Characteristic Traits of Mild cognitive impairment in Parkinson's disease

Vicente Ferrer-Gallardo[1], Manuel Delgado[2,3], Irene Navalpotro[4], Stefano Moia[1,5], Manuel Carreiras[1,6], Pedro M. Paz Alonso[1], María Cruz Rodriguez-Oroz[7,8], César Caballero-Gaudes[1]

vferrer@bcbl.eu
@VFerrerGallardo

[1]Basque Center on Cognition, Brain and Language, San Sebastian, Spain, [2]Neurology Department, Sierrallana Hospital, Torrelavega, Spain, [3]Psychiatry Research Area, IDIVAL, University Hospital Marqués de Valdecilla, Santander, Spain, [4]Instituto De Investigacion Sanitaria Biodonostia (IISB), San Sebastian-Donostia, Spain, [5]University of the Basque Country (UPV/EHU), San Sebastian, Spain, [6]Ikerbasque (Basque Foundation for Science), Bilbao, Spain, [7]Clinica Universidad de Navarra, Servicio de Neurologia. Pamplona , España, [8]CIMA Universidad de Navarra, Area de Neurociencias. Pamplona , España

Background

- Mild cognitive impairment (MCI), frequent in Parkinson Disease (PD), is a well-known risk factor for dementia.
- Functional connectivity resting state networks (RSNs), such as the default mode, dorsal attention, executive control and sensorimotor networks, have been reported to correlated with cognitive deficits in PD. Inter-network connectivity is crucial as well [1,2].
- This study investigates how whole-brain functional networks are affected by MCI in PD using a Connectome ICA (connICA) analysis with resting state functional MRI (RS-fMRI).
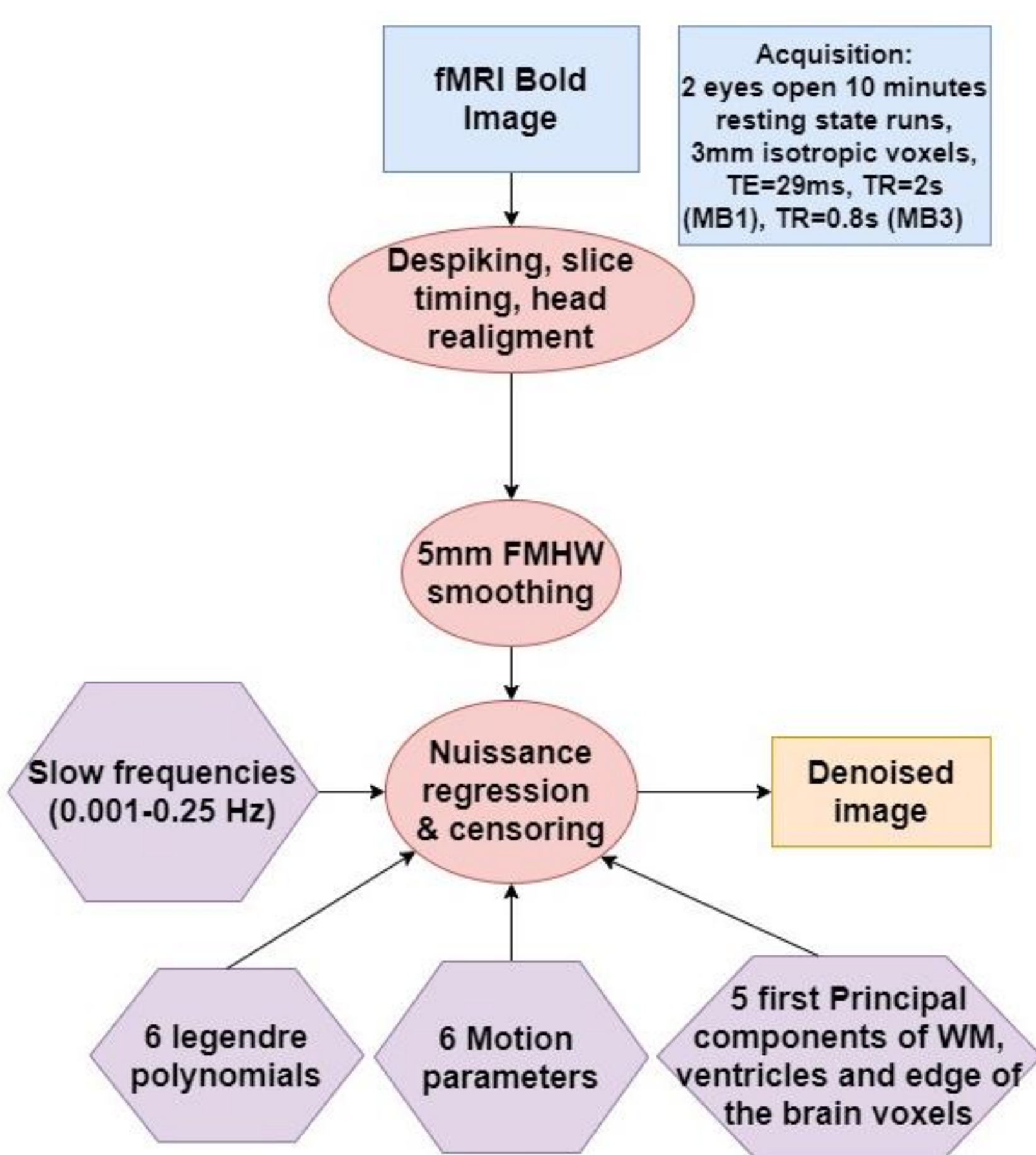
Dataset

