

TOWARDS LONGITUDINAL RADIOMICS FOR SURVIVAL PREDICTION OF GLIOBLASTOMA PATIENTS

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Abstract

Glioblastoma (GBM) are the most common primary brain tumors in humans. Due to their rapid growth and infiltrative nature, the prognosis for patients with high-grade glioma is poor, with an average survival time of only 14 months. There is no curative treatment available. Glioblastoma are treated with a combination of surgical resection, radiation- and chemotherapy [1]. The response of a patient to a treatment is currently assessed by the Response Assessment in Neuro-Oncology (RANO) criteria. RANO categorizes response as complete response, partial response, stable disease, or progression. Apart from qualitative criteria, RANO relies on 2D-based metrics with known limitations (e.g. [2]). An increase of $\geq 25\%$ of the sum of product of perpendicular diameters is used to define disease progression, while a decrease by $\geq 50\%$ defines a response. These thresholds are widely used but remarked to be rather arbitrary. Reported shortcomings of the current RANO recommendations along with promising results in radiogenomics, radiomics and automated tumor segmentation, call for improving the RANO criteria by a combined medical image computing approach. Performing radiomics regarding survival of GBM patients may lead to MR imaging biomarkers for disease progression assessment. The current state of the art (e.g. [3]) uses almost exclusively pre-operative MR imaging data, we propose a longitudinal radiomics approach.

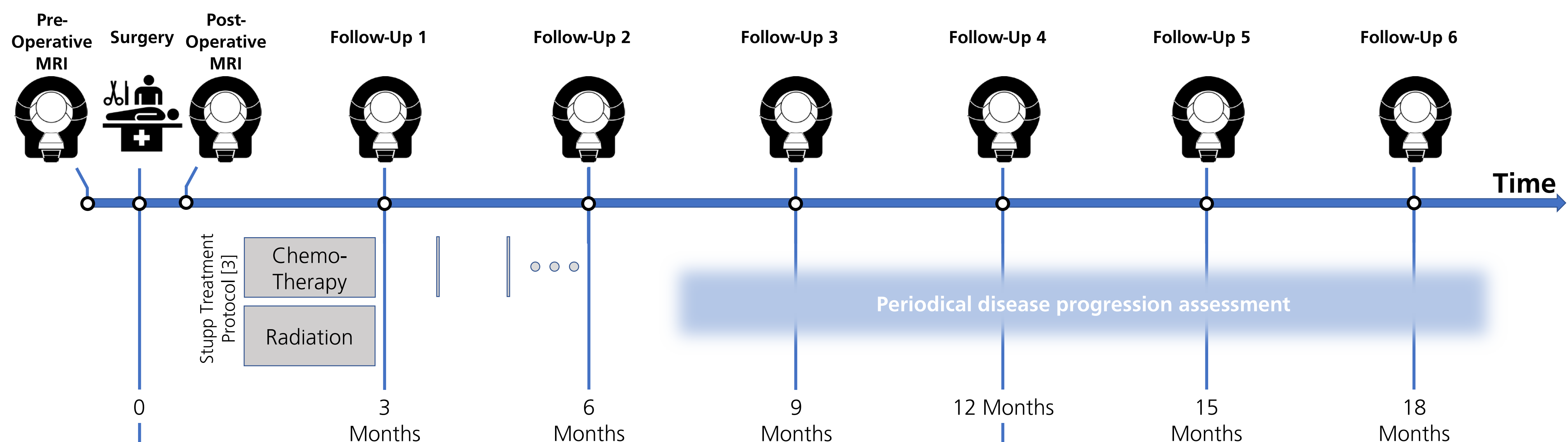
Proposed Approach

Using only pre-operative data results in confounding factors such as Extent-of-Resection and treatment response, which are known to have a high impact in the survival time of GBM patients. We therefore propose the use of longitudinal MR data for biomarker discovery and overall survival prediction.

We are using retrospective longitudinal MR imaging data of 94 GBM patients (age: 62 ± 10.3 years, median overall survival: 15.4 months) with an average of five timepoints per patient, resulting in a total of 600 timepoints.

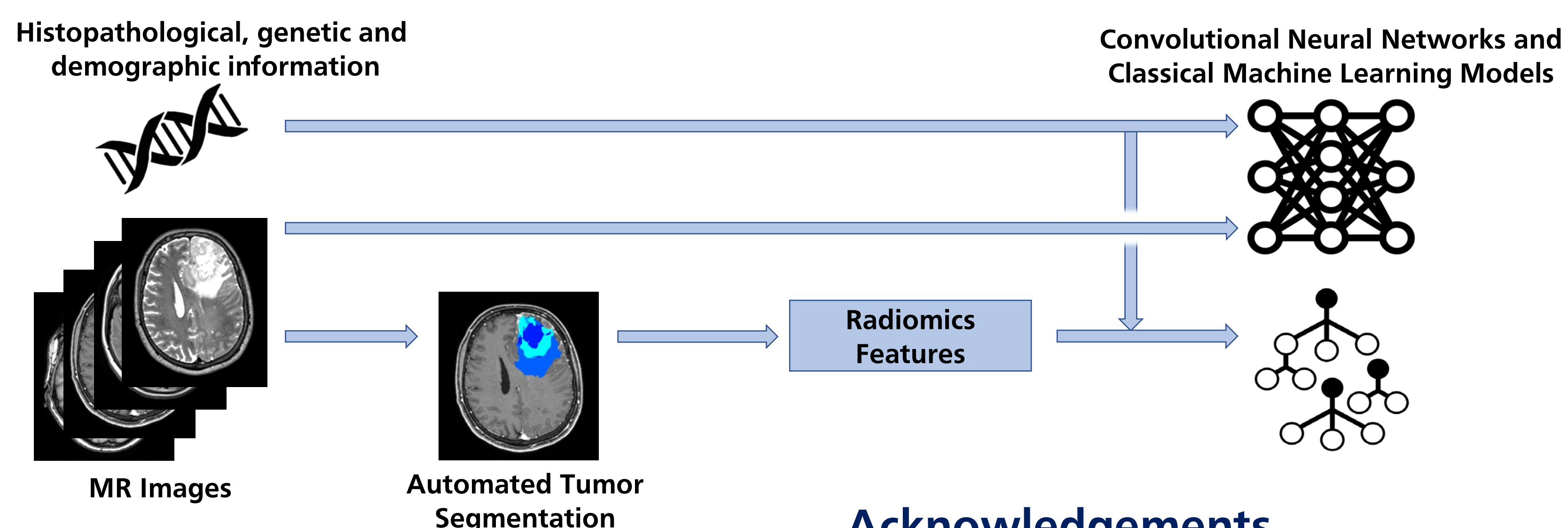
This new approach has to be evaluated by comparison to published results on publicly available datasets. These experiments need to be repeated on our clinical data. Since most publicly available dataset (e.g. BraTS [4]) contains only pre-operative MR data, benchmarking is performed with these datasets and on pre-surgical data from our local university hospital. Baseline models with classical hand-crafted features and Deep Learning predictions are compared.

Challenges are missing timepoints and sequences for some patients.



State of the Art

Proposed Longitudinal Approach



References

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