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MRI-Based AI Estimation of Regional Tau Burden for Alzheimer's Assessment

Stanford researchers have developed a software method that estimates the regional burden of neurofibrillary tau in the brain using magnetic resonance imaging (MRI) acquired in patients. Tau burden and its spatial distribution are important for assessing the likely cause of a dementia syndrome and the risk and pace of progression. Today this information is obtained mainly through tau positron emission tomography (PET) or cerebrospinal fluid analysis, both of which are costly, limited in availability, and either invasive or radiation-bearing. Emerging blood-based tau tests are promising, but do not provide regional or spatial information about where tau is deposited in the brain.

The Stanford method uses artificial intelligence applied to standard, non-contrast MRI sequences, together with basic demographic information, to produce a quantitative estimate of regional tau burden organized by recognized neuroanatomical staging. Because it draws on imaging that many older patients already receive, it is designed to add no additional scan, cost, or patient burden, and it can in principle operate opportunistically in the background of examinations performed for unrelated reasons.

The recent approval of anti-amyloid therapies for Alzheimer's disease has substantially increased the clinical role of brain MRI, which is now central to assessing treatment eligibility and to monitoring for known side effects of these therapies. This shift has created rapidly growing demand for MRI-based tools that help clinicians characterize Alzheimer's-related pathology and manage patients on therapy. A tool that extracts additional pathology-relevant information from MRI already in the workflow is well aligned with this direction of the field.

The most plausible near-term applications are in specialty memory clinics and academic medical centers, and in the identification and enrichment of participants for clinical trials of Alzheimer's therapies. In each of these settings, a non-invasive, MRI-derived readout of regional tau could complement existing biomarkers and support triage decisions about who should proceed to more definitive and more expensive testing.

Stage of Development:
Prototype

Applications

- Supporting the assessment of regional tau burden as part of a memory-clinic evaluation.
- Helping to identify individuals at elevated risk of near-term cognitive progression.
- Opportunistic identification of individuals among older adults imaged for unrelated indications.
- Assisting in the assessment of suitability for, and longitudinal monitoring of, anti-amyloid and other Alzheimer's therapies.
- Supporting participant identification and enrichment for clinical trials.

Advantages

- A regional, spatially resolved estimate of tau burden, rather than a single global value, organized by established neuroanatomical staging.
- Operation on routine, widely available non-contrast MRI sequences, without a dedicated or specialized acquisition.
- No added scan, contrast agent, radiation, or patient burden, because it uses imaging obtained as part of the standard workup.
- A screening-oriented output designed around the real-world prevalence of tau positivity, intended to support triage to confirmatory testing rather than to replace it.
- A software design intended to integrate into existing imaging and reporting workflows and to complement, rather than compete with, blood-based and PET-based biomarkers.

Innovators

- Greg Zaharchuk
- Donghoon Kim

Licensing Contact

Jon Gortat

Licensing & Strategic Alliances Director for Physical Science

Email