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Bridging the gap: integrating Deep Brain Stimulation imaging and clinical data in a unified data management system

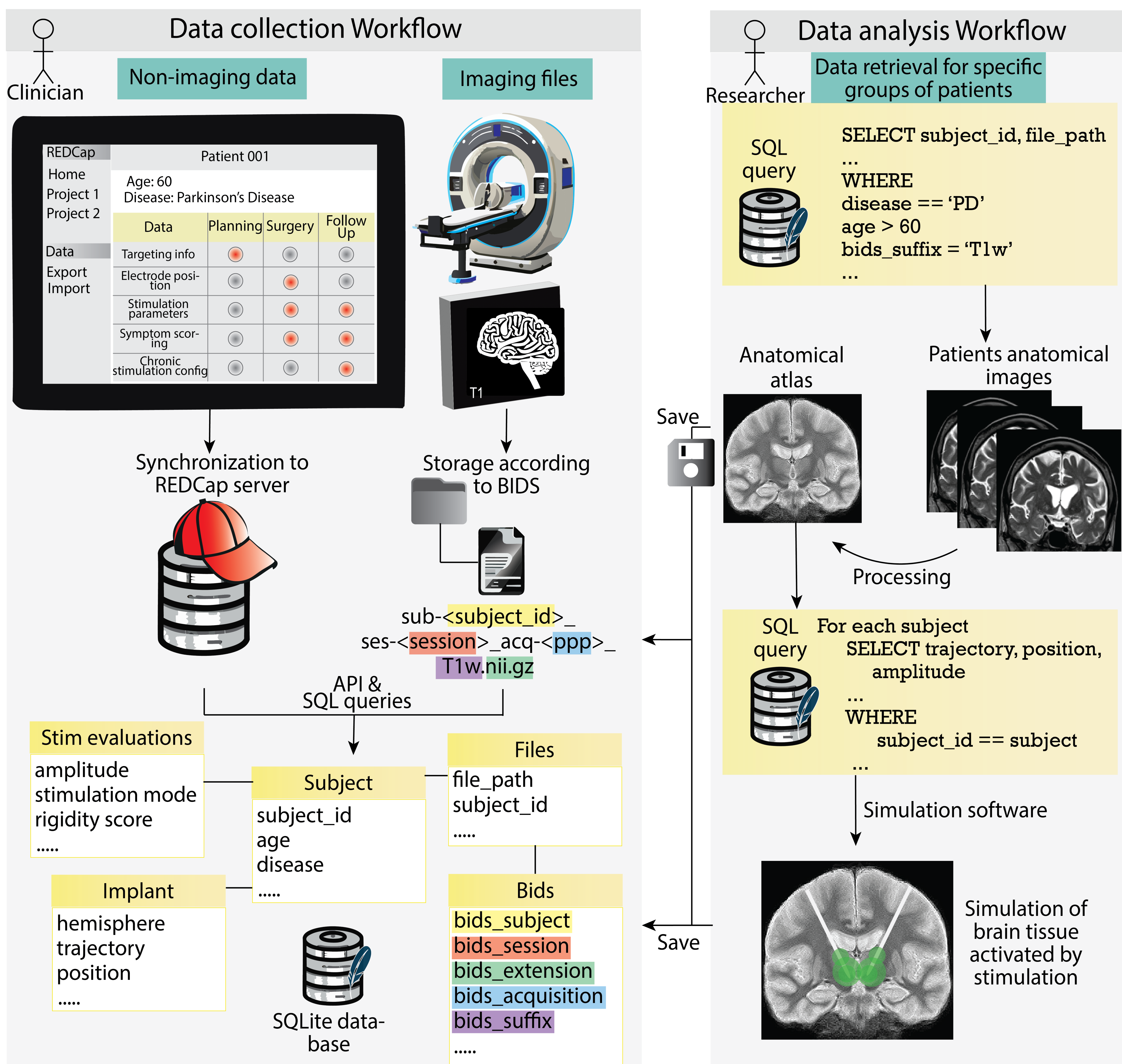
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Introduction

- ❖ Deep Brain Stimulation (DBS) research faces challenges in managing the heterogeneous data types generated during the patient's journey (e.g. clinical evaluations, medical images).
- ❖ This work proposes a framework for enhanced metadata capture leveraging Brain Imaging Data Structure (BIDS)[1] as standardized file structure and Research Electronic Data Capture (REDCap)[2] for validated data collection in hospital settings.
- ❖ BIDS and REDCap limitations are overcome through their integration with SQLite, a lightweight relational database management system.

Data type	REDCap	BIDS
Clinical	✓	✗
Image	✗	✓

Materials and Methods



The system caters to two primary user groups: clinicians and researchers.

Clinical (non-imaging) data management

- ❖ Collection via structured forms within REDCap.
- ❖ Transfer into SQLite database

Imaging data management

- ❖ Storage and transfer in the anonymized DICOMDIR format.
- ❖ Conversion into the Neuroimaging Informatics Technology Initiative (NIFTI) format
- ❖ Storage in a BIDS-compliant directory structure
- ❖ Establishment of image references within the SQLite database

Results

Data collected by 2 medical institutions with the proposed system was successfully fed to DBS processing pipelines.

Captured data	Database structure
University Hospital Basel	28 tables
University Hospital Clermont-Ferrand	230 data fields
107 patients	33 relationships
~35 imaging files per patient	

Discussion and Conclusions

The presented framework enables:

- ❖ Data collection and streamlining from clinics to research centers
- ❖ Heterogeneous data management and detailed metadata capture
- ❖ Data retrieval through a unique interface

It facilitates deeper and more efficient DBS research, potentially leading to improved clinical decision-making and patient outcomes.

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Literature:

[1] Krzysztof, G., Jean-Baptiste, P., David, K., B. N., Tibor, A., R., C., Guillaume, F., Satrajit, G., Vanessa, S., Ariel, R., Yaroslav, H., Michael, H., Christian, H., Karl, H., Camille, M., Thomas, N., Jessica, T., Samir, D., David, K., & Russell, P. (2015). Brain Imaging Data Structure - a new standard for describing and organizing human neuroimaging data. *Frontiers in Neuroscience*, 9.
 [2] Harris, P. A., Taylor, R., Thielke, R., Payne, J., Gonzalez, N., & Conde, J. G. (2009, April). Research electronic data capture (REDCap)—A metadata-driven methodology and workflow process for providing translational research informatics support. *Journal of Biomedical Informatics*, 42(2), 377–381

