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Intracortical microstructure profiling: a versatile method for indexing cortical lamination

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Intracortical microstructure profiling represents a powerful, scalable approach for investigating the laminar organisation of the human cortex on both post-mortem and in-vivo datasets. Building upon a long tradition of histological analysis, this method leverages advances in high-resolution MRI and surface-based sampling to generate quantitative profiles of tissue properties across cortical depths. The present work outlines a standardised workflow for intracortical microstructural profiling that can operate on both 3D post-mortem histology and in-vivo MRI datasets. We demonstrate that the shapes of microstructure profiles are reliable, reproducible across sites and modalities, and robust to variations in data resolution. The workflow can be easily applied to new datasets with the open "microkit", which is accompanied by comprehensive documentation and a data warehouse ("Microstructural Marketplace"). As the range of applications of microstructure profiling expands across development, aging, and disease, we aim to demonstrate the potential the approach holds bridging microstructural neuroanatomy with systems-level neuroscience.

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