"Temporal Monitoring of Brain Tumor Progression Using Longitudinal MRI and Change Detection"

Abstract:
We present a method for tracking brain tumor progression using longitudinal MRI and change detection techniques. By aligning follow-up scans and computing voxel-wise differences, we estimate volumetric growth and spatial dynamics of tumor expansion. The system provides an interpretable progression map for clinicians.

Introduction:
Monitoring changes in tumor size and morphology is essential for assessing treatment response. Conventional techniques rely on manual inspection, which is error-prone. Automated change detection can provide objective and reproducible tracking.

Methods:
MRIs from 20 patients taken at three-month intervals were registered to a common space. Pre- and post-treatment scans were differenced after intensity normalization. A thresholded voxel-wise subtraction and connected-component analysis estimated changes in tumor volume and location.

Results:
The system detected significant changes (>20% volume shift) in 15/20 cases. Tumor shrinkage aligned with treatment milestones in 8 patients, while 3 showed early regrowth patterns before clinical symptoms appeared.

Discussion:
This method supports early detection of treatment failure or recurrence. While simple, its transparency and low computational load make it suitable for integration into standard radiology workflows.