



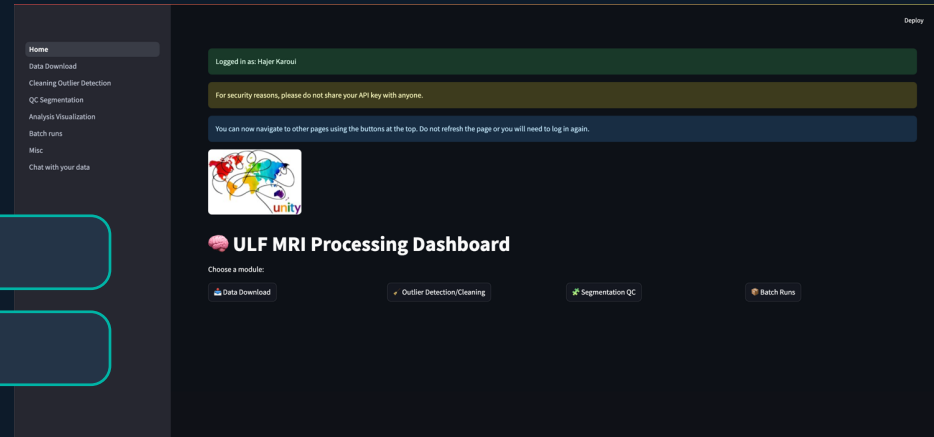
A browser interface for managing multi-site MRI research data

Multi-site neuroimaging

ULF MRI

Open-source

LMIC & HIC



UNITY Network · Ultra-Low-Field MRI · King's College London

Speaker: Hajer Karoui

The Challenge

40+ Hyperfine Swoop 64mT MRI systems · HIC & LMIC sites · Centralised Flywheel platform



Data Retrieval

Fetching derivatives from multi-project Flywheel required manual SDK scripting — inaccessible to most collaborators



QC & Cleaning

Brain segmentation QC and outlier detection had no unified interface or process, creating bottlenecks and method inconsistency across sites



Unequal Access

Technical barriers excluded LMIC collaborators with limited RSE capacity from participating in data workflows

UNITY Network: Ultra low field neuroimaging in the Young

unity-genie: What It Does

Browser-based · Authenticated · No command-line required

Data Download



Fetch harmonised derivatives from multiple Flywheel projects into a single CSV

→ Full provenance logging

Cleaning & Outlier Detection



Statistical outlier detection across processing tools with two-level intersection logic

→ Tool-agnostic · Expert-designed

Segmentation QC



Interactive brain QC — MP4 scrolling video or PNG grid modes, with structured review forms

→ No local data download

Batch Gear Execution



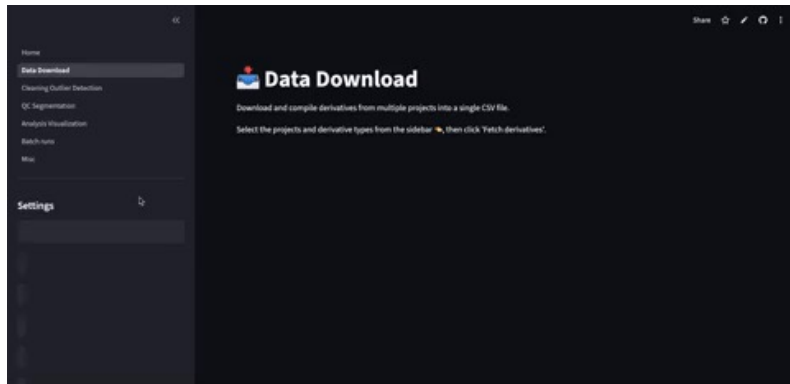
Launch batch processing jobs on Flywheel gears without SDK knowledge

→ Avoids redundant reprocessing

All outputs log: MRI software version · gear version · Flywheel analysis ID

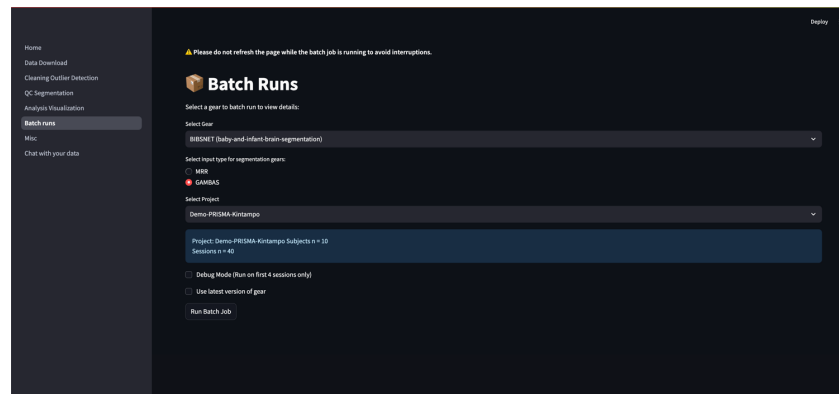
App in Action

Data Download



Multi-project selection · Brain Segmentation Tool filter (minimorph, recon-all-clinical, supersynth) · Single harmonised CSV output

