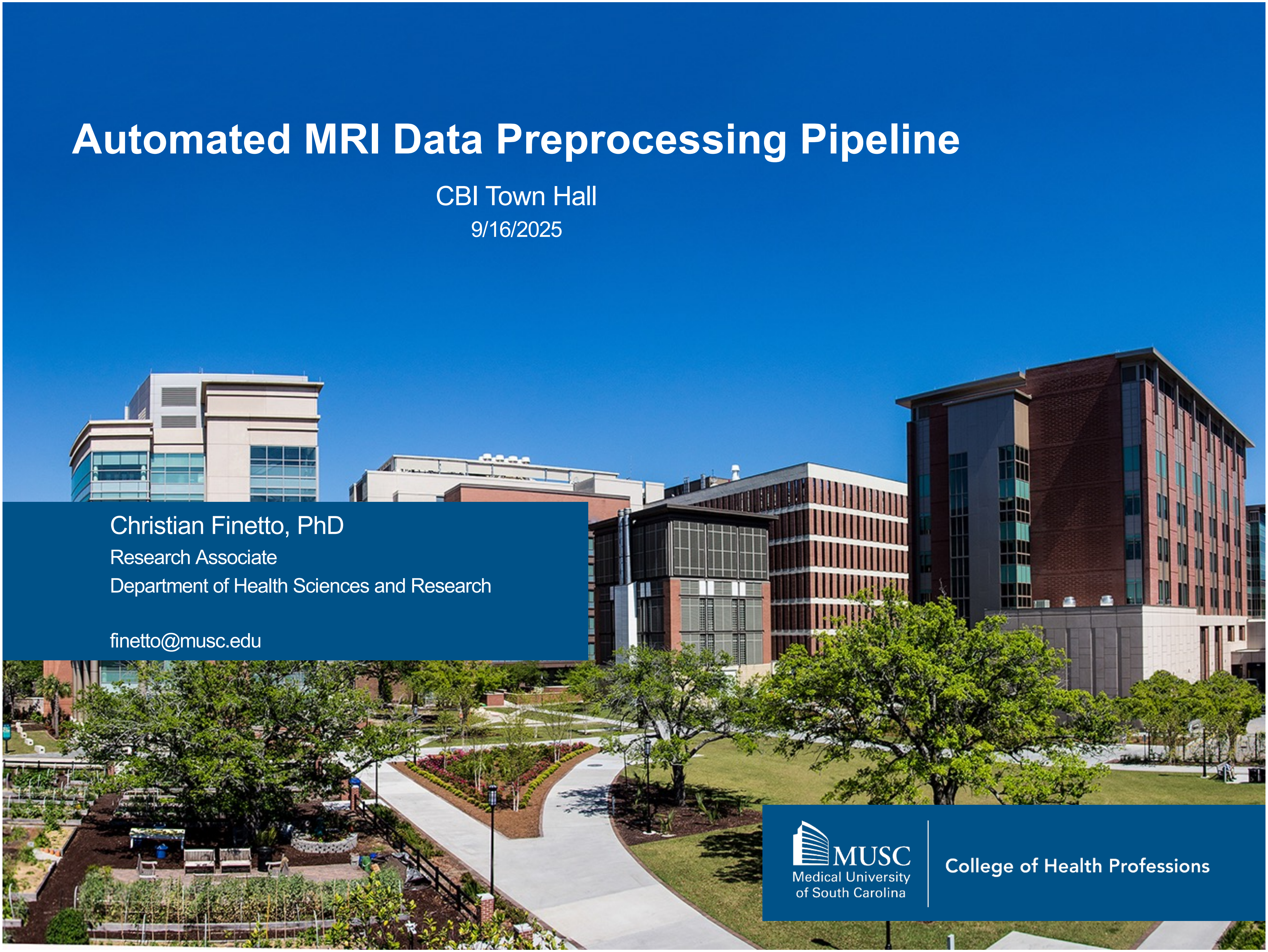

Automated MRI Data Preprocessing Pipeline

CBI Town Hall

9/16/2025

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MUSC Medical University of South Carolina | College of Health Professions

