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Skin Cancer Detection and Classification using Convolutional Neural Network

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Abstract:

With the increasing number of cancer cases around the world, it is becoming increasingly important to monitor and identify them at an early stage. Unhealthy lifestyle choices, a lack of awareness, carelessness, and a fear of being checked up are all key contributors to the rising number of instances. Thus, development of a technical solution for it becomes extremely important, as it will be widely available and much more user friendly.

We present a Convolutional Neural Network (CNN) model that can distinguish between 9 forms of skin cancer if present or state Cancer not detected if not present. Combination of many convolutional layer and max pooling layers along with dense and dropout layers make up the model. We attempted to shape the model into a web app such that a user might implement the model by just providing a photo of the contaminated area captured from a dermatoscopic device.

KEYWORDS: CNN, Convolutional, max Pooling, dropout

1. Introduction:

Skin cancer, or aberrant cell proliferation, is most typically detected on sun-exposed skin. The three most frequent types of skin cancer are melanoma, basal cell carcinoma and squamous cell carcinoma.

The epidermis, or upper surface of the skin, is where skin cancer develops. The epidermis is made up of three types of cells:

1. Squamous Cells: These cells are the inner lining of the skin.

2. Basal Cells: These cells are in charge of the generation of new skin cells.

3. Melanocytes: Melanocytes are the cells that produce the pigment that gives skin its color which is melanin.

Your skin cancer's nature and treatment options are determined by where it starts. [1]. Neural Networks are utilized to detect skin cancer from images taken via dermatoscopic device. Convolutional Neural Network (CNN) is a part of the deep learning system that is used for image and signal processing. CNN is considered as it can process a lot of complex data and provide results with high accuracy. CNN consists of various layers

and it performs the tasks accordingly. The input is first passed through the Convolutional layer, which performs the convolution operation by taking into consideration all the filters of a specific kernel size. The extracted information is then passed onto the pooling layer which reduces/compresses the spatial size to ensure less computational power is required for processing of the data. Pooling activities are classified into two types: maximum pooling and average pooling. Before moving to the next layer, it is important to note that there can be n number of combinations of Convolutional layer and pooling layer. The information from pooling layer is sent to Straightening layer to convert it into one dimensional vector, so that it can further be used with neural network for training the model or making the predictions (i.e. classifying cancer into various categories in this case).

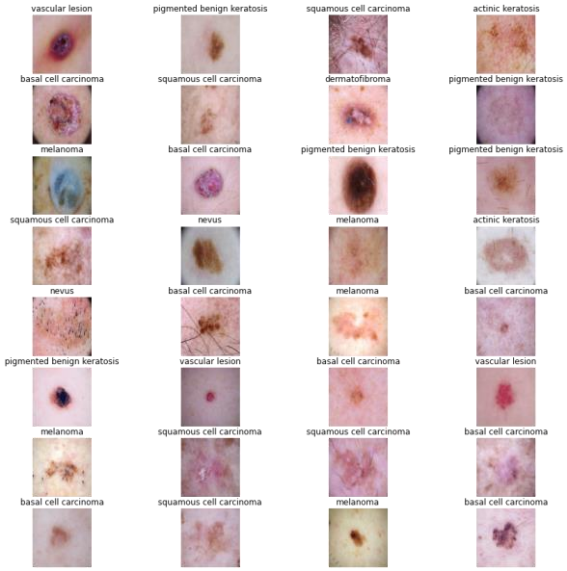

Figure: Various type of skin cancer present in the dataset

2. Methodology:

The dataset consists of 9 types/labels of skin cancer namely, basal cell carcinoma, vascular lesion, pigmented benign keratosis, basal cell carcinoma, dermatofibroma, melanoma, nevus, pigmented benign keratosis, squamous cell carcinoma, seborrheic keratosis, squamous cell carcinoma and actinic keratosis. The dermoscopic pictures for each of the category were present under the specified labels in the dataset. The dataset was divided into three parts before training the model: training, validation, and test. In our proposed model, there were a set of layers that data has to move across before getting the result. This is similar to humans where data has to pass through various layers in the Visual Cortex before the image formation. The primary layer is the input layer, which is where the data sets are trained on. The next is Convolutional layer takes place where the information is extracted using filters. Then comes the pooling layer where Max Pooling

or Average Pooling operation happens. After Pooling, the data is converted into one dimensional vector using the flatten layer. Then finally it is passed through Dense or hidden layers to extract a pattern and then that pattern are used as basis for the output layer to classify the cancer into one of the categories using Softmax activation function. With the Convolutional layer, the reLu activation function is utilized. Activation is used to decide whether a neuron must be used or not [2].

2.1 Steps:

The below mentioned steps are followed to achieve the results from the model:

1. Preprocessing the input images and dividing them into batches.
2. Dividing the batches into training, validation and testing dataset.
3. Developing a CNN model.
4. Compiling the model.
5. Fitting the training data along with the validation data to get the training accuracy as well as validation accuracy.
6. Testing the model on test dataset and getting the predictions.

If the results for any of the accuracy are not satisfactory, or the model is underfitting or overfitting, then we repeat the process from step 3.

3. Results:

We were able to get test accuracy of around 86 percent and validation accuracy of around 80 percent while training the model, and we were able to reach test accuracy of approximately 77 percent when testing the model. The model is going through a bit of overfitting but this can be solved by hyper-parameter tuning when we have access to high powered technical equipments.

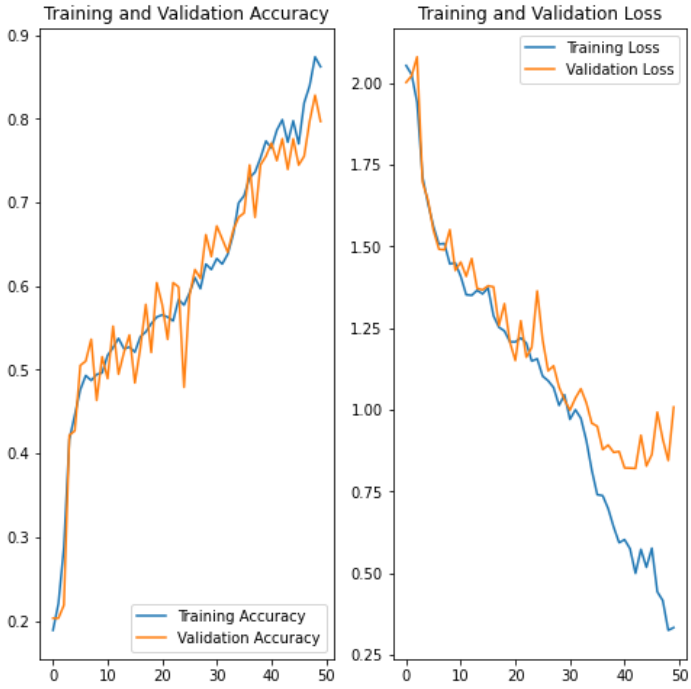

Figure: Results achieved from model via training process

4. Conclusion:

This paper has proposed a CNN model to detect and classify cancer into various types if present. Further progress in the model can be achieved when the access to more and accurate data as well as highly powered technical equipments is provided. The future holds strong for the proposed approach. CNN models can become a benchmark for the healthcare industry as it can really cut down the traditional process and detect cancer based on some random images.

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