PROJECT REPORT
CS 677
Data Science with Python

CATARACT PREDICTION

Name : Vaidehi Shah
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DATASET

The “Ocular Disease Recognition” dataset has been taken up from Kaggle.
Link to dataset: ocular disease recognition
It has images of around 5000 patients with age, color fundus photographs from left and right eyes and the doctor’s diagnostic keywords. They classify patient into 8 labels including:

1. Normal (N),
2. Diabetes (D),
3. Glaucoma (G),
4. Cataract (C),
5. Age related Macular Degeneration (A),
6. Hypertension (H),
7. Pathological Myopia (M),
8. Other diseases/abnormalities (O)

I have used the dataset to make predictions for Cataract using CNN (Convolutional Neural Network).

ABOUT THE ALGORITHM

Convolutional Neural Network:

Training the machines to develop the ability of object identification is done by Convolutional Neural Network.

Artificial network is a standard network that contains various interconnected layers. Each layer receives an input, transforms this input and passes it out to the next layer. It has a section of layers within which lie “filters” which perform the pattern recognition.

The filter is a 3x3 block. This 3x3 block can be used to specify the pattern we want to search for in the image and we analyze such a 3x3 block from the original image and check how similar they are. The algorithm is designed to traverse all such 3x3 blocks of the image and keep track of the pattern. This gives us an array of how similar these 3x3 blocks are to our filter. Likewise, we can add multiple filters to the model.

These numeric arrays from all the layers are taken together and combined in a process called pooling. This helps us get a better understanding of what is contained in these pixel series.

The application of the filters increases as we go deeper into the layers. After pixel recognition, the filter in the next layer might be able to recognise patterns and then objects as a whole, as we traverse through various such layers and keep pooling the output arrays that we get from these filters to gain better information. And eventually we will be able to classify the images to various categories.

VGG19:

VGG19 is a CNN that has been trained on more than a million images from the imagenet database. This network consists of 19 layers (16 convolution layers, 3 fully connected layers, 5 MaxPool layers and 1 SoftMax layer) and can classify images into 1000 object categories. A fixed size of 224x224 rgb image is given as an input to this network, which is why I resized images in my dataset to the same dimensions. MaxPooling is performed over a 2x2 window. This is followed by a “relu” activation function to introduce non-linearity.

Code Environment:

I have processed and implemented the code in Kaggle as I required a GPU for running the code.

In Kaggle settings, I set up the accelerator to GPU P100 and the Environment settings to “Always use the latest environment” with “Internet on” for fetching the pre-trained tensorflow CNN model checkpoint.