

Name of the project:

Unsupervised community detection in hierarchical brain networks: the importance of multimodal integration of structural and functional data.

Brief description:

Elucidating the exact relation between brain structure and function is a key challenge for modern neuroscience. Recent progress in magnetic resonance imaging (MRI) has helped advance our understanding of this important issue, with diffusion images allowing to build structural connectivity (SC) and functional magnetic resonance imaging providing functional connectivity (FC). To exploit the multi-scale computation of the human brain, we made use of a modular hierarchical clustering approach to combine SC and FC datasets gathered independently from healthy human subjects. Our novel approach allowed to find a common skeleton shared by structure and function from which we built a new Brain Hierarchical Atlas. In this project, we will continue recent work using this hierarchical atlas to study different pathologies of the human brain and address atlas robustness across different data sets and different magnetic field intensities, such as 1.5T (available in most of the Hospitals), 3T (standard for neuroimaging research) and 7T (used only in pilot studies, non-approved yet for human conventional use). This TFM aims to shed some light precisely on the key limitation of modern neuroimaging, the fact that acquisitions are highly variable not only between different subjects but between different machines.

What the students needs:

Ideal candidates for this project should have experience in Matlab and Python, and have an interest in studying the human brain.

Supervisor:

Prof. Jesus M Cortes
Ikerbasque Research Professor
Biocruces Health Research Institute
Research Professor at the University of the Basque Country
<https://www.jesus cortes.info>