Automated MRI Data Preprocessing Pipeline

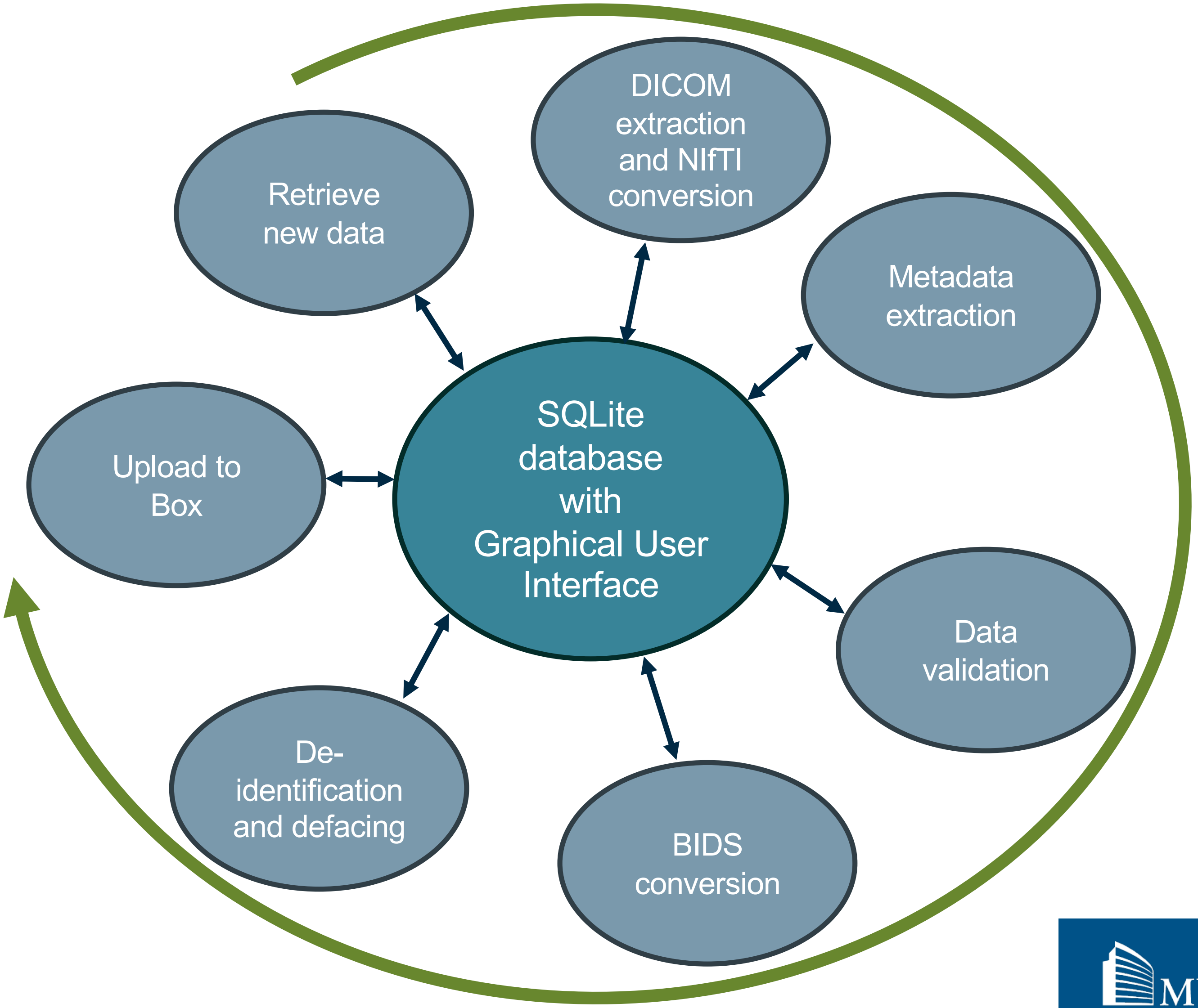
We developed this pipeline for Dr. Lisa McTeague’s DARPA RECOVERS study to streamline data preparation and automate repetitive tasks:

- Data retrieval (from CBI Home or from local folder)
- DICOM extraction and NIfTI conversion
- Metadata extraction
- Data validation
- Conversion to BIDS format
- De-identification and defacing
- Upload to Box

The pipeline can be easily adapted to other studies by modifying the configuration files

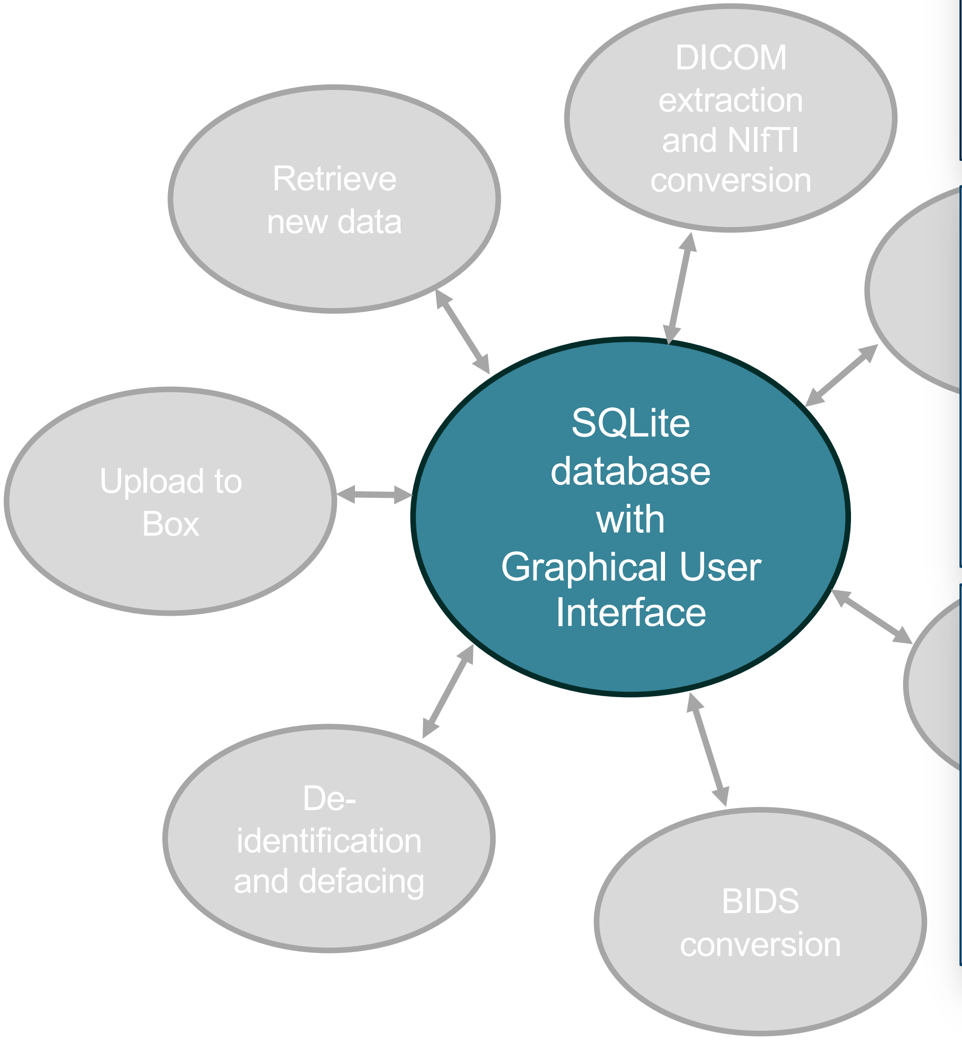
The software is freely available on GitHub:
https://github.com/finetto/musc-automated-imaging-pipeline

Automated MRI Data Preprocessing Pipeline



- Can be run manually or on a schedule
- Modular design (steps can be enabled or disabled)
- Fully local (except data download and upload)
- Database stores information on each participant, session and series
- Database stores current processing state for each session