- PD-MCI diagnosed according to Movement Disorders Society Guidelines (Level II).
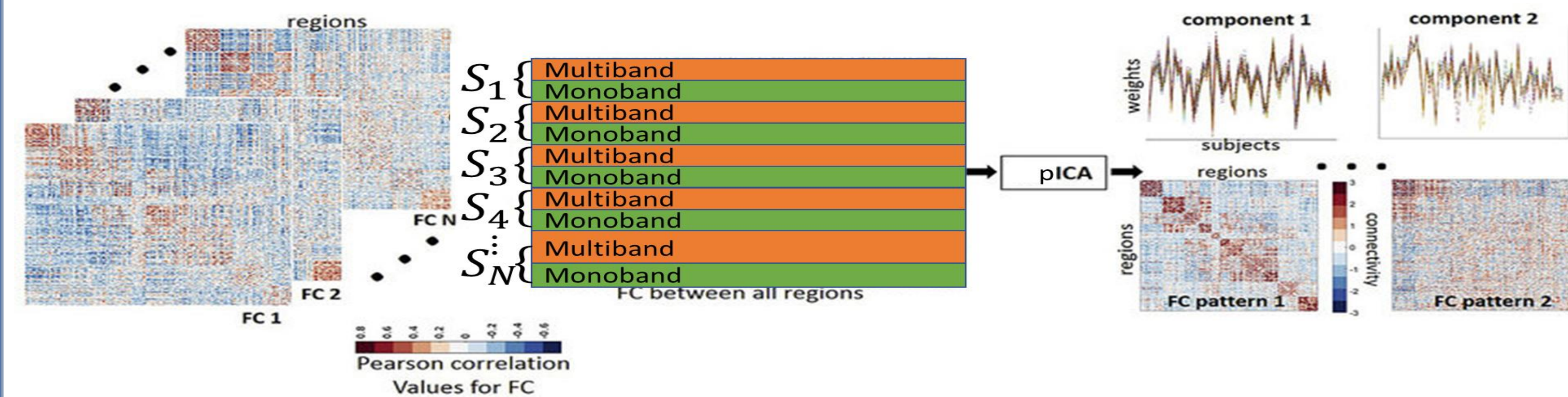- Patients