Research Paper: Machine Learning Application for Brain Tumor Localization in the Repository of Molecular Brain Neoplasia Data (REMBRANDT)

Machine Learning for Health Care (Heinz 95-845) - Lukas Mohs

1. Abstract

Within this paper, I want to present the putcome of the combined application of *Computer Vision* (CV) and *Machine Learning* (ML) to the *Repository of Molecular Brain Neoplasia Data* (REMBRANDT) dataset. This dataset contains pre-surgical *magnetic resonance* (MR) multi-sequence images of 130 patients. Based on a visual analysis and the application of several ML algorithms, I tried to predict the location of the brain tumor and compare it to the evaluation of three Radiologist, which defined the affected brain part and the potential impact on the brain functionality.i

2. Introduction

2.1 Brain Cancer

Among all types of cancer, brain cancer is one of the deadliest even if it's not one of the most common ones. With a so-called *5-Year Relative Survival Rate* of 32 % for white people and 39 % for black people it ranks on place 7 out of 26 for the lowest survival rate. Specific cancer types like *Glioblastoma*, a very fast growing type of tumor, even has a a rate of 5%. Especially in the later years of life, this rate decreases heavily for all types of brain cancer. (Society) The high variance in the surivial rate is given by many factors such as the type of tumor, the location and of course whether it was treated. Especially the latter ones formed a major part of scientific studies that included ways of scanning the human brain for malignant tissue as well as the way of stopping the growth of the tumor cells.

2.2 Magnetic Resonance Imaging (MRI)

Magnetic Resonance Imaging (MRI) addressed the challange of *scanning* the human body by using *radiology* to see different layers of the inner tissue or organs. These different layers can be combined together to construct a 3-dimensional model of any part of the body. Mainly a strong *magnetic fields* is used in combination with *radio waves* and so-called *field gradients*. In comparison to *Computer Tomography* (CT), MRI doesn't rely on *X-radiation*, which qualifies it as a less harmful method. It should be mentioned that the magnetic waves of MRI can affect *cardiac pacemakers* so that exceptions apply. (Edelman and Warach, 1993)

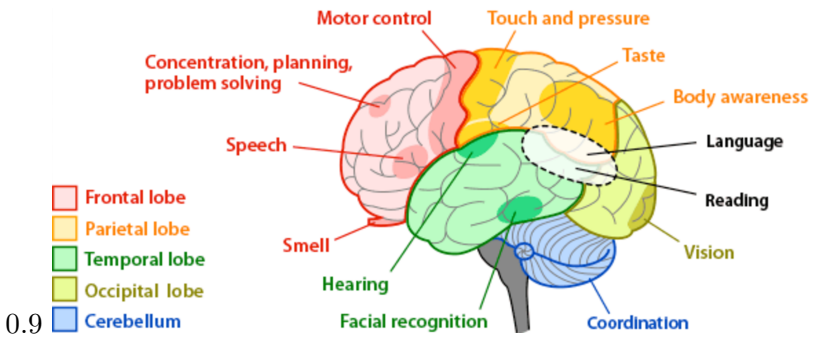

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Figure 1: Brain Areas (source: Arizona State University)

2.3 The Human Brain

Especially the development and refinement of the MRI technology favored advanced studies about the structure and functionality of the human brain. In order to understand the classification task of the presented algorithm, the major parts of the human brain are shortly described:

- *Frontal Lobe:*

(Duvernoy et al., 2012)

References

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