Artificial Intelligence Solution for Effective Treatment Planning for Brain Tumor Patients

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Glioblastoma is the most aggressive brain tumor that claims around 200,000 people each year. Glioblastoma patients have a median survival of less than 4 months when left untreated. To extend patient's survival time, it is critical to develop effective treatment plans, which require accurate determination of the methylation status of a DNA suicide repair enzyme, MGMT, to assess patient's response to chemotherapy. Additionally, accurate segmentation of tumor subregions is needed to monitor disease progression and aid other clinical applications. However, current methods to determine the methylation status of MGMT promoter involve time consuming surgical procedures. Current methods for tumor segmentation are manual and differ in consistency. With less than 4 months of survival time, there is a pressing need for non-invasive and automated means to predict MGMT methylation status and segment tumor subregions. My research created a non-invasive AI solution to predict MGMT methylation status with more accuracy than current methods, and automatically segment tumor subregions in a consistent manner, using brain MRI scans. My solution includes a radiogenomic model and a segmentation model which were built with customized convolutional neural networks as the backbone. I developed novel deep learning techniques including intelligent slice selection, innovative loss functions for multi-class prediction and logistics regression with independent predictions by image type, to improve performance. My solution has been field tested with data from local institutions, which differ significantly in quality and format and achieved world class performance, which is 23 points higher than the current research in predicting MGMT methylation status.

Awards Won:

Fourth Award of $500

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