examined under anti-parkinsonian medication.
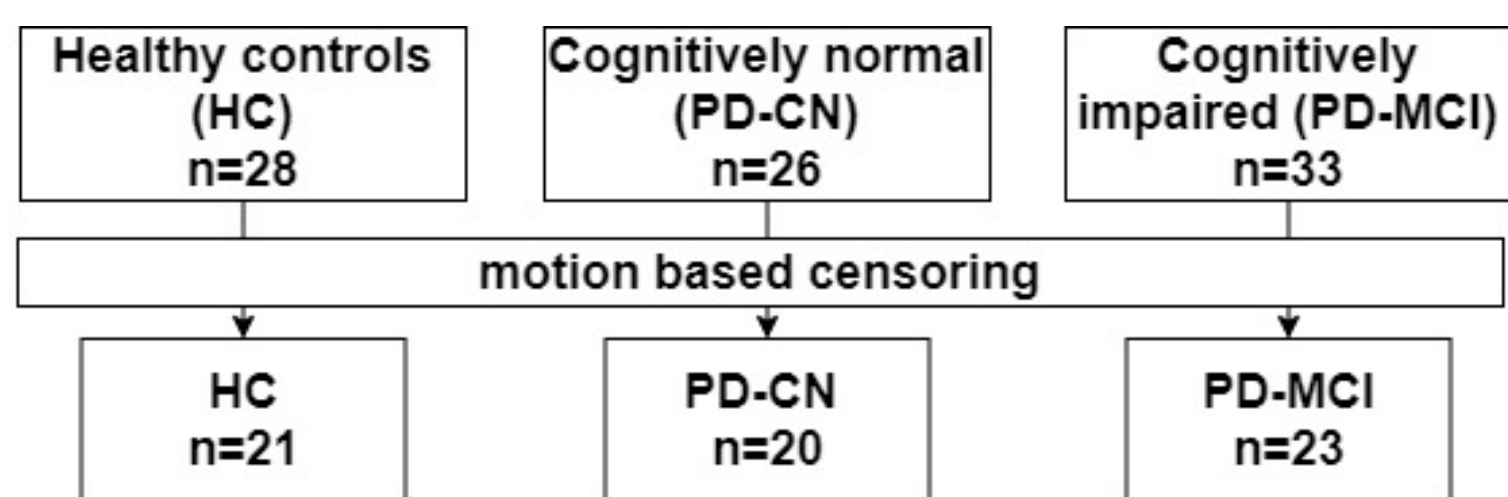