DPABINet: A turn-key brain network and graph theory analysis platform based on MRI data

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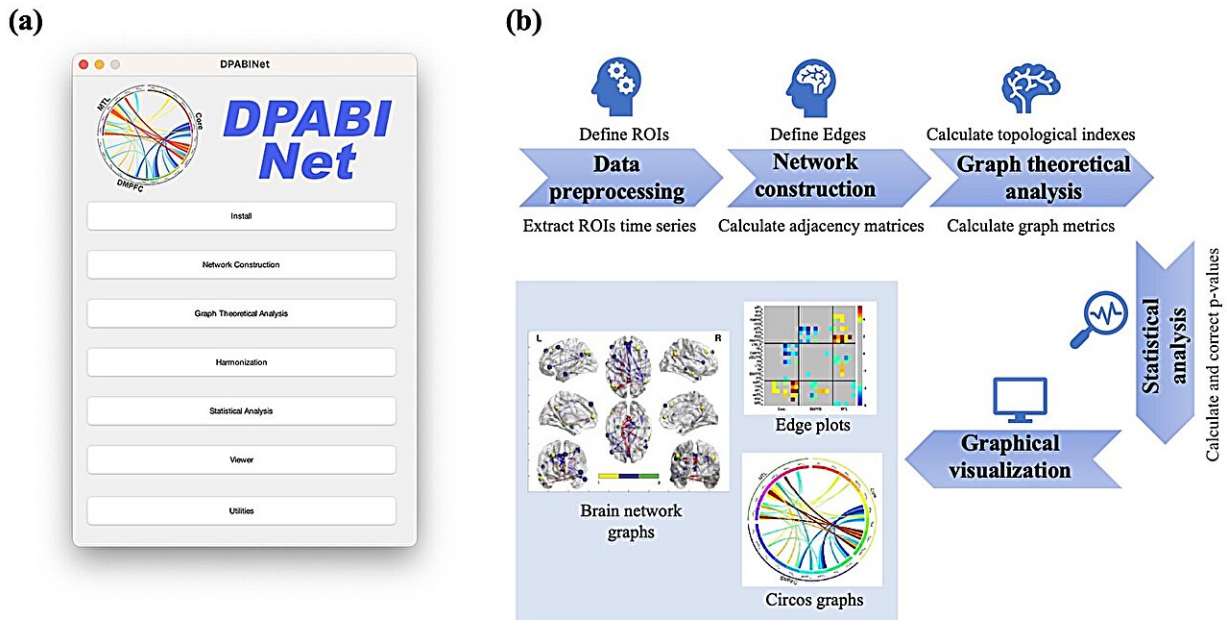

DPABINet, a sophisticated enhancement of the DPABI software suite, streamlines the intricate analysis of brain networks through fMRI data, providing researchers of all expertise levels with user-friendly access to insights into the brain's complex network architecture. Credit: Science China Press

DPABINet, developed by Dr. Chao-Gan Yan's team at the Institute of Psychology, Chinese Academy of Sciences, simplifies brain network analysis with a user-friendly, one-click software that requires no

programming skills.

Leveraging the widely-used DPARSF/DPABI/DPABISurf platform, it democratizes access to complex brain imaging analyses. This innovation is set to advance brain function research and clinical studies by making sophisticated analyses more accessible to a broader range of researchers. The work is published in the journal *Science Bulletin*.

The human brain, a marvel of complexity, operates as an intricate network where various regions collaborate structurally and functionally. These interactions forge complex patterns that underpin the diverse functionalities of the brain.

Understanding these complex functions necessitates a deep dive into the brain's networks and the sophisticated interconnections and communication modalities they encompass. Moreover, the exploration of brain network mechanisms opens new vistas in the study of diseases marked by abnormalities in brain function, such as brain injuries and mental disorders, making the investigation of the brain's complex network system paramount for a holistic grasp of its functionalities.

Graph Theory, the bedrock of network science, has found extensive application in dissecting the attributes of complex networks, including those of the brain. It lays out a framework for examining the topological structures of these networks, unveiling pivotal organizational details of functional brain networks across both micro and macro scales.

Despite graph theory's immense analytical potential, the intricacy of existing professional imaging data processing software—often demanding high-level programming acumen—has been a bottleneck, hampering the broader adoption and application of these analytical methods.

Addressing this challenge, Dr. Chao-Gan Yan and his team from the Magnetic Resonance Imaging Research Center at the Institute of Psychology, Chinese Academy of Sciences, have innovated beyond their previously acclaimed brain imaging processing platform (DPARSF/DPABI/DPABISurf, cited in over 5,000 research works, with the DPABI software paper being distinguished as one of the top 0.01% highly cited papers by ESI and featured among the hot papers in the Chinese medical field for 2015-2019).

They unveiled DPABINet, a pioneering platform that amalgamates cutting-edge image processing modules like Brain Connectivity Toolbox, FSLNets, BrainNet Viewer, Circos, SPM, PALM, among others, leveraging docker technology to furnish a user-friendly, cross-platform interface and algorithms.

DPABINet's intuitive graphical interface (GUI) empowers users to seamlessly construct brain networks, conduct graph theory analysis, and perform statistical analysis and result visualization with a single click, eliminating the need for programming or scripting expertise.

Additionally, DPABINet enhances the research on brain structural networks derived from diffusion-weighted imaging, providing a robust analysis framework for brain structural fiber networks predicated on DPABIFiber's preprocessing results.

Inheriting and broadening the design ethos of DPARSF/DPABI/DPABISurf, DPABINet significantly lowers the barrier to entry, enabling users devoid of programming knowledge to undertake precise and efficient brain network construction, graph theory analysis, and data interpretation.

To bolster user proficiency, Dr. Yan's team also offers complimentary online video tutorials, facilitating a swift mastery of DPABINet. This

freely accessible, open-source toolbox is tailored to support both newcomers and seasoned users, catalyzing the deployment of brain network research methodologies in both academic and clinical translational studies.

DPABINet marks a significant leap forward in brain imaging data analysis, furnishing researchers with a potent, user-friendly instrument to delve into the complexities of brain networks and their implications in health and disease. This platform enhances the efficiency and precision of constructing and analyzing brain networks, propelling brain science research forward and offering novel investigative tools for the diagnosis and treatment of brain function disorders.

The introduction and utilization of DPABINet promise to significantly advance the popularity and application of brain network research techniques, accelerating progress in brain functional and structural imaging studies, and providing robust support for clinical translational research endeavors.

More information: Chao-Gan Yan et al, DPABINet: A toolbox for brain network and graph theoretical analyses, *Science Bulletin* (2024). DOI: 10.1016/j.scib.2024.02.038

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