CANCER DETECTION USING CONVOLUTIONAL NEURAL NETWORK

Major Project Synopsis Report

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ABSTRACT

Cancer is one of the most harmful diseases in the developing countries and the detection of the cancer at the early stage is a challenge. Analysis and cure of malignancy have been one of the greatest difficulties faced by humans over the most recent couple of decades. Early identification of tumor would facilitate in sparing a huge number of lives over the globe consistently. Convolutional Neural Network (CNN) can be used to classify the tumors as malignant or benign.

Key Words: Cancer, Computed Tomography, Chest CT image, Neural Network, Deep Learning, Convolutional Neural Network

INTRODUCTION

Cancer is one of the most dreadful diseases in the developing countries and its mortality rate is 19.4%. Early detection of tumor is done by using many imaging techniques such as Computed Tomography (CT), Sputum Cytology, Chest X-ray and Magnetic Resonance Imaging (MRI). Detection means classifying tumor two classes (i) non-cancerous tumor (benign) and (ii) cancerous tumor (malignant). The chance of survival at the advanced stage is less when compared to the treatment and lifestyle to survive cancer therapy when diagnosed at the early stage of the cancer. Manual analysis and diagnosis system can be greatly improved with the implementation of image processing techniques. A number of researches on the image processing techniques to detect the early stage cancer detection are available in the literature. But the hit ratio of early stage detection of cancer is not greatly improved. With the advancement in the machine learning techniques, the early diagnosis of the cancer is attempted by lot of researchers. Neural network plays a key role in the recognition of the cancer cells among the normal tissues, which in turn provides an effective tool for building an assistive AI based cancer detection. The cancer treatment will be effective only when the tumor cells are accurately separated from the normal cells.

Principal Component Analysis (PCA)

For extracting the features from the image we have a lot of feature extraction techniques which can be used. Each of these techniques have a basis on which they work and they are suitable for particular datasets. In this case we have used Principal Component Analysis (PCA) which is one the best feature extraction technique. PCA is a procedure for reducing the dimensionality of the variable space by representing it with a few orthogonal variables that capture most if its variability. This technique reduces the dimensionality of the dataset and preserves the variance in the features at the same time.

Contrast Limited Adaptive Histogram Equalization (CLAHE)

The first equalization we saw performs a global contrast transformation which is not useful for the images which have both light and dark pixels. To solve this problem, we have contrast limited adaptive histogram equalization which performs equalization in particular regions.

In this, image is divided into small blocks called “Tiles”. Then each of these blocks are histogram equalized as usual. So in a small area, the histogram would confine to a small region (unless there is noise). If noise is there it will be amplified. To avoid this, Contrast limiting is applied. If any histogram bin is above the specified contrast limit, those pixels are clipped and distributed uniformly to other bins before applying histogram equalization. The below given images show the adaptive histogram equalization which performs equalization in particular regions.

Figure -1 Before Applying CLAHE

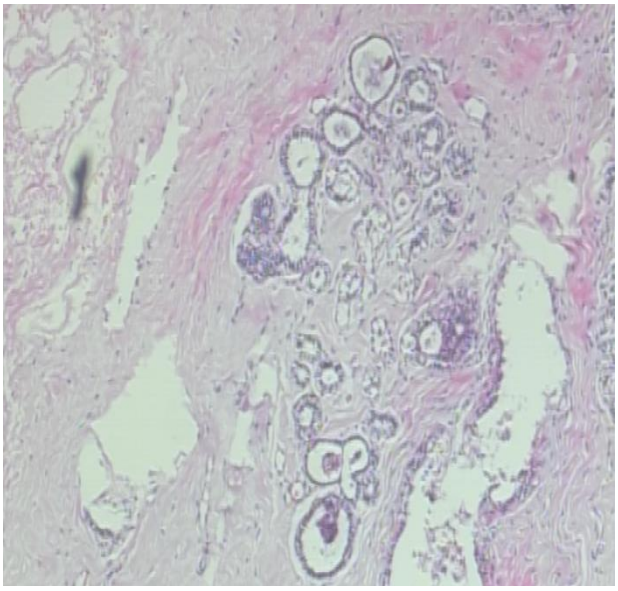
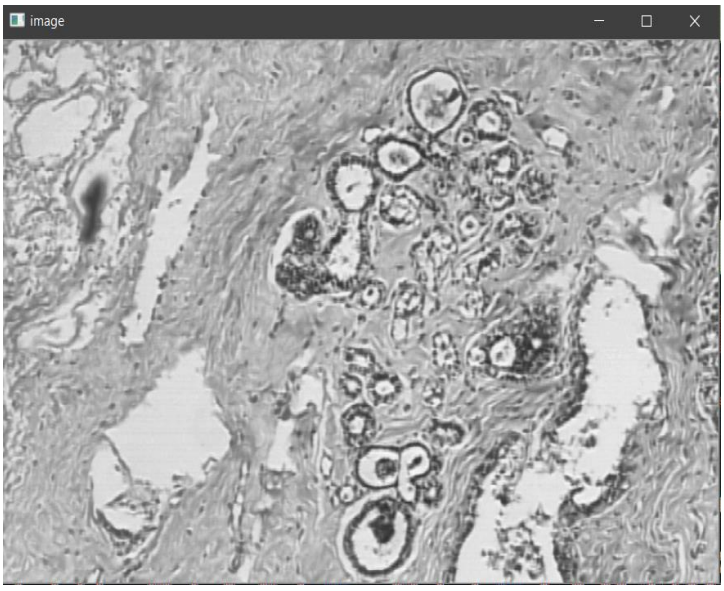


