LICENSING OPPORTUNITY

Clinical Decision Support Tool Using Deep Neural Network for Brain Tumors

Here, we present a deep learning algorithm used for imaging segmenting that can statistically and significantly outperform neuroradiology technicians in both accuracy and speed. This technology can also improve patient outcomes by allowing for more precise and locally aggressive treatments. Magnetic Resonance Imaging is the primary method used for visualizing brain structure and tumors due to its high quality, high-contrast images. Due to the complexity of the brain and the highly-infiltrative nature of brain tumors, imaging segmentation is a necessary step. Segmentation, however, is a very time-consuming process and is entirely dependent on the skill of the operator, which can negatively influence results and patient outcomes.

COMMERCIAL OPPORTUNITY

- Among brain tumors, glioblastoma is the most common and most aggressive type, leading to a short life expectancy. GBM accounts for about 15% of the more than 22,000 Americans diagnosed with brain and nervous system cancers per year. Patients with GBM have a poor prognosis and usually survive less than 15 months with no long-term treatments available.

- Magnetic resonance imaging (MRI) is the imaging technique of choice for brain analysis. MRI provides high resolution, high-contrast images and does not have the health risks CT present. Brain tumor identification from MRI consists of several stages. Segmentation is known to be an essential step in medical imaging classification and analysis. Performing the brain MRI imaging segmentation manually is a difficult task as there are several challenges associated with it.

- In the clinical practice, manual segmentation is a time-consuming task and performance is highly depended on the operator’s experience. Radiologists and medical experts spend extensive time manually segmenting brain MR images, and this is a non-repeatable task. An automatic segmentation of brain MR images is needed to correctly segment white matter, gray matter and cerebrospinal fluid tissues of brain in a shorter span of time.

TECHNOLOGY

This technology is a decision support tool for clinicians that use deep learning (DL) algorithms for brain tumor segmentation in MRI. A multi-institutional database of 741 pretreatment MRI exams was compiled. Each contained a post-contrast T1-weighted exam, a T2-weighted FLAIR exam, and at least one technician-derived tumor segmentation. The database included 729 unique patients (470 male, 259 female). Of these exams, 641 were used for training the DL system, and 100 were reserved for testing. On this platform, twenty neuroradiologists performed 400 side-by-side comparisons of segmentations on 100 test cases. They scored each between 0 (poor) and 10 (perfect). Agreement between segmentations from technicians and the DL method was also evaluated quantitatively using the Dice coefficient, which produces values between 0 (no overlap) and 1 (perfect overlap). The neuroradiologists gave technician and DL segmentations mean scores of 6.97 and 7.31, respectively ($p < 0.00007$). The DL method achieved a mean Dice coefficient of 0.87 on the test cases and able to perform its task in a significantly short duration of time in minutes compared to the technician, which took hours.

PUBLICATION/PATENT

PCT application were filed for Dr. Ross Mitchell May 23, 2019

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