A Two-Phase Optimal Mass Transportation Technique for 3D Brain Tumor Detection and Segmentation

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Abstract

The goal of optimal mass transportation (OMT) is to transform any irregular 3D object (i.e., a brain image) into a cube without creating significant distortion, which is utilized to preprocess irregular brain samples to facilitate the tensor form of the input format of the U-net algorithm. The BraTS 2021 database newly provides a challenging platform for the detection and segmentation of brain tumors, namely, the whole tumor (WT), the tumor core (TC) and the enhanced tumor (ET), by AI techniques. We propose a two-phase OMT algorithm with density estimates for 3D brain tumor segmentation. In the first phase, we construct a volume-mass-preserving OMT via the density determined by the FLAIR grayscale of the scanned modality for the U-net and predict the possible tumor regions. Then, in the second phase, we increase the density on the region of interest and construct a new OMT to enlarge the target region of tumors for the U-net so that the U-net has a better chance to learn how to mark the correct segmentation labels. The application of this preprocessing OMT technique is a new and trending method for CNN training and validation..

Keywords Optimal mass transportation, Brain tumor segmentation, Machine learning

References

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