Machine Learning Nanodegree
Capstone Proposal

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1 Domain Background

Skin cancer is the most deadly type of cancer which directly affects the skin of the patient. This deadly type of cancer is on the rise because of the ozone layer depletion. There is 50 percent rise in the cases of skin cancer cases all over the world. With the rise in the cases of skin cancer it is necessary to find the computer-aided solution instead of the manual method of analysing the patterns in the skin moles by the experts, which is very tedious and time-consuming process. If machine learning and image processing are used in the solution, we can make this process quick and easy. To automate the process of skin cancer detection, this project aims to develop a deep convolutional neural network . As the transfer learning will not require heavy computational power to achieve the better performance. The deeper CNN models will give much more better performance compared to shallower models.

The first step in the diagnosis of a malignant lesion by a dermatologist is visual examination of the suspicious skin area. A correct diagnosis is important because of the similarities of some lesion types; moreover, the diagnostic accuracy correlates strongly with the professional experience of the physician. Without additional technical support, dermatologists have a 65-80percent accuracy rate in melanoma diagnosis. In suspicious cases, the visual inspection is supplemented with dermatoscopic images taken with a special high-resolution and magnifying camera. The combination of visual inspection and dermatoscopic images ultimately results in an absolute melanoma detection accuracy of 75-84 percent by dermatologists. CNN methods used to classify skin lesions are presented. A basic requirement for the successful training of deep CNN models is that sufficient training data labeled with the classes are available.

2 Problem Statement

The main objective of this project is to classify the skin cancer type by classifying its image. This is a multiclass classification problems. Input is a image of affected skin area and the output will be the type of skin cancer in the image. One effective way of image classification is Convolutional Neural Network, which can be made more effective by using the transfer learning.

3 Datasets and Inputs

The Dataset is used for this project is taken from the Kaggle Skin Cancer Challenge ie. Skin Cancer mnist Ham-10000. There are 7 types of different sin cancer images in this dataset. Thee dataset is bit imbalanced towards Melanocytic Nevi images, hence the data should be balanced out using data augmentation.

The Metadata file contains different details of the images of skin moles like age and sex of patient, the locality of the mole and image name and other important details.

4 Solution Statement

The above problem can be classified into 3 major sub parts like Image Preprocessing, Model Training, Fine Tuning of the model.

4.1 Image Preprocessing

Image Preprocessing must be done on the images in the dataset before the actual training. Various preprocessing like Image Resizing, conversion to tensor and normalization.

Various other strategies like mole segmentation, skin color normalization, brightness normalization can also be experimented after successful implementation of above techniques.

The dataset is imbalanced to a specific class that problem can be solved by using data augmentation, this will also avoid overfitting of the data.

4.2 Classification Model

The above stated problem can be solved using deep learning approach. The solution to the problem of actual image classification can be implemented using transfer learning approach where pre-trained models like VGG16, ResNet152 or Inception can be used for feature extraction and a fully connected layers will be connected to it for the actual classification.

After successful implementation of above approach, the fine tuning of the model will be attempted. Through this attempt, better performance will be tried to achieve.

5 Benchmark Model

The performance of above model will be compared with the 2016 paper "Melanoma Detection by Analysis of Clinical Images Using Convolutional Neural Network" by Nasr Esfahani. In the above paper the author have used a 2 layer deep CNN model to achieve the task. The above approach achieved the sensitivity and specificity of 0.81 and 0.80 respectively, the model also got accuracy of 0.81 percent.

6 Evaluation Metrics

The evaluation Metrics used are mentioned in the benchmark model section. Accuracy, Precision, Recall, F1-score are major evaluation metrics. The most important matrices will be F1-score, as it is most important evaluation metrics in classification metrics.

Other evaluation metrics like loss, Area under the ROC curve(AUC) will also be considered for future work to evaluate the model and make it better in terms of performance.

7 Project Design

The Project Design Process can be divided into several parts like data visualization and preprocessing, Model Creation, Fine tuning and hyperparameter tuning.

7.1 Data Preparation

In this section, the data is prepared for the next process and at the the same time. The data is visualized for better understanding of the data. This process will help us to find better data preprocessing and transformations strategies.

7.2 Model Creation and Training

In this process, the understanding of the data gained by above process will be used to create a better model for the classification purpose of skin lesion.

7.3 Experimentation and Evaluation

In this process, the model created will be experimented to get more better performance through evaluation metrics. Various experimentation like fine tuning, hyperparameter tuning will be done, as well as various different pretrained models will be used and their performance will be documented.

7.4 Future Work

After successful implementation of above stages, the future work will be implemented. In this section various new concepts like Bayesian Learning and active learning will be tried to be implemented. The model will also be deployed using various AWS tools like SageMaker, AWS Lambda and API GateWay.