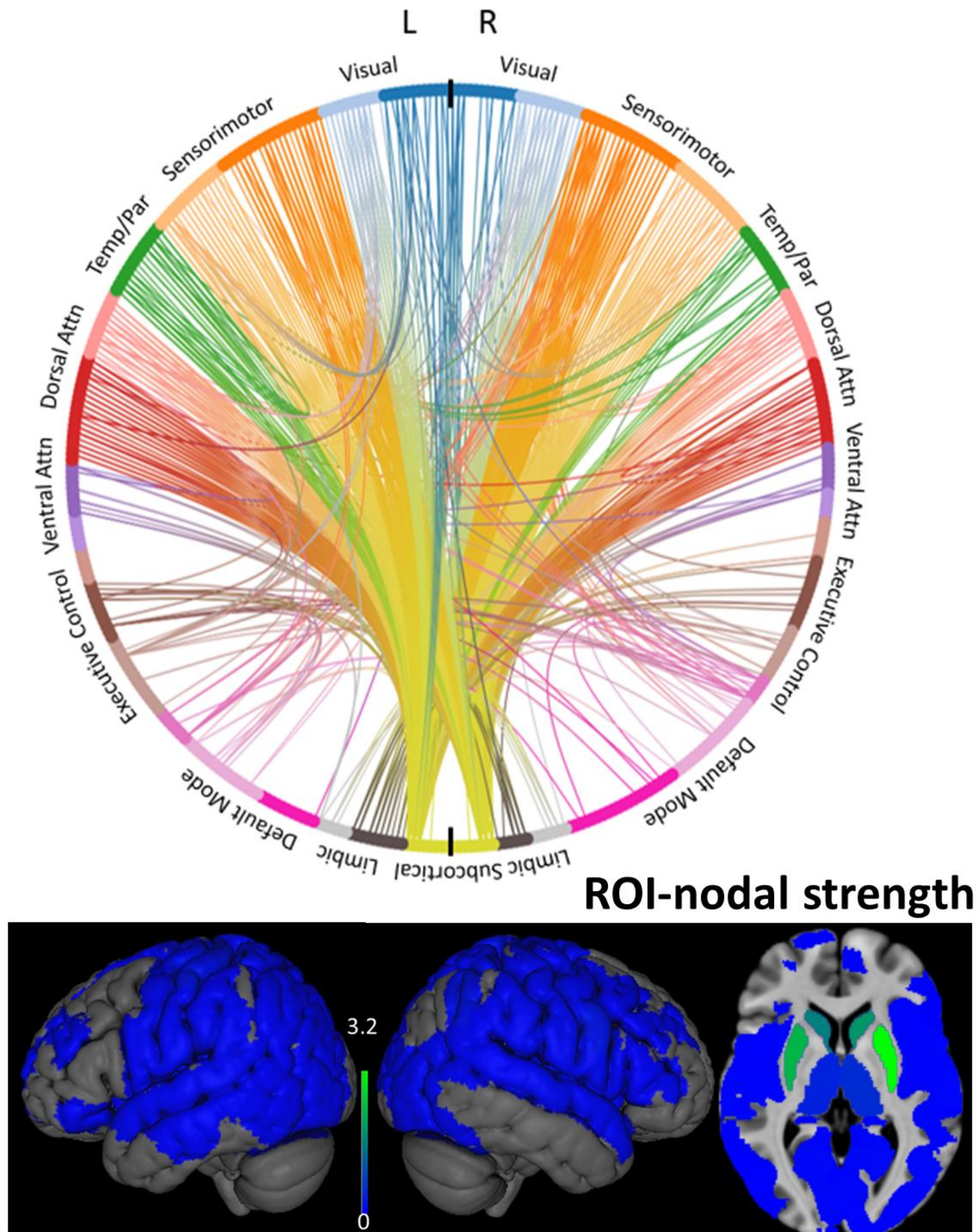
Anatomical Preprocessing
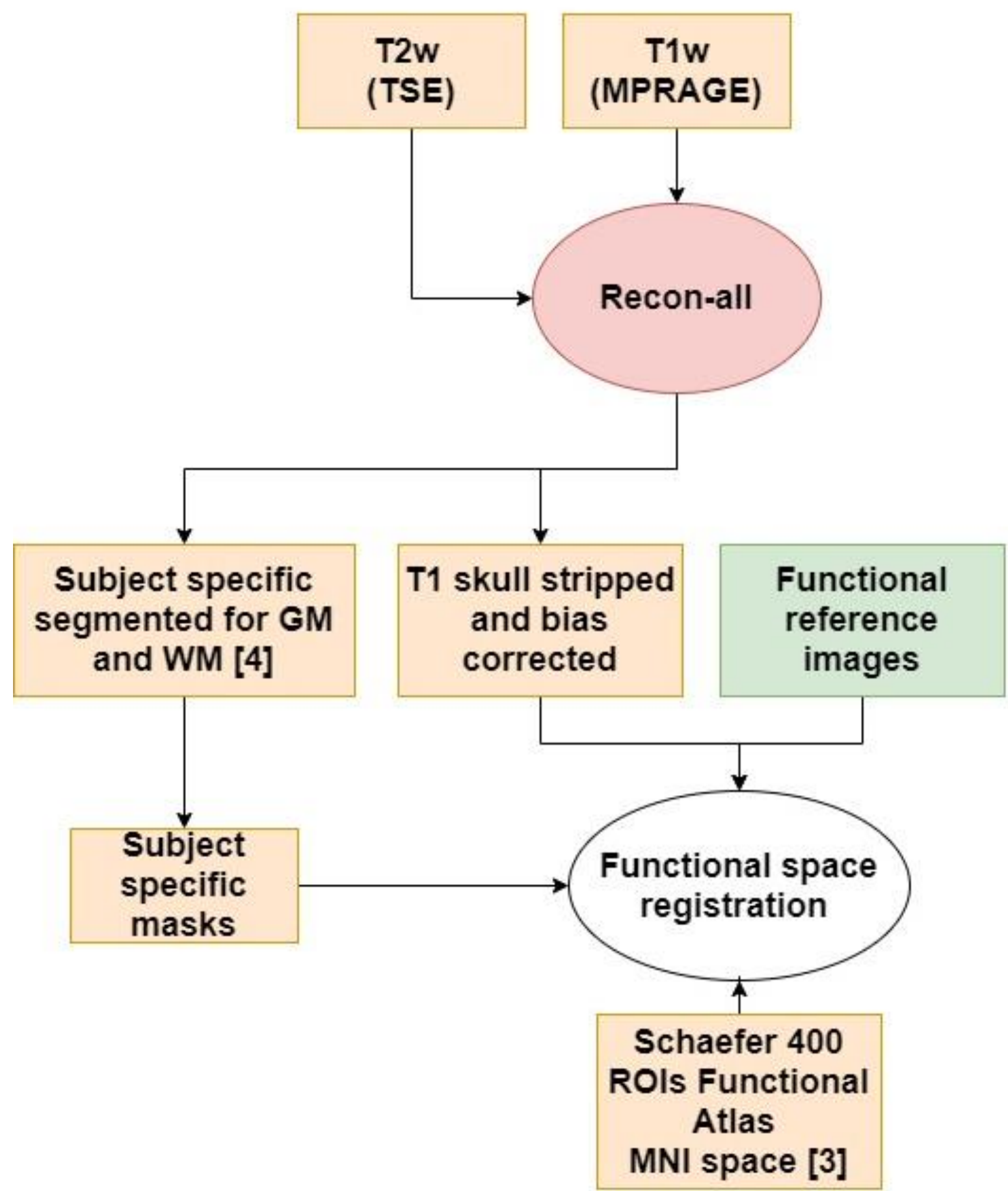
Functional Preprocessing

