Machine learning helps doctors diagnose severity of brain tumors

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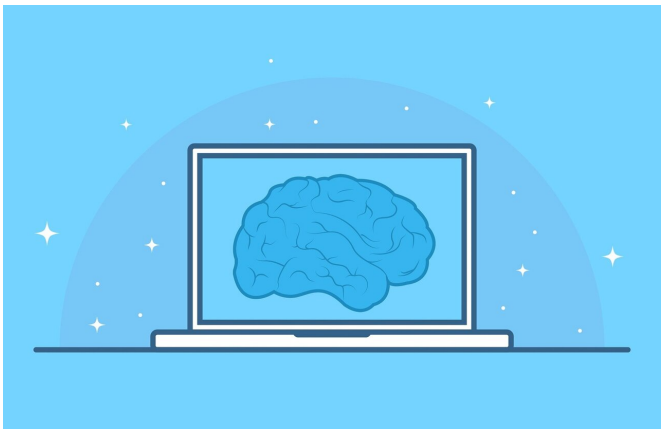

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An estimated 18,000 people in the United States will die of brain and spinal cord tumors in 2020. To help doctors differentiate between the severity of cancers in the brain, an international team of researchers led by Dr. Murat Günel, Chair of Neurosurgery at Yale School of Medicine, and Nixdorff-German Professor of Neurosurgery, built a machine learning model that uses complex mathematics to learn how various types of brain tumors look in the brain. The model is designed to "learn" from this gathered data to make predictions and help doctors diagnose the stage of brain cancers faster and more accurately.

To test their artificial learning method, the team used 229 patients with brain tumors along a spectrum of how likely they are to become malignant from lower-grade gliomas, which are relatively slow-growing tumors that originate from glial cells of the brain—to glioblastomas, the highly aggressive counterpart to gliomas.

"Our machine learning models used to differentiate the tumor types were very accurate," said Hang Cao, a medical student from Xiangya Hospital working with Dr. Gunel, and the lead author of the study published in *European Radiology*.

The researchers compiled data from a public tumor machine resonance imaging (MRI) database called The Cancer Imaging Archive. Board-certified neuro-radiologists then identified and selected glioma cases, which the researchers used for their model.

The team found significant differences in how the cancers looked, their volumes in various regions of the brain, and their locations. When taken together, the model could predict which tumors were lower-grade gliomas or glioblastomas with a high degree of accuracy.

The timeline for using such a model in a clinical setting is not known at this time. Although it would be possible to implement now as a stand-alone evaluation, the process is not yet integrated into the clinical evaluation of the patient. A clear set of standards will need to be established by the scientific community and then be embraced the manufacturers of software and hardware used in radiology departments.

"This work is fundamentally important to our understanding of brain tumors and a great example of the collaborative, multidisciplinary effort we use to advance the field and provide the best care to brain tumor patients," said co-author Dr. Jennifer Moliterno, assistant professor of neurosurgery at Yale School of Medicine and Clinical Program Leader of the Brain Tumor Program.

More information: Hang Cao et al. A quantitative model based on clinically relevant MRI features differentiates lower grade gliomas and glioblastoma, *European Radiology* (2020). DOI: 10.1007/s00330-019-06632-8

Hang Cao et al. Correction to: A quantitative model based on clinically relevant MRI features differentiates lower grade gliomas and

glioblastoma, *European Radiology* (2020). DOI: 10.1007/s00330-020-06774-0

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