Database and GUI



SQLite database with Graphical User Interface

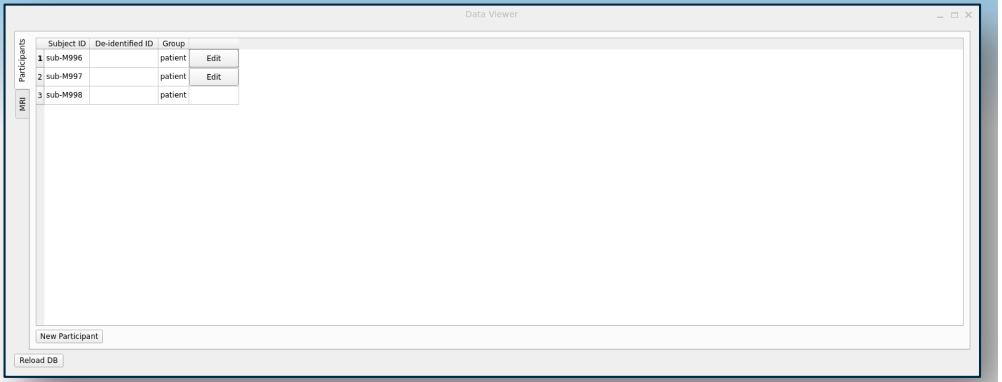
Retrieve new data

DICOM extraction and NIfTI conversion

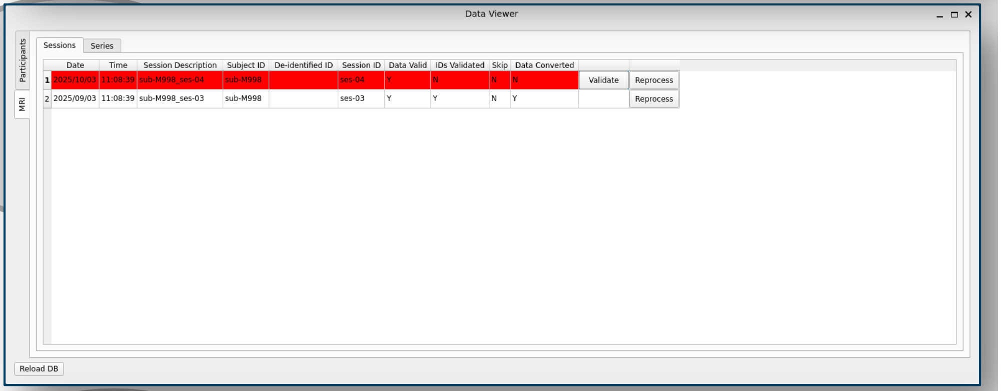
Upload to Box

De-identification and defacing

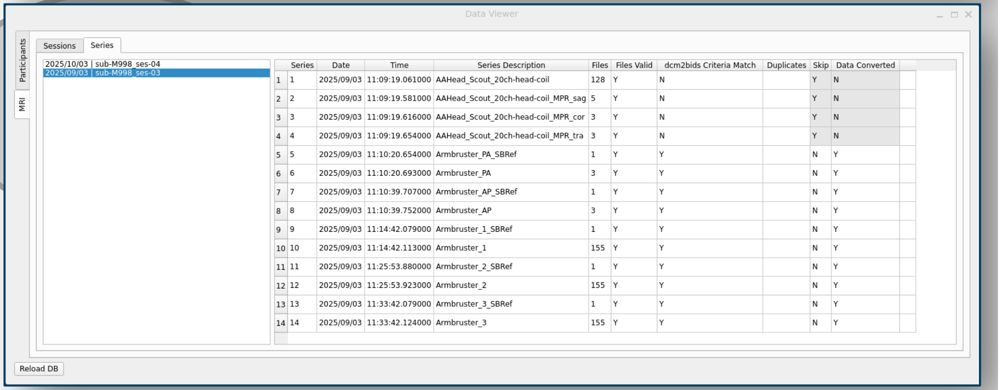
BIDS conversion



	Subject ID	De-identified ID	Group
1	sub-M996		patient
2	sub-M997		patient
3	sub-M998		patient



