Bangladesh University of Business and Technology

Department of CSE

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Survey Paper Name:

A shallow deep learning approach to classify skin cancer using down-scaling method to minimize time and space complexity.

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Summary of the Paper:

The survey paper presents a deep learning model with a shallow architecture to classify the lesions into benign and malignant. Here they use skin cancer dataset from kaggle and as a methodology they used ‘box blur’ down-scaling method and shallow convolutional neural network (SCNN_12) model. By using those model, they were able to achieve 98.87% accuracy with optimizer Adam and a learning rate of 0.001.

Unique Contribution of the Paper:

Here SCNN_12 classification model several metrics are used namely accuracy, precision, recall, fi-score, and specificity. In this project, all the ablation study cases with results are discussed along with statistical analysis. A comparison of the time and space complexity is presented to evaluate the efficiency of our introduced down-scaling method. Space complexity is found out by comparing the storage taken by images before and after applying dawn-scaling method.

How the proposed model works in the paper:

They constitute three main subsections such as image preprocessing, segmentation and down-scaling**.** Image preprocessing involves suppressing undesired features of an image as well as enhancing meaningful features such as color, shape and texture which are necessary for a particular application. For hair removal, two algorithms are picked and since morphological closing yields the highest PSNR score, closing is employed for the process. The result is that hairs, both inside and surrounding the foreground object, are successfully removed from the input image. The process flow of morphological closing. But the main goal of image preprocessing is image restoration or enhancement in order to enhance the relevant details by applying a suitable algorithm, based on the nature of the dataset. In the segmentation step, the Otsu's thresholding, morphological dilation, substraction, morphological erosion, largest contour detection and hole-filling methods are carried out to extract the cancerous lesion from the surrounding healthy skin . Automatic threshold proposed by Otsu is one of the most powerful methods . The output image is denoted as 'mask-1' with a red border surrounding it, in order to show the white regions surrounding the four corners of the image more clearly. Morphological dilation, which requires two inputs to perform the process. The first input is the original input image, and the second input is the structuring element by which the image will be dilated. The purpose of dilating the white region of mask-1 and producing mask-2 is to acquire the edge of the cancerous lesion. Using the functions of OpenCV, namely findContours () and drawContours (), it is possible to locate and acquire the size of contours in an image. After extracting the largest contour from the image, it can be noticed that the interior of the blob has intensity values similar to the background pixels. Therefore, the hole has to be filled to obtain the final mask for segmentation. The term down-scaling used two filters namely bilateral filter and box blur simultaneously for the purpose. The process of applying the bilateral filter is made images smooth without blurring of edges and where the output of gamma correction is used as input of the bilateral filter. Down-scaling is carried out using different interpolation algorithms such as bi-linear, bi-cubical and nearest neighbor. Box blur filter is the fastest filter algorithm, using an N x N kernel full of ones. The amount of blurring of the pixels of an image and the computational complexity are determined by the value of N. A weighted average is computed by multiplying the individual pixel with the corresponding kernel matrix. After multiplication, the average of the pixels is calculated.

Advantages of the paper:

The advantages of large-scale supervised pretraining with three medical images: chest radiography, mammography, and dermatological images. Five tasks including in-domain performance, generalization under distribution shift, data efficiency, subgroup fairness, and uncertainty estimation were conducted to test if large-scale pretraining aided in the modeling of medical images. Finally, experiment results indicated that, despite significant differences from the pretraining data, employing larger pretraining datasets can achieve significant improvements across a wide range of medical disciplines. Besides, they discovered that pretraining at scale may allow downstream tasks to more effectively reuse deeper features.

Disadvantages of the paper:

They have worked with a few images. Though data augmentation technique enlarges the dataset, the performance of our proposed model could be more evaluated, experimenting with a larger dataset. Moreover, in some cases, real data differs from publicly available datasets. It could be investigated, how the model performs with real world data, if we could work with a real world dataset.

Conclusion:

In order to address the issues of skin cancer detection and classification in dermoscopy pictures, they offer an automated method based on shallow CNN architecture in this study. The method is based on preprocessing the dermoscopy pictures with morphological closure and gamma correction, smoothing with bilateral filter, scaling down using box blur algorithm, and enhancing the dataset using four enhancing strategies. Additionally, segmentation has been added, in which the ROI is taken from the preprocessed pictures using morphological operations and thresholding. In comparison to much deeper networks, the shallow CNN does quite well in terms of classification and takes relatively little time to compute. In order to make it more resilient, an ablation research is used to construct a shallow CNN network. The system used the Adam optimizer to obtain an accuracy of 98.74%.