Brain Tumor Detection Using Segmentation

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Introduction

Brain tumor is a malformed mass of tissue in which the cells multiply abruptly, and there is no control over the growth of these cells. It is one of the most aggressive diseases which can lead to short life expectancy if not treated in its early stages. Treatment planning of patients suffering from brain tumors plays a very vital role in improving the quality of their life. Computed Tomography (CT), Magnetic Resonance Image (MRI) and ultrasound images are some of the techniques used to evaluate tumors in the brain, lungs and various parts of the body. The process of Image segmentation is used for the isolation of abnormal tissues from normal brain tissues in MRI images. Classification of tumor vs non-tumor plays a very significant role as a huge amount of data is generated through MRI scans. Computer aided technology can help remove some workload of the doctors and also improve accuracy.

Objectives

Computer aided technology can help remove some workload of the doctors and also improve accuracy as segmentation, detection, and extraction of infected tumor area from MR images are a primary concern but the time taking task is performed by radiologists or clinical experts, and their accuracy depends on their experience only, we design a system to differentiate within tumor and non-tumor images from the MRI images.

In the segmentation of Medical image there is an essential role in computer-aided diagnosis systems. Medical images are hard to deal with and diagnosis has to be automated as there are limited expertise doctors and limitation of time and need for early diagnosis. For all these reasons the medical images have to be compatible with some computer aided algorithm to produce automated results.

Methodology & Study Area

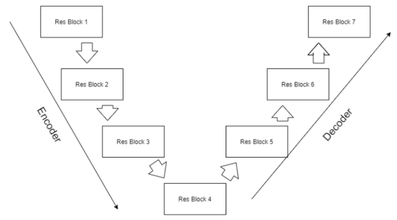
We have used image segmentation to focus on the Area of interest to get near precise results.
Along with CNN model to automate the process of diagnosis.
We tried different Nueral networks and found the best accuracy with Resunet CNN as it combines best with medical image process and overcomes the Vanishing graduent problem that exists in aome other nueral networks.

Our contribution in this area has been in Res block as they were midified to produce best observed results.

Area of study : Ml and Al
ML in medical diagnosis.

Results (Font Size ‘24’, Type ‘Arial’)

We are using Resunet model structure for this task, due to the ability of high performance using few parameters, Resunet is a fully convolutional network which was developed by Zhengxin Zhang et al. for the purpose of semantic segmentation. Resnets have encoder-decoder architecture .
We can roughly split our model in two parts :
•Predicting whether it contains tumor or not
•Predicting the mask of MRI Image



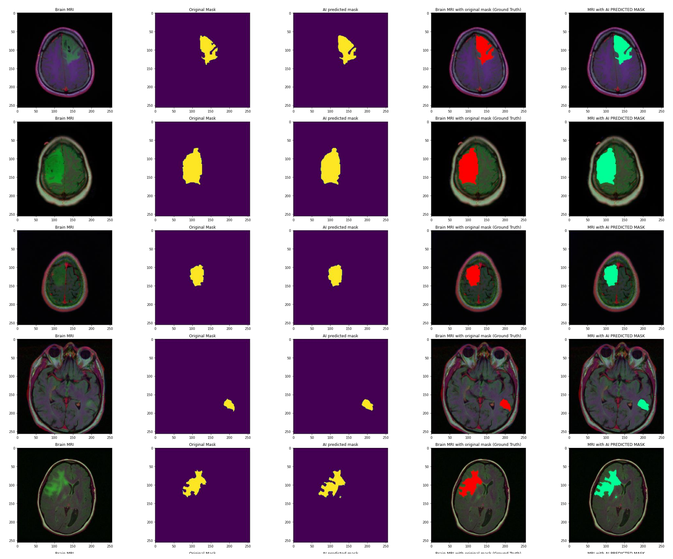
Our resnet architecture as shown above consists of three parts , Encoder , Decoder and the bottleneck part. We are trying to pool our data till the bottleneck part and then we will try to upsample it for better performance.

For the first part of our model, we are using the standard resnet50 model appended by a number of layers to predict whether our image contains a tumor or not.

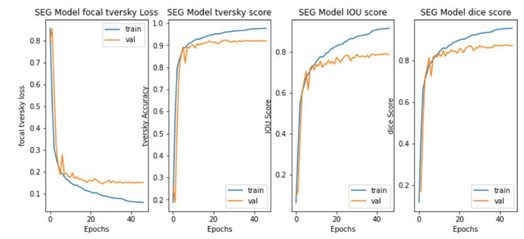
As a result of part 1, we will get a number 1 or 0, which will indicate the presence of a tumor in the image. If we get 1 as a response from our model, we will move forward to the creation of a mask in our image.

For part 2, we will create a custom resnet model with custom residual blocks. Each residual block will contain a number of layers.

As a response of the above block, our custom resnet model will provide us predicted mask using the provided MRI image as show below.



Conclusion

- The observed dice score coefficient on the test dataset is 85.26% , in the mentioned base research paper the observed dice score coefficient was 82%. After applying semantic segmentation, we have come to the conclusion that our model is giving a significant improvement in our performance metric (DSC score).
- For efficient tumor detection, identification, any of these techniques can be used but it is very difficult to be sure about any of these techniques. Although the accuracy of these techniques are high, still these techniques are not reliable. Future of these techniques are very scalable and with time these techniques may grow more reliable. For these techniques to be implemented in practical use, these techniques need to become more accurate.
- 

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Poster Presentation

May 5, 2021

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