Brain Tumor Detection

EE435 Project Proposal

Author: Kuangzheng Zhang, Jingmin Zhao

Brain Tumor Detection (BTD) is a trending research topic in human brain image analysis, which relies on the proposed segmentation and classification frameworks. Deep Neural Networks (DNN) based architecture is widely leveraged in this application domain, which includes a variety of types from glioma, meningioma and pituitary tumors. Different stages of the disease categorized as sub-acute, chronic and acute also bring challenges to the detection algorithm design, as well as the damage locations have specific effects on different brain parts. The proper analysis of segmentation, locating and following quantitative assessment on these clinical image data is valuable in providing early detection, evaluation, treatment planning and subsequent monitoring of patients.

Therefore, we are planning to utilize the DNN to conduct accurate analysis on the multidimensional images, avoiding the need of manual annotation by human experts which is time-consuming, risky and tedious. A more efficient automated extraction and analyzing framework is the ultimate goal for practical medical images. With the existing neural network architecture and published datasets, the course project will try the optimal performance architecture and conduct the performance evaluation.

In this project, the brain tumor dataset we will use comes from Kaggle. It has already been split into training and testing directory. There are four subdirectories in each directory, ‘no_tumor’ stands for not having a tumor while the other three stands for different kinds of tumor: Glioma, Meningioma and Pituitary tumors. The resolution of each MRI image is 398x397 with 96 dpi and 8 bit depth. The deep learning networks that we are going to build include RCNN, Faster-RCNN[1], ResNet[2], AlexNet[3]. The evaluation metrics of the trained model involves Accuracy, PR-Curve, F1. We will find out the best configuration of the training process like number of epochs, layer sizes, learning rate and so on to select the model that achieves the best performance. Finally we will present the outcome of our trained model and draw the conclusion.

Reference

[1] Ren, Shaoqing, et al. "Faster r-cnn: Towards real-time object detection with region proposal networks." *Advances in neural information processing systems* 28 (2015).

[2] He, Kaiming, et al. "Deep residual learning for image recognition." *Proceedings of the IEEE conference on computer vision and pattern recognition*. 2016

[3] Krizhevsky, Alex, Ilya Sutskever, and Geoffrey E. Hinton. "Imagenet classification with deep convolutional neural networks." *Advances in neural information processing systems* 25 (2012).