Functional connectivity identifiability and ConnICA Analysis [6, 7]
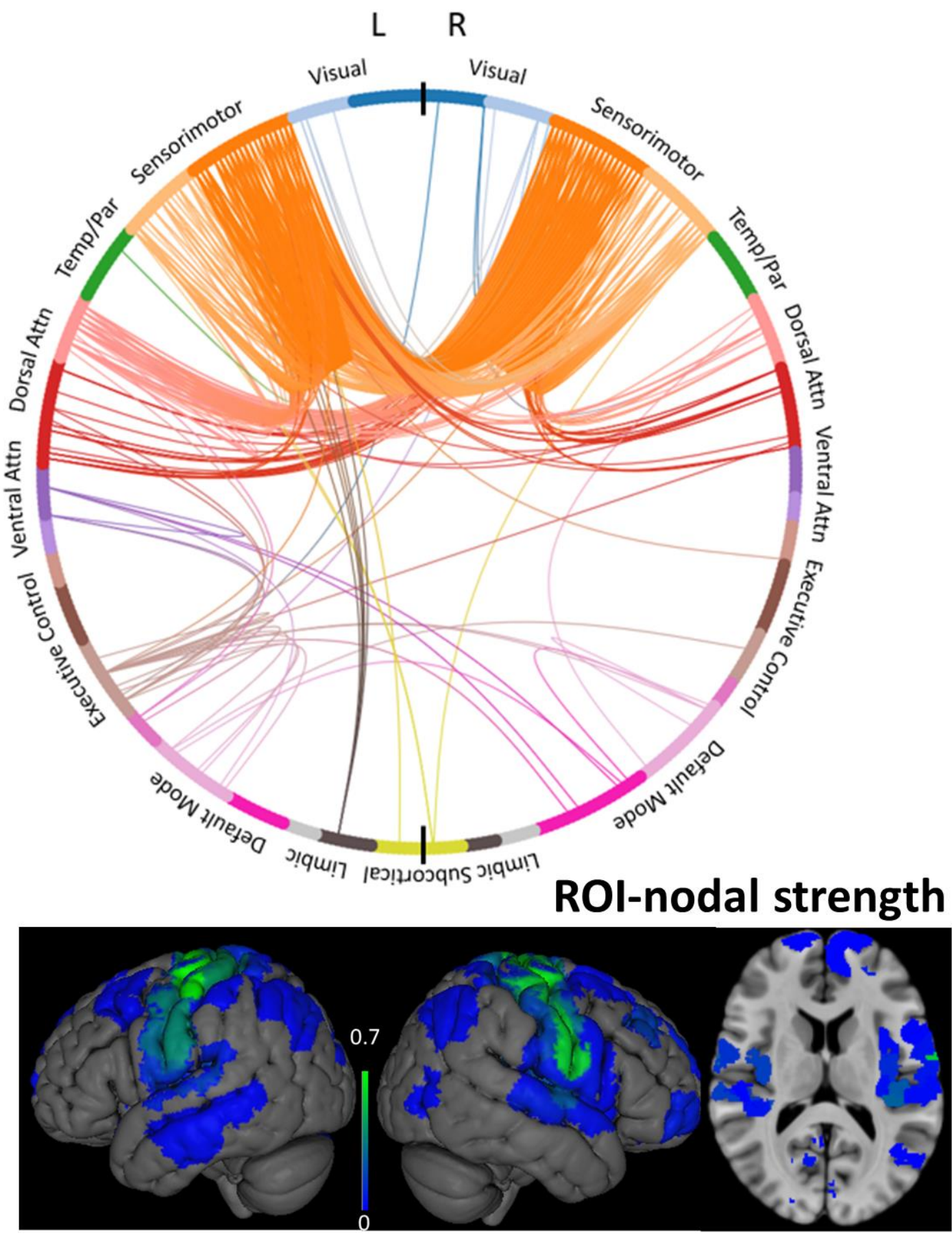

