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Multi-atlas Multilayer Brain Networks, a multimodal approach to brain connectivity in frontotemporal dementia and Alzheimer's disease.

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State of the art
Multilayer networks (MNs) constitute an insightful multidimensional framework. Bimodal MNs built on functional and structural networks lay the foundation for an authentic multimodal analysis. In the present work, the aim is to explore MNs built on functional and structural connectivity and to show the different contribution of the two layers to behavioural variant of frontotemporal dementia (bvFTD) and Alzheimer's disease (AD).

Methodology
We built such networks using atlases specific to each modality. We employed the generalized richness and coreness multilayer metrics to study different aspects of brain connectivity. We applied this new method to 14 bvFTD patients, 22 AD patients and 44 Healthy Controls (HC). Metrics were computed for each subject and the three populations were compared. To assess the contribution of each modality (structural and functional), a Linear Discriminant Analysis was performed.

Results
Patients had different connectivity patterns than controls and the pathological regions were congruent with the atrophy patterns of the two diseases (more anterior for bvFTD, more posterior and medial temporal for AD). We found that the optimal relative weights assigned to each layer (structural/functional) differed between populations. In bvFTD we observed one Fisher's Criterion "spike" for the highest structural to functional ratio, while in AD there were two spikes, one for high structural ratios and another one for higher functional ratios.

Conclusion
Our method is promising in providing valuable insights into disease by capturing disease-specific features. Indeed, the underlying biological process (AD vs FTD) specifically influences alterations in structural and functional connectivity.

Conflicts of interest

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