Brain Tumor Survival Prediction Project: Challenges in a Tunisian context

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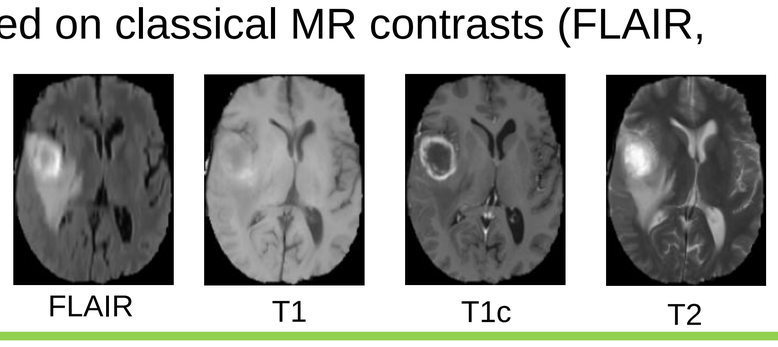
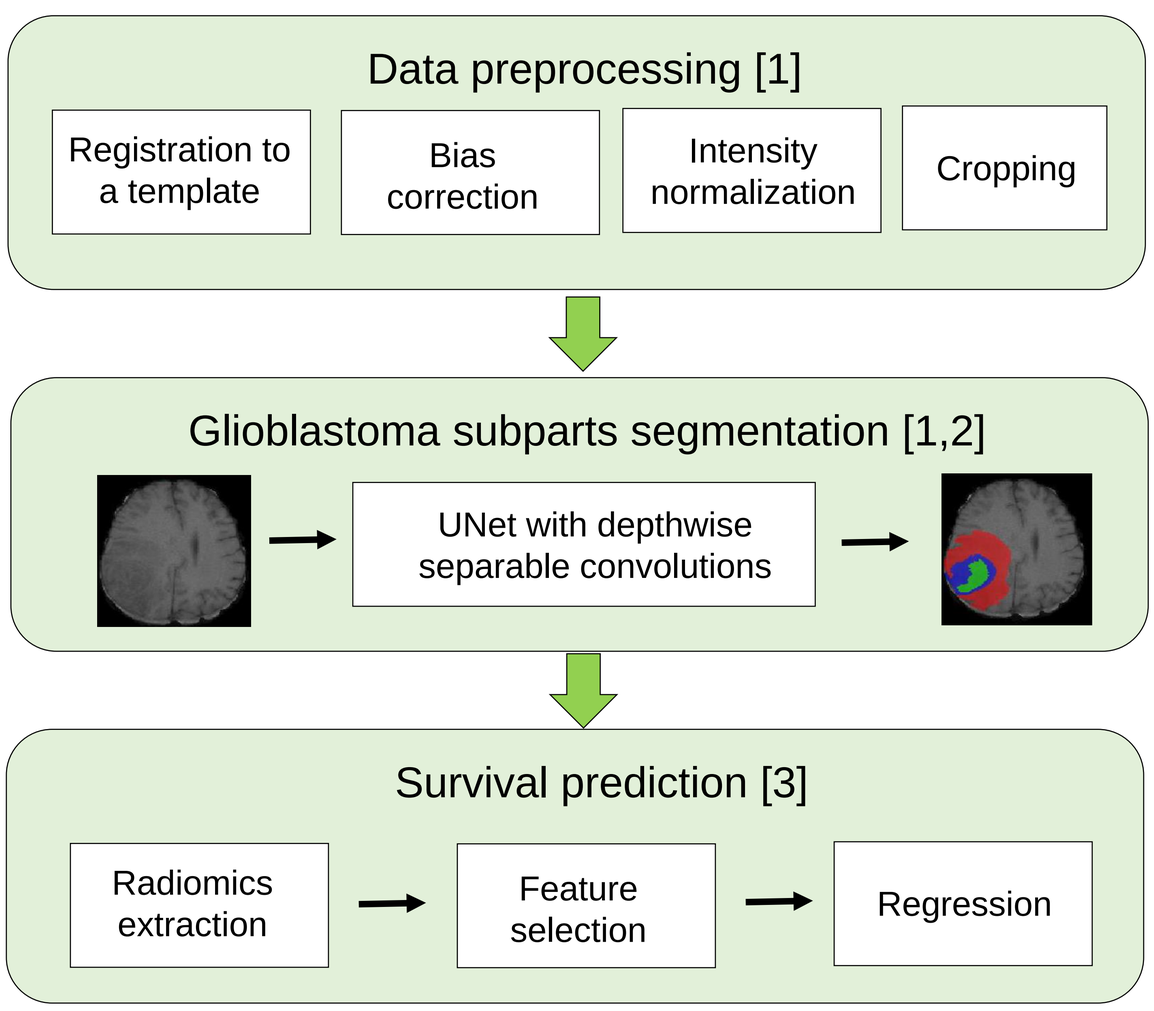
Introduction

Glioblastoma is an aggressive brain tumor which has a poor vital prognosis. An early prediction of the survival rate could help doctors to adapt treatments. Previous studies focused on the prediction of the overall survival of patients having a glioblastoma using Magnetic Resonance Imaging (MRI). While some studies focused on classical MR contrasts (FLAIR, T1, T1c, T2) using radiomic measures, other studies investigated Diffusion Weighted Imaging (DWI) and particularly Apparent Diffusion Coefficient (ADC) which showed a strong link with the severity of glioblastoma. In this project involving Tunisian doctors and engineers, we tried to investigate both classical anatomical contrasts and DWI.



Material and Methods

Project Overview



Main challenges

Data

1. No PACS in Tunisian hospitals
   → Few data (33 subj)
   → Use of international database + transfer learning
2. Data heterogeneity
   → Registration + interpolation
3. Missing data
   → Need for data completion methods

Computational ressources

No private GPU

→ Use of Kaggle:
13 GB RAM
20 GB Free disk
30h a week
9h execution time

→ - Use of light architectures
- Working with 2D
- Sampling data + data augmentation

Conclusion and Perspectives

This project adressed a classification problem (glioblastoma subparts segmentation) and a regression problem (survival prediction) using both classical machine learning techniques and deep learning methods. Many challenges related to data and computational ressources were adressed. Light deep learning architectures were used for the classification problem to overcome the limitations of computational ressources and provided good results. An international database (BRATS) was also combined to local data in order to compensate the lack of data. Nevertheless, missing data problems need to be adressed in the future using reconstruction methods.

References
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[3] W. El Ferchichi, 2021 Master Thesis. Glioblastoma Patients Prediction using Machine Learning and Deep Learning Techniques.

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