Dear Editor,

We are writing to inquire whether our paper entitled “NiChart: A machine learning oriented neuro-imaging brain chart, derived from 71,820 MRI scans, and its methodology” is suitable for submission to Nature.

MRI studies are typically analyzed independently, which limits statistical power and restricts the ability to generalize outcomes among diverse disease groups and populations. Our paper presents the NiChart platform that makes available normative statistical summarizations, pre-trained harmonization models and compatible machine learning (ML) models from a large and diverse pooled and harmonized dataset. NiChart ML models establish the dimensional brain chart that characterizes structural brain changes due to aging and neurodegenerative diseases, and map high-dimensional imaging data from individuals into a low-dimensional chart of expressive, yet interpretable imaging signatures.

We have included the full abstract (below) and two primary figures (attached). We hope that our findings will be of interest to the readership of Nature and contribute to the advancement of machine learning applications in medical imaging. We eagerly anticipate your feedback and the opportunity to contribute to the Nature community.

Sincerely,

Guray Erus

Full Abstract:

Brain Magnetic resonance imaging (MRI) has been widely adopted by studies of brain aging and neurologic disorders including neurodegenerative diseases, which have collectively generated a rich data resource for understanding and quantifying normal and pathologic brain aging. Machine learning (ML) methods have shown great promise for developing individualized MRI-based biomarkers with diagnostic and prognostic value. However, modest diversity and sample sizes of individual studies, as well as variations in MRI scanners and imaging protocols across studies, often limit the power and generalizability of results and derived models. We describe a neuro-imaging brain chart (NiChart), a dimensional neuroimaging system derived from and validated against a diverse harmonized dataset composed of 71,820 MRI time points from 53,757 participants across 23 studies, acquired in over 100 scanners and 3 decades (with an on-going expansion to an additional 12 studies and 9257 individuals).

The dimensions of NiChart capture variation of structural brain features, as well as expression of multi-variate imaging signatures derived via ML models, such as imaging signatures of brain age and of Alzheimer’s disease. These measures reflect different aspects of heterogeneity in brain aging trajectories in individuals with normal cognition, cognitive deficits, and dementia. Statistical harmonization methods in NiChart enable researchers to minimize confounding inter-scanner and inter-protocol variations and map MRI scans onto the brain chart, thereby gaining access to NiChart’s normative statistics and ML-derived imaging signatures and further contributing their own measures to this reference space.

We envision NiChart to be a community-based tool that can grow with user input of data and machine learning models from additional studies. To make NiChart easily accessible, we provide both cloud-based and locally installed software tools with a point-and-click graphical user interface.

We demonstrate the utility of NiChart with applications in multiple, independently acquired studies of specific focus, including neurodegenerative diseases.