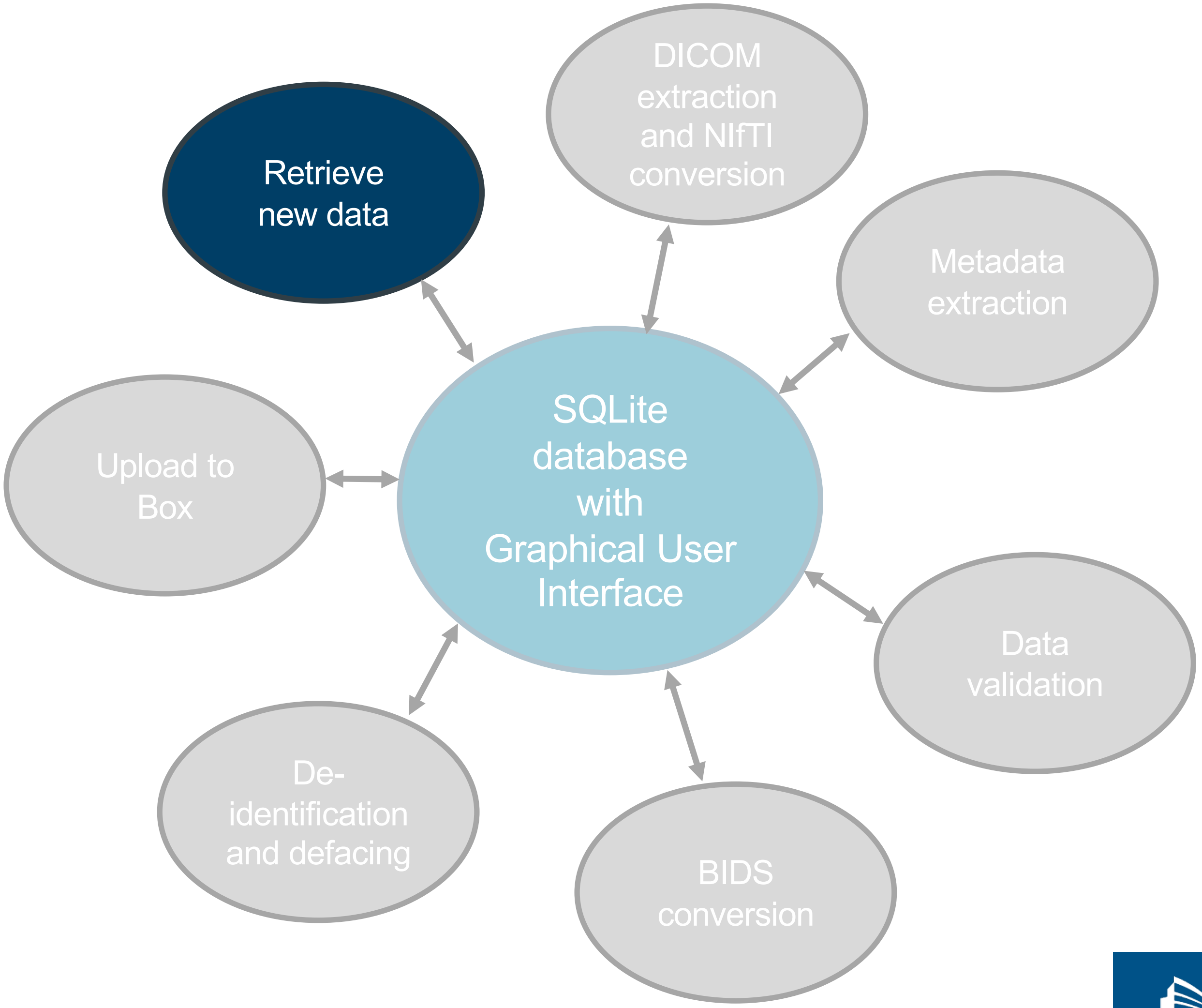
	Date	Time	Session Description	Subject ID	De-identified ID	Session ID	Data Valid	IDs Validated	Skip	Data Converted
1	2025/10/03	11:08:39	sub-M998_ses-04	sub-M998		ses-04	Y	N	N	N
2	2025/09/03	11:08:39	sub-M998_ses-03	sub-M998		ses-03	Y	Y	N	Y



2025/10/03 | sub-M998_ses-04
2025/09/03 | sub-M998_ses-03

	Series	Date	Time	Series Description	Files	Files Valid	dcm2bids Criteria Match	Duplicates	Skip	Data Converted
1	1	2025/09/03	11:09:19.061000	AAHead_Scout_20ch-head-coil	128	Y	N		Y	N
2	2	2025/09/03	11:09:19.581000	AAHead_Scout_20ch-head-coil_MPR_sag	5	Y	N		Y	N
3	3	2025/09/03	11:09:19.616000	AAHead_Scout_20ch-head-coil_MPR_cor	3	Y	N		Y	N
4	4	2025/09/03	11:09:19.654000	AAHead_Scout_20ch-head-coil_MPR_tra	3	Y	N		Y	N
5	5	2025/09/03	11:10:20.654000	Armbruster_PA_SBRef	1	Y	Y		N	Y
6	6	2025/09/03	11:10:20.693000	Armbruster_PA	3	Y	Y		N	Y
7	7	2025/09/03	11:10:39.707000	Armbruster_AP_SBRef	1	Y	Y		N	Y
8	8	2025/09/03	11:10:39.752000	Armbruster_AP	3	Y	Y		N	Y
9	9	2025/09/03	11:14:42.079000	Armbruster_1_SBRef	1	Y	Y		N	Y
10	10	2025/09/03	11:14:42.113000	Armbruster_1	155	Y	Y		N	Y
11	11	2025/09/03	11:25:53.880000	Armbruster_2_SBRef	1	Y	Y		N	Y
12	12	2025/09/03	11:25:53.923000	Armbruster_2	155	Y	Y		N	Y
13	13	2025/09/03	11:33:42.079000	Armbruster_3_SBRef	1	Y	Y		N	Y
14	14	2025/09/03	11:33:42.124000	Armbruster_3	155	Y	Y		N	Y

