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Structural connectomics in brain diseases

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Abstract

Imaging the connectome *in vivo* has become feasible through the integration of several rapidly developing fields of science and engineering, namely magnetic resonance imaging and in particular diffusion MRI on one side, image processing and network theory on the other side. This framework brings *in vivo* brain imaging closer to the real topology of the brain, contributing to narrow the existing gap between our understanding of brain structural organization on one side and of human behavior and cognition on the other side. Given the seminal technical progresses achieved in the last few years, it may be ready to tackle even greater challenges, namely exploring diseases mechanisms. In this review we analyze the current situation from the technical and biological perspectives. First, we critically review the technical solutions proposed in the literature to perform clinical studies. We analyze for each step (i.e. MRI acquisition, network building and network statistical analysis) advantages and potential limitations. In the second part we review the current literature available on a selected subset of diseases, namely, dementia, schizophrenia, multiple sclerosis and others, and try to extract for each disease the common findings and main differences between reports.

Keywords

Connectome, diffusion MRI, DTI, structural connectivity, graph theory, psychiatric disorders, neurological disorders