ML Project Progress Report

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Github Link:https://github.com/ramanujan123/CS550_PROJECT

Project Title : Brain Tumor Segmentation using Deep Neural Networks

Project Description

This project is about Brain Tumor Segmentation using Deep Neural Networks. It will be done in two phases:

1. In phase 1, exploratory data analysis, data preprocessing, training and validation of U-Net based CNN model has been done.
2. In phase 2, multimodal U-Net architecture will be implemented and trained to improve the accuracy. Also, we will implement some other ML models for segmentation and a comparison between them will be made.

Data Collection and Preprocessing

We have collected data from the **BraTS2020**(Brain Tumor Segmentation 2020) dataset.

BraTS2020 Dataset:

- Used for the BraTS (Multimodal Brain Tumor Segmentation) challenge.
- Consists of MRI data from around 400 patients.

MRI Data Details:

- Each patient's MRI data comprises five images.
- Images are in .nii format, commonly used for medical imaging.

Image Aspects:

- Four of these images represent the brain structure while the fifth one is the segmentation image.
- The four images represent different aspects of the same brain.
- Fifth image is the segmentation image, which has been segmented by medical experts in that field.

Data Preprocessing:

A custom Data Generator function was used to facilitate the processing and delivery of data to the neural network.

Following are some of the preprocessing steps that have been done:

1. Retrieve the path of the images for each sample (T1CE image)
2. Retrieve the path of the segmentation image
3. Load the T1CE and segmented image into the memory
4. Create two arrays - X and y. These arrays will contain all the selected slices for the T1CE and segmented image respectively.
5. Resize each image of the slice from (240,240) to (128,128)

Model Description and Validation Accuracy

Model Used:
We used the baseline U-Net architecture to design a basic CNN model for brain tumor segmentation.

Validation Accuracy:
The model was performing quite well on test data(val. accuracy ~ 98.9%). But in some cases, it was giving False Positives, i.e, it was showing tumors in regions where there was none.

Challenges Faced and Future Plans

1. **False Positives:**
    - Acknowledge the challenge of false positives despite achieving high overall accuracy in the model.
2. **Medical Implications:**
    - Recognize the medical significance of false positives, considering the potential impact on patient well-being and the need for utmost accuracy in medical diagnoses.
3. **Future Plans:**
    - We have planned to implement Multimodal U-Net architecture to improve the model's accuracy.
    - We may also explore some other architectures, if time permits.