Data Retrieval



Retrieve new data

DICOM extraction and NIfTI conversion

Metadata extraction

Data validation

BIDS conversion

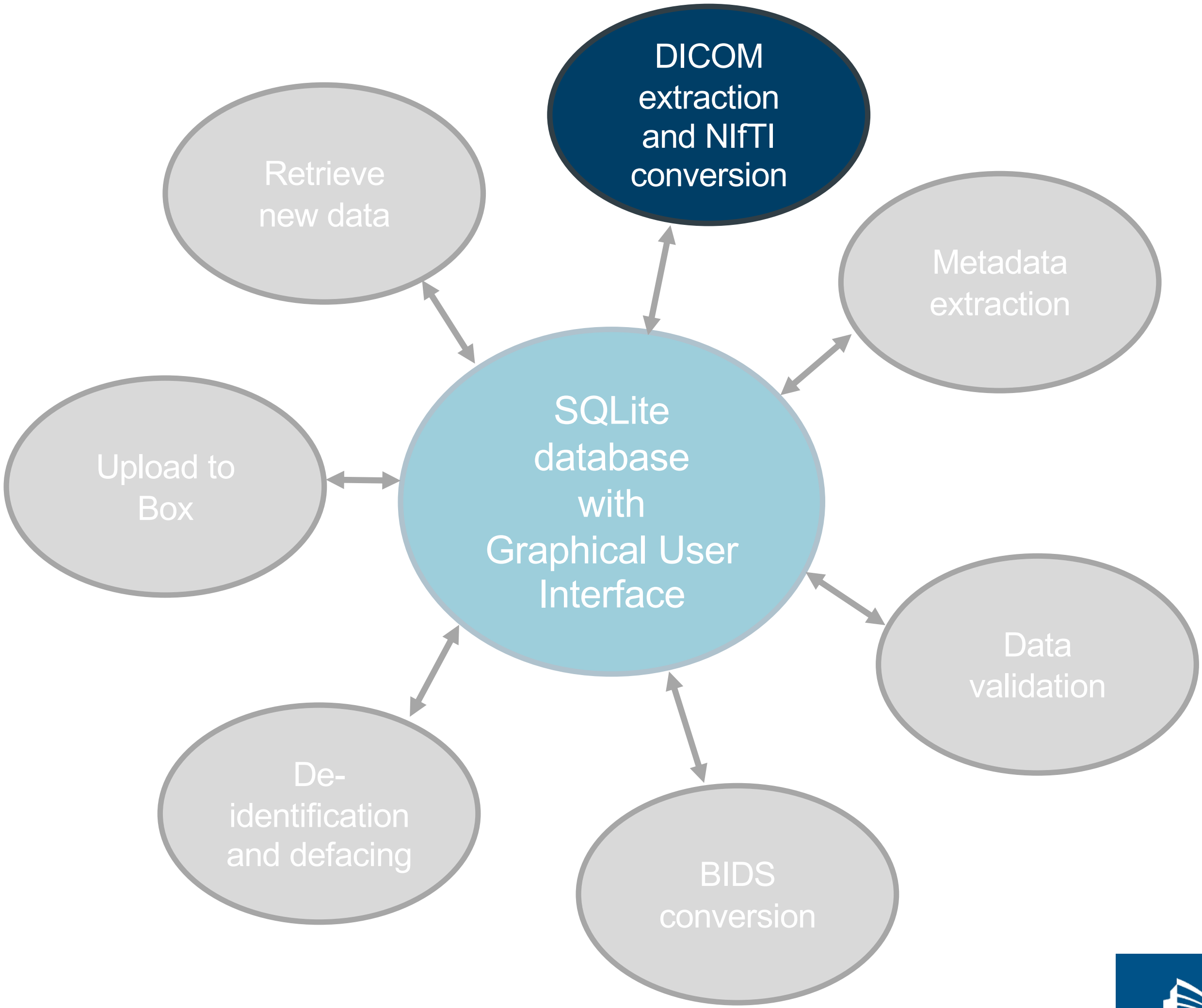
De-identification and defacing

Upload to Box

SQLite database with Graphical User Interface

- Scans the study folder on CBI home, or a local folder
- If a new session is found, the data is downloaded
- New sessions are added to the database, initiating all following steps

DICOM extraction and NIfTI conversion



DICOM extraction and NIfTI conversion

Retrieve new data

Metadata extraction

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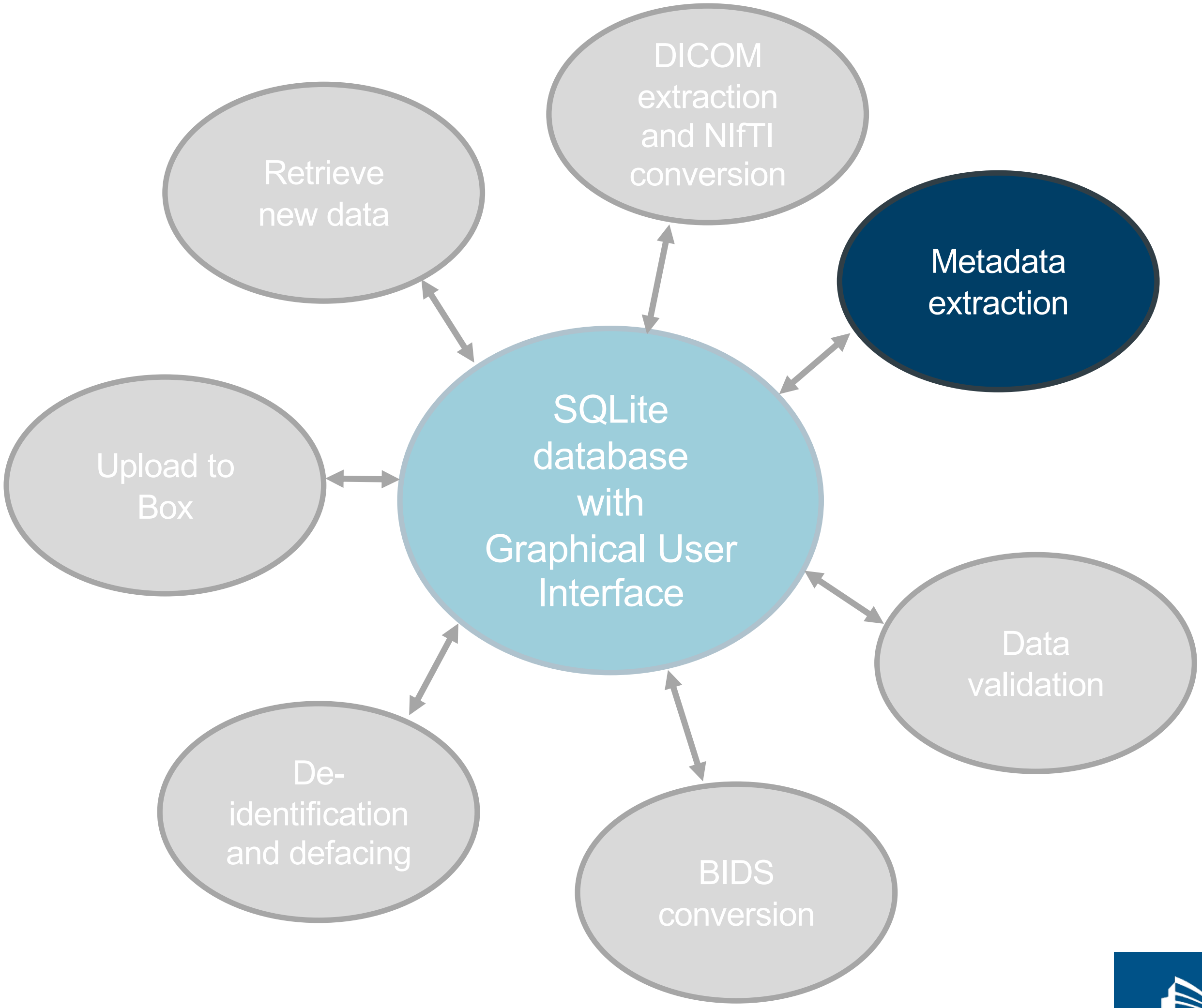
BIDS conversion