Figure-2 After Applying CLAHE



The Architecture

The architecture of the neural network is designed in such a way that the feature extraction process becomes more precise. We create a feature from the original picture and then this feature map is divided into small parts called as subsamples to create a subsample from already existing subsample. This process makes the process of the feature extraction better and at the end of this process we have a number of feature maps from which we can generate and accurate prediction. The below given image shows the architecture governing the neural network.

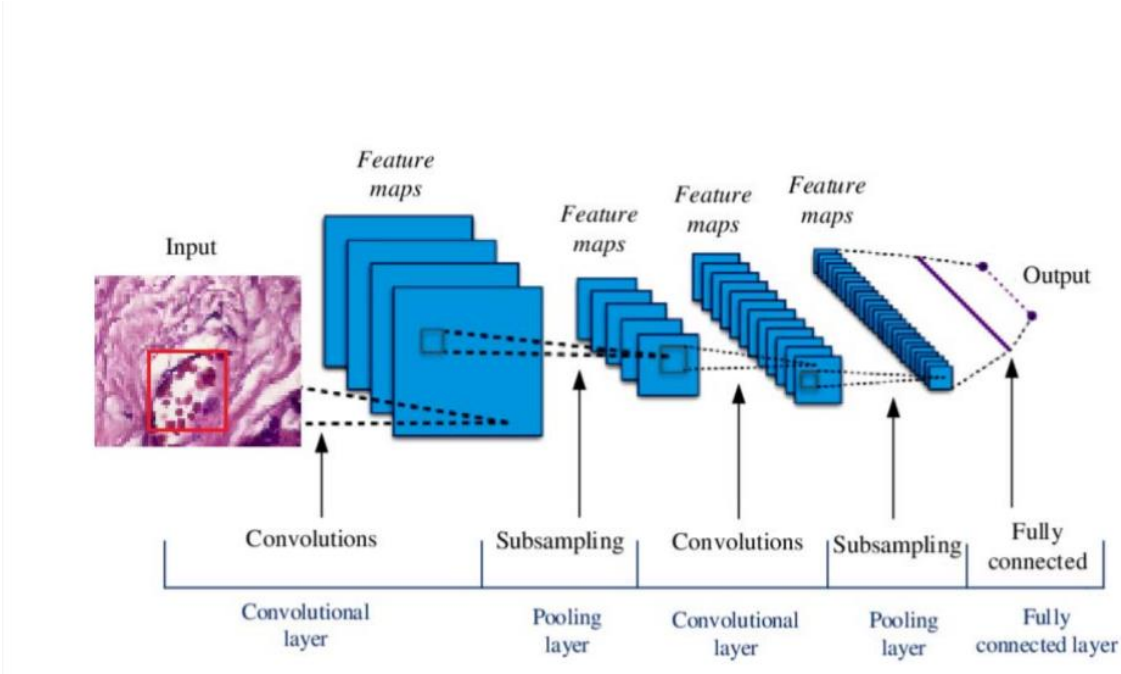
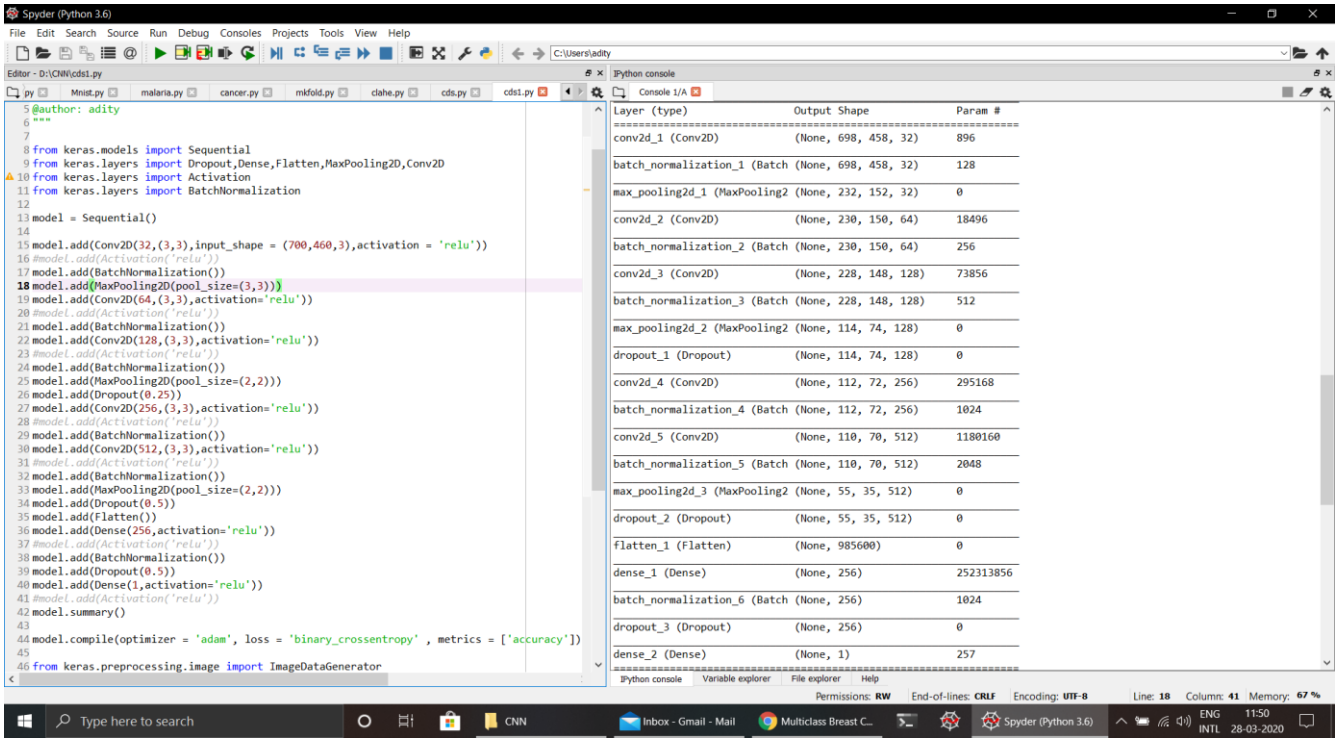


Figure-3 Stages of Architecture.

To generate an architecture shown in the above picture we have to create a number of hidden layers in the network. The below given image shows the information of all the layers present in the neural network



. Figure-4 Layers present in the Network

CONCLUSIONS

To get a maximum accuracy, we divide our data in 60% percent for training and 40% for testing. Once the network gets trained on the training set we achieve an accuracy of 95.33% and a loss of 4.86%. When the network is given a random image to classify between benign and malignant, the network is able to give accurate prediction.

Literature Survey

SL NO.	Paper & Author Details	Year	Findings
1.	Classification of Breast Microscopic Imaging using Hybrid CLAHE-CNN Deep Architecture Ankit Vidyarthi*, Jatin Shad,Shubham Sharma, Paridhi Agarwal Department of CSE&IT Jaypee Institute of Information Technology Noida, INDIA	2019	• Use of CLAHE for image pre-processing • Use of deep convolutional network for classification of the breast microscopic imaging.
2.	A Dataset for Breast Cancer Histopathological Image Classification Fabio A. Spanhol∗ , Luiz S. Oliveira, Caroline Petitjean, Laurent Heutte	2015	• Introduced a dataset which is publicly available • Automation of the images into two classes i.e. Benign and Malignant.
3.	Multiclass Breast Cancer Classification Using Convolutional Neural Network	2019	• Using of multi class image recognition on Breakhis dataset. •