FC-Trait 5: Subcortical-cortical connectivity

- Differentiates HC from PD groups.
- Hubs in putamen, caudate and thalamus.
- Mainly associated with attentional neuropsychological tests implying attentional deficits at the beginning of PD.

## FC-Trait 9: Sensorimotor and Attention Networks

- Differentiates PD-MCI from HC and PD-CN
- Inter-intra-hemispheric connections between motor and somatosensory cortices and dorsal and ventral attention networks.
- Attention and memory behavioral test are significantly linked suggesting a motor disfunction in the PD-MCI.

FC-Trait 13: Visual-frontoparietal connections
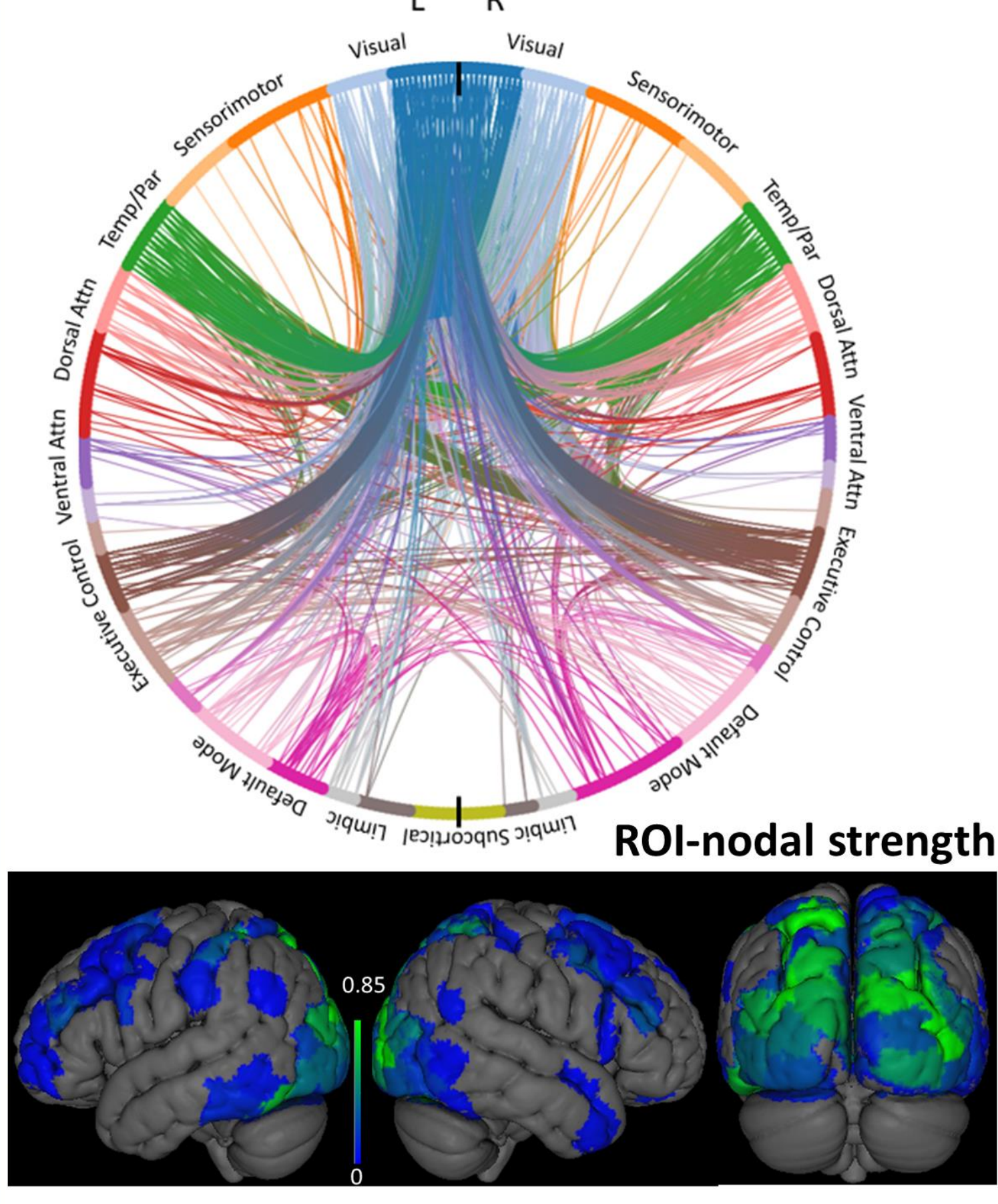
- Differentiates HC from PD groups.
- Visual-parietal and visual-executive control connections.
- Associated to UPDRS-III which suggest a connection to motor symptoms.