- Extract the downloaded zip file
- Use dcm2niix [1] to convert to NIfTI
- Get all series for the session and add them to the database

[1] https://github.com/rordenlab/dcm2niix

Metadata extraction


Retrieve new data

DICOM extraction and NIfTI conversion

Metadata extraction

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Data validation

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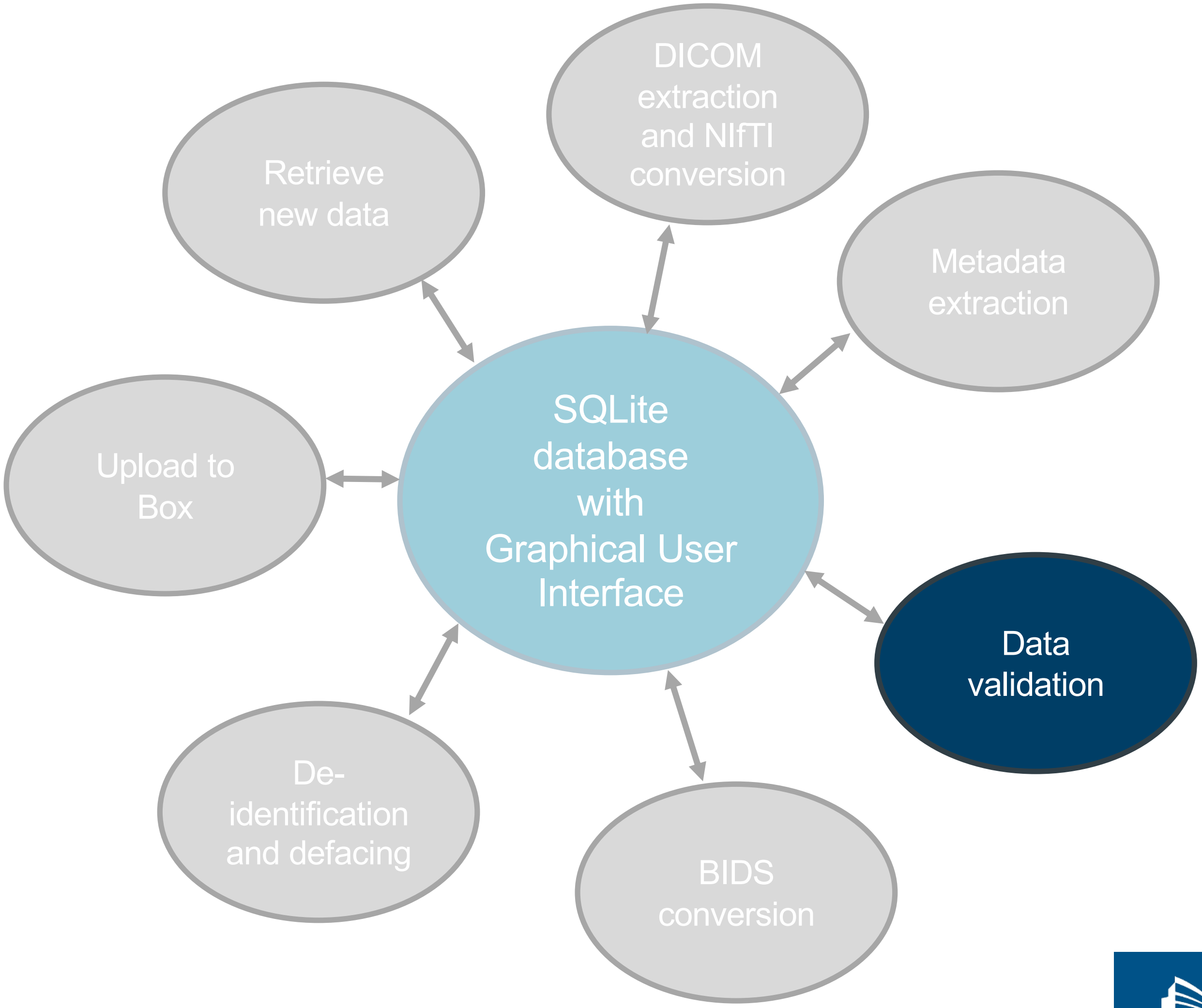
BIDS conversion

- Extract timestamp, subject ID and session ID from data file name
- Extract series information from sidecar file