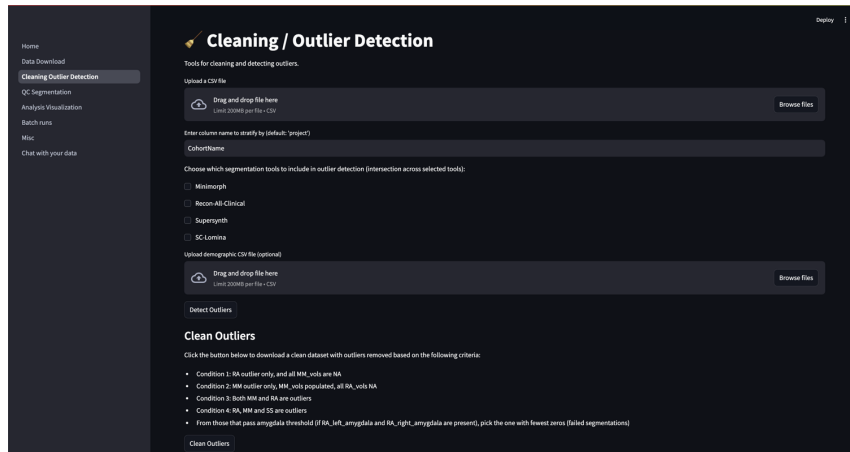
Batch runs



Submit jobs to Flywheel without SDK scripts · Avoids repeated analyses

App in Action

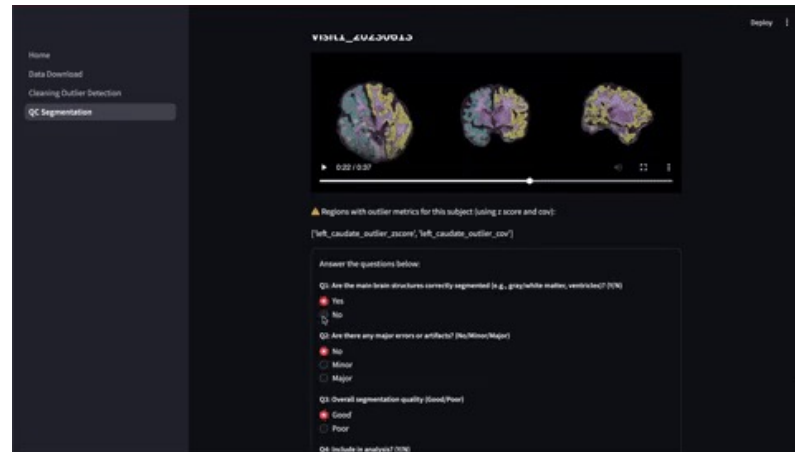
Outlier Detection



The screenshot shows the 'Cleaning / Outlier Detection' interface. On the left is a sidebar with navigation links: Home, Data Download, Cleaning Outlier Detection (selected), QC Segmentation, Analysis Visualization, Batch runs, Misc, and Chat with your data. The main panel has a title 'Cleaning / Outlier Detection' and a subtitle 'Tools for cleaning and detecting outliers.' It includes two file upload sections: 'Upload z CSV file' and 'Upload demographic CSV file (optional)', both with 'Drag and drop file here' instructions and 'Browse files' buttons. Below these is a 'Detect Outliers' button. A section titled 'Clean Outliers' provides criteria for outlier removal: Condition 1: RA outlier only, and all MM_vols are NA; Condition 2: MM outlier only, MM_vols populated, all RA_vols NA; Condition 3: Both MM and RA are outliers; Condition 4: RA, MM and SS are outliers; and a note to pick the one with fewest zeros from those passing an amygdala threshold. A 'Clean Outliers' button is at the bottom.

Unified and consistent outlier detection across sites and projects

Segmentation QC



The screenshot shows the 'QC Segmentation' interface. The sidebar is identