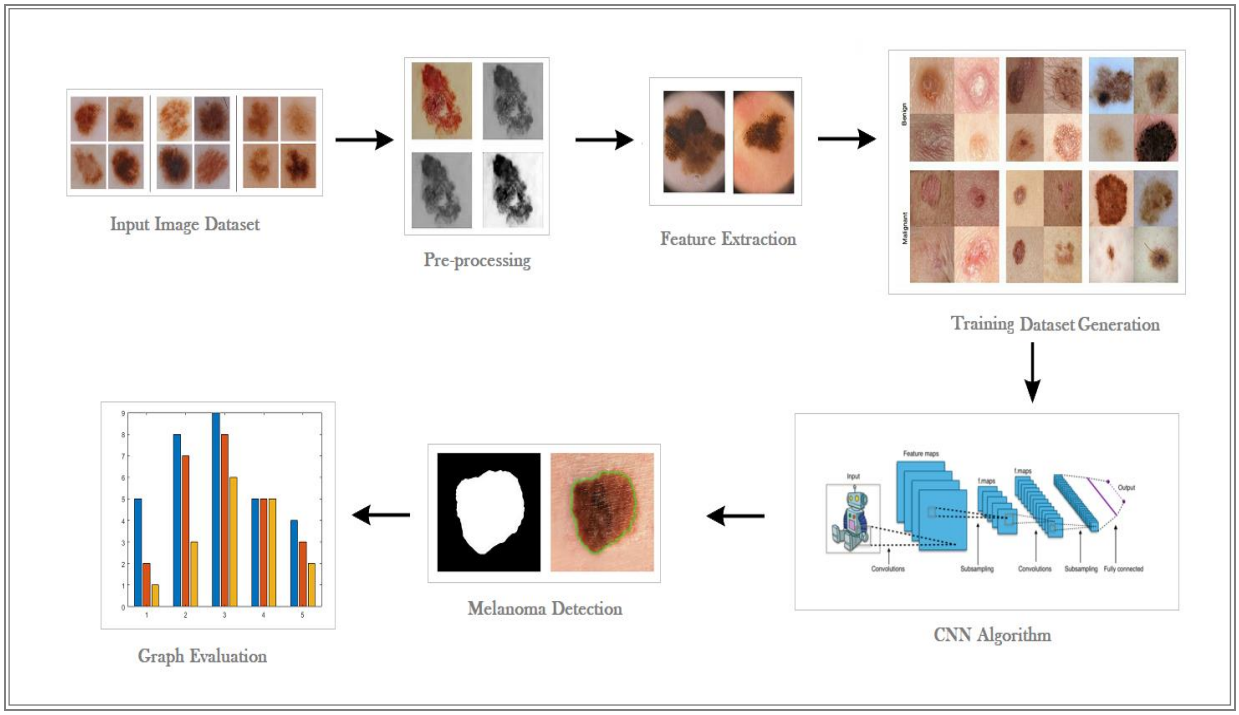

Figure 1: System Architecture

IV.RESULT AND DISCUSSION

A. Dataset / Database used

Used the ISIC[11] dataset for training, validating, and testing, which consist of a total of 10015 dermoscopic images of seven skin lesion classes with huge class imbalances.

B. Experimental Setup

All the experimental are implemented in Python in congestion with Anaconda (Jupiter) tools, algorithms and strategies, and the competing classification approach with feature extraction technique, and run in environment with System consist configuration of Intel Core i5-6200U, 2.30 GHz Windows 10 (64 bit) machine with 8GB of RAM.

B. Result

Fig. 2 shows the performance analysis Graph. We summarize the performance result of the three machine learning methods in term of spam sensitivity and specificity. Table 1 shows the reading from which fig.2 graph is plot. Fig 3 shows the accuracy graph we can find that the SVM method is the most accurate while the k nearest neighbour give us lower percentage, while in term of spam precision we can find that the proposed CNN algorithm has better accuracy compare to that of SVM and CNN with softmax algorithm. In Following graphs x-axis show different classification algorithms while y-axis show percentage.

Table 1. Performance parameters reading

Algorithms	AC	SE	SP
CNN (Softmax)	0.850	0.500	0.934
SVM	0.844	0.520	0.824
CNN (Proposed)	0.939	0.507	0.854

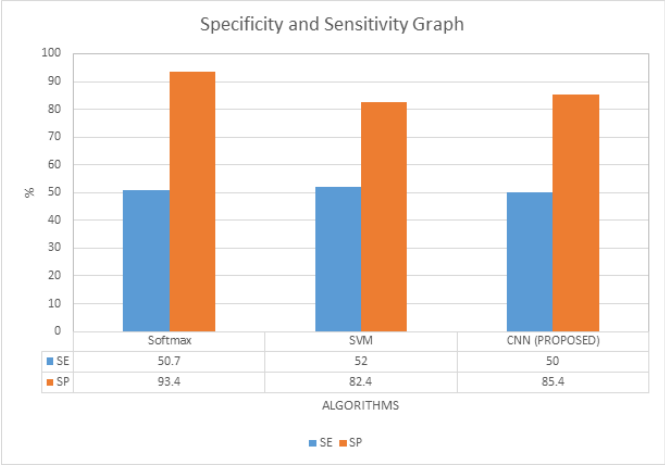

Figure 2: Specificity and Sensitivity Graph

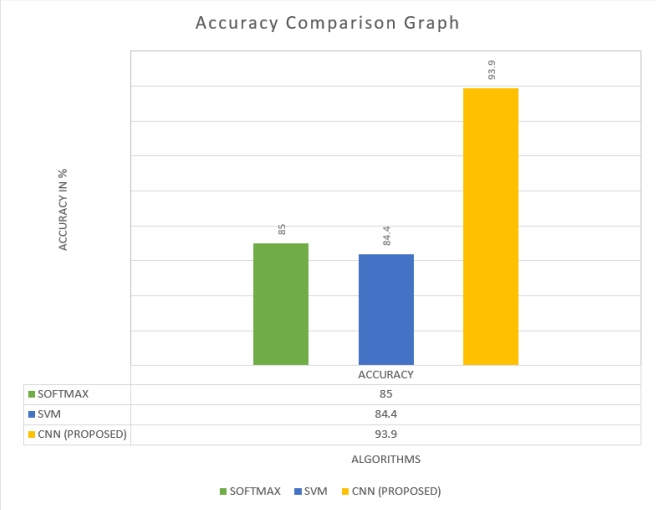

Figure 3: Accuracy Comparison Graph

V. CONCLUSION

Skin cancer is treated as one of the deadliest types of cancer over the world. Here, we build a computer aided skin lesion classifier system utilizing different deep neural network architectures with transfer learning techniques & segmentation. Also utilized CNN classifier for melanoma and non-melanoma images detection and utilized different pre-processing and augmentation rules applied to lessen the effect of class imbalance characteristic of ISIC.

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