Data validation


Retrieve new data

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Data validation

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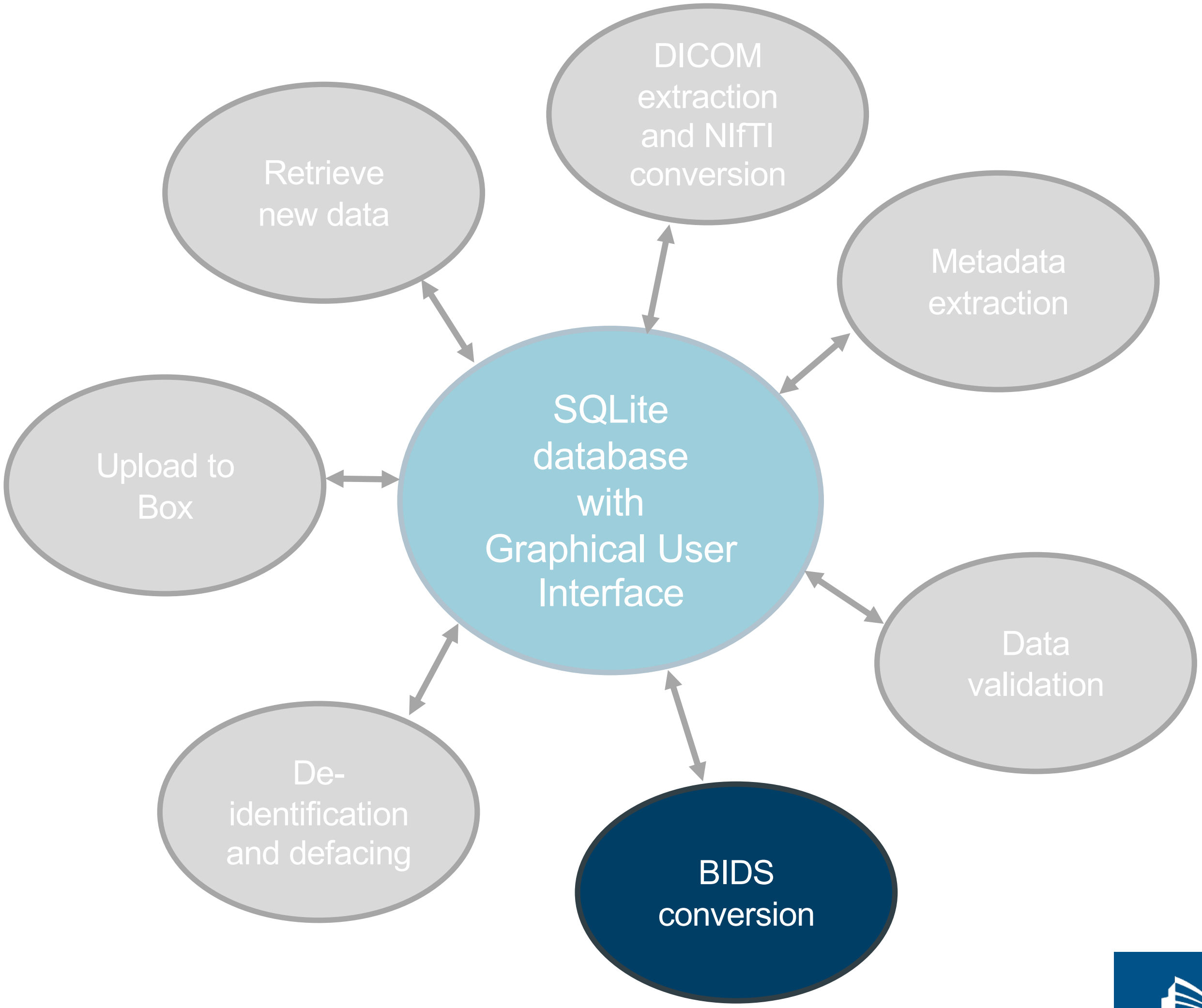
BIDS conversion

- Make sure files were extracted correctly
- Match dcm2bids criteria to each series
- Identify duplicate series (only one will be processed)
- Make sure the extracted series match the CBI Summary file (if available)
- Ask user to confirm subject ID and session ID
- User can mark sessions or series to skip

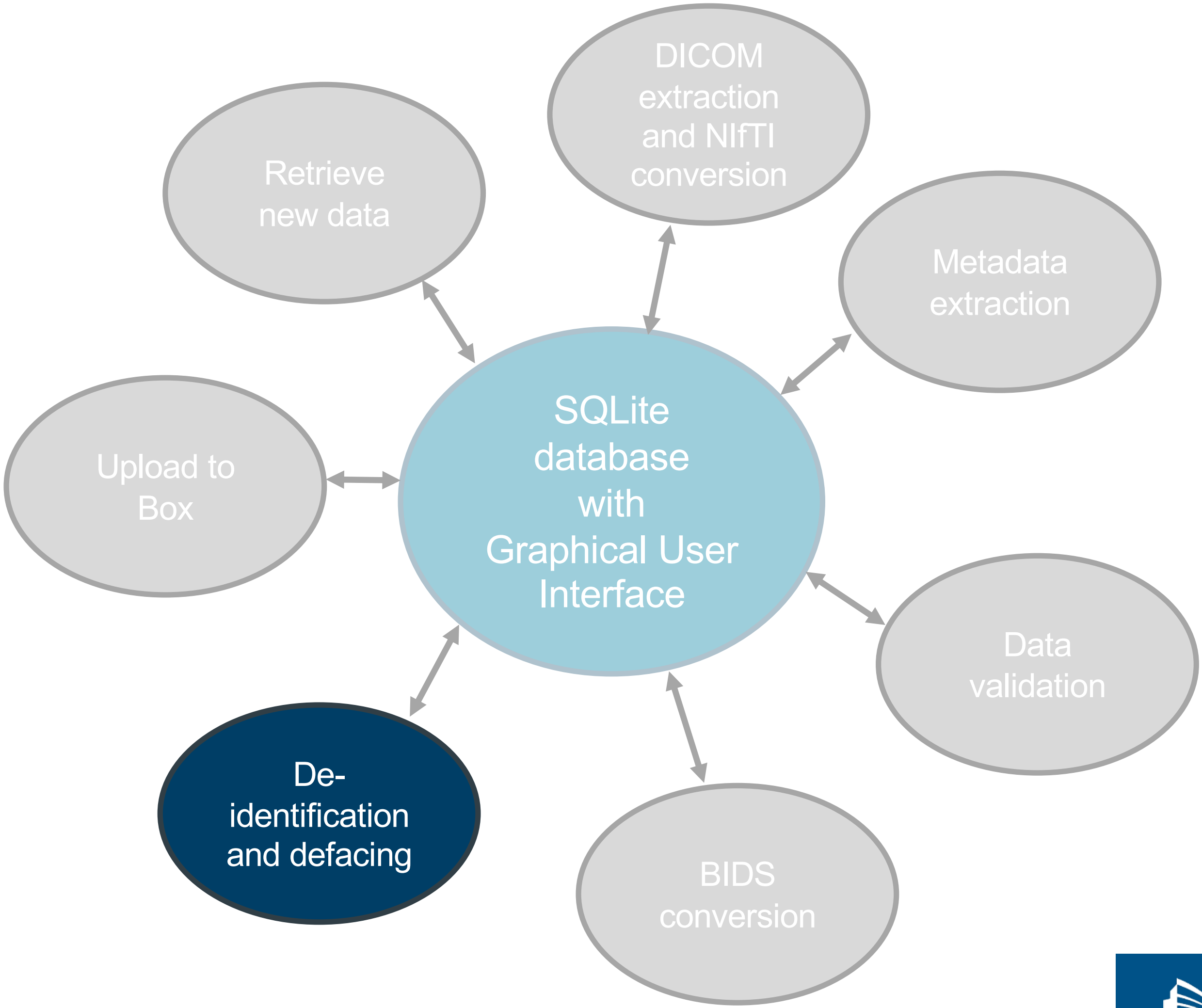
BIDS conversion



- Sessions that passed data validation will be converted to BIDS format
- NIfTI files are converted using dcm2bids [2]
- User needs to define a dcm2bids configuration file