FC-Trait 34: Angular gyrus temporal and attention
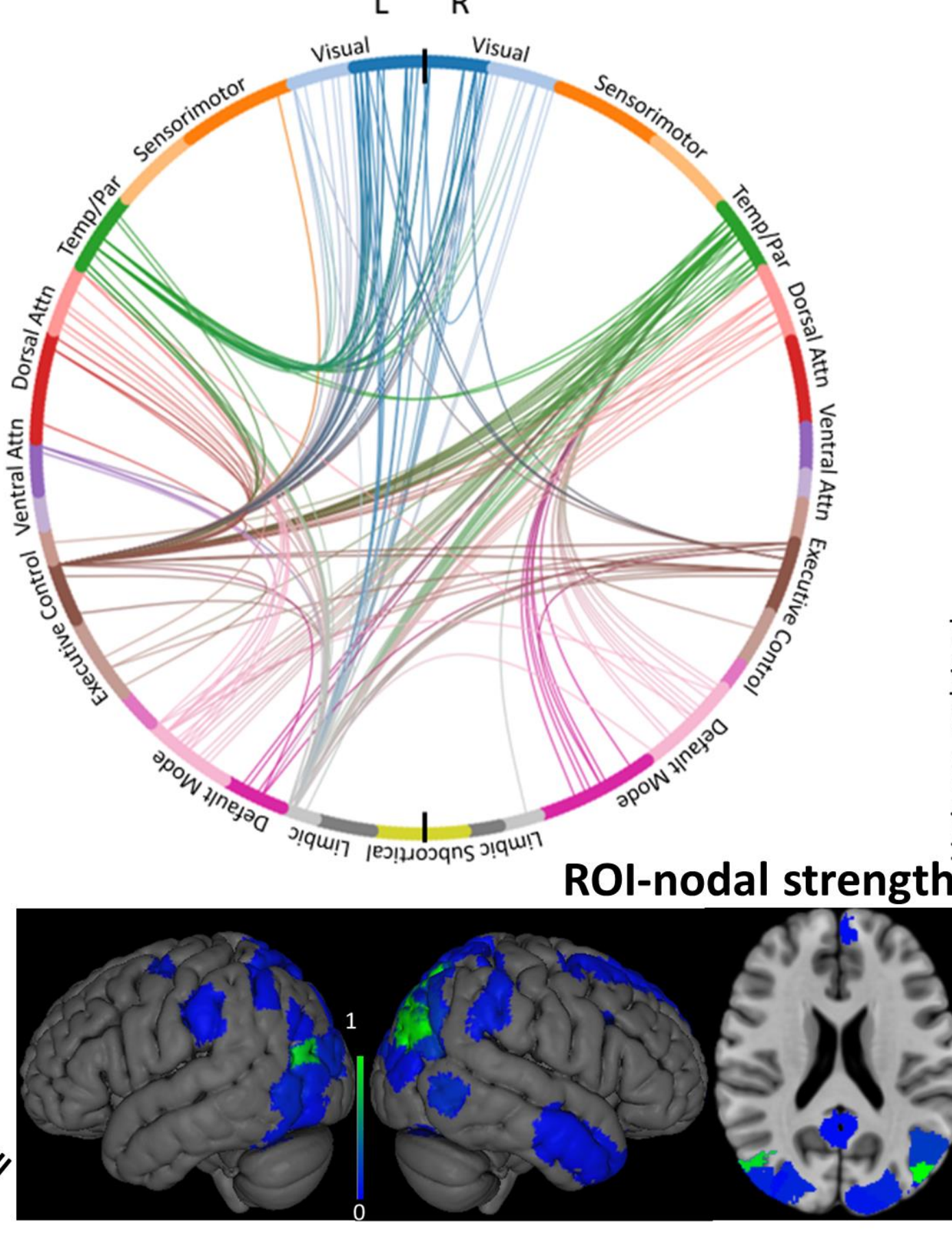
- Differentiates all three groups from each other.
- Angular gyrus with temporal, parietal and visual connections.
- No behavioral links.

Linear mixed effects model on FC traits weights

Trait	5	9	13	34
Anova F-value	9.563	15.51	7.738	8.169
Anova Pvalue	0.00916	6.62E-05	0.04498	0.03066
HC vs PDCN	0.000561	0.307563	0.000975	0.046402
HC vs PD-MCI	0.000937	6.12E-07	0.000967	0.009107
PDCN vs PD-MCI	0.405277	6.89E-06	0.98814	1.83E-05

Conclusions

- Pronounced subcortico-cortical and visuo-cortical FC changes related to attentional and motor skills differentiated PD patients from healthy controls.
- Functional connections between attentional and sensorimotor regions are key for PD-MCI development, and are associated with deficits in attention and memory abilities.

References

1. Deepti P, et al (2015) Neuroimage Clinical doi: 10.1016/j.nicl.2015.01.012
2. Kim, J et al (2017) doi: 10.1093/brain/awx233 . 3. Schaefer A, et al (2018). Cerebral Cortex doi: 10.1093/cercor/bhx179b 4. Destrieux, C. et al. (2010), NeuroImage, doi: 10.1016%2Fj.neuroimage.2010.06.010 5. Power J. D. et al. (2012), NeuroImage, doi : 10.1016/j.neuroimage.2011.10.018 6. Amico, E. et al. (2017), NeuroImage, doi: 10.1016/j.neuroimage.2017.01.020 7. Amico, E & Goñi, J (2018) doi: 10.1038/s41598-018-25089-1