Clinica: an open-source software platform for reproducible clinical neuroscience studies

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Introduction:
Neuroimaging studies often rely on heterogeneous tools and complex data processing workflows.   Initiatives such as Nipype[1] for cross-interface uniformization of tools, and BIDS[2] for data organization, help researchers achieve reproducible results. Nonetheless, the entry-cost for non-specialists remains significant and the room for error non-negligible. For that purpose, we present Clinica[3], an open-source, community-oriented software platform for reproducible clinical neuroscience studies. As such, Clinica bridges the gap between neuroimaging experts and users looking for a straightforward and efficient way to process and analyse neuroimaging data.

Methods:
Clinica is developed around three main axes: BIDS converters, neuroimaging processing, and statistics and machine learning workflows. For each of these axes, Clinica puts forward several pipelines through a uniform and simple to use but powerful command line interface. BIDS converters allow users to transform several publicly-available imaging datasets into the community-driven BIDS standard. The converters serve as an entry point into further analysis workflows. Next, the neuroimaging processing workflows provide step-by-step procedures to prepare neuroimaging data (T1w-MRI, DWI and PET) for neuroscience studies. These are organized into goal-oriented pipelines and rely on third party tools. Finally, statistics and machine learning pipelines allow users to perform univariate analysis and classification on the organized and pre-processed datasets.

Results:
Clinica provides a unified set of tools to tackle neuroimaging studies relying on best-practices and community driven efforts. It is a gateway into performing reproducible research. The source code of Clinica is hosted on Github and the software is distributed under an MIT license. A comprehensive user guide accompanies the software platform (available from www.clinica.run).

Discussion:
By providing a user-friendly, end-to-end, and standards-reliant neuroimaging software platform, Clinica's aim is twofold. First, it encourages community-driven efforts through the adoption of open-source tools and standards such as Nipype, BIDS and Github. Second, it paves the way for more reproducible and less error-prone research. As such the software has been used to that end in several works[4,5,6].

Conclusion:
As a general neuroimaging software platform, Clinica tackles most challenges around the open-science and reproducible problems for MRI. It is open-source, uses and encourages open-data formats and favours and assists in reproducible research.

References:
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