[2] https://unfmontreal.github.io/Dcm2Bids/3.2.0/

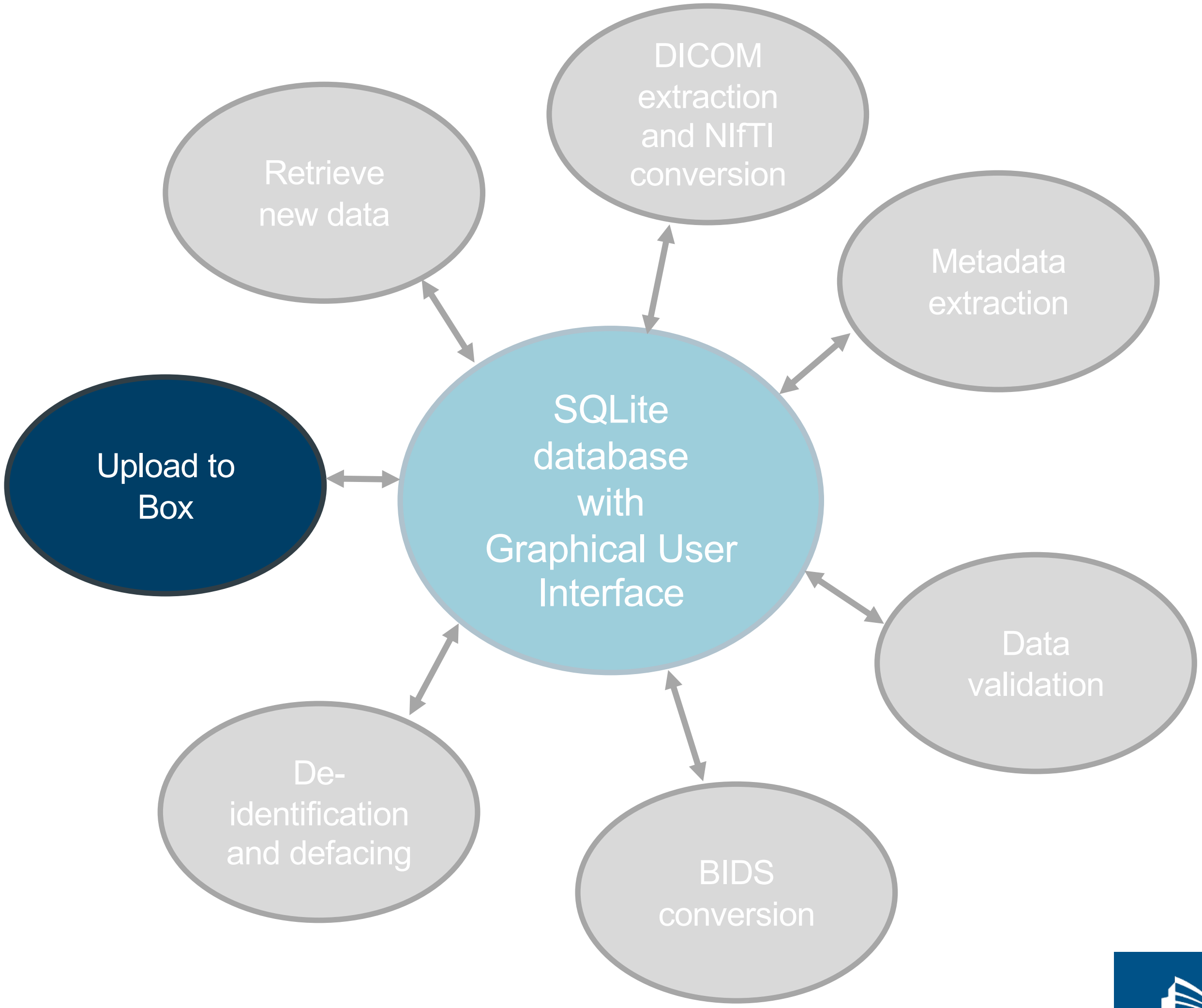
De-identification and defacing



- Optional step
- De-identified IDs are either assigned to subject or automatically generated
- All files are renamed using de-identified subject IDs
- Anatomical images are defaced using FSL [3] and pydeface [4]
- De-identified data is stored in separate folder structure

[3] https://fsl.fmrib.ox.ac.uk/fsl
[4] https://github.com/poldracklab/pydeface

Data upload to Box


SQLite database with Graphical User Interface

Retrieve new data

DICOM extraction and NIfTI conversion

Metadata extraction

Data validation

BIDS conversion

De-identification and defacing

Upload to Box

- Optional step
- Data is uploaded to Box using Box SDK [5]
- Source data, converted data and de-identified data are uploaded to separate folders
- For each file, the upload is verified and repeated if necessary
- Database and config files are backed up to Box as well

[5] https://github.com/box/box-python-sdk-gen

Installation and configuration

Installation

- Tested on Ubuntu and WSL2
- Instructions provided in the repository *README* file
- To install, download/clone the repository and run the *install.sh* script

Configuration

- There are several configuration files that need to be added and/or modified
  - Database configuration
  - Data download configuration (CBI Home or local folder)
  - Study configuration (e.g. study name, format of IDs,…)
  - Processing configuration (e.g. destination folders)
  - Box configuration
  - Notifications
- If synchronizing from CBI Home, one needs to create a credentials file
- A dcm2bids configuration file is necessary for the BIDS conversion

Running the pipeline

- The pipeline can be run on a schedule (e.g. every hour). This is configured automatically when running the installation script
- The pipeline can also be run manually with the *run_mri_pipeline.sh* script
- To launch the Data Viewer GUI, one can use the *run_data_viewer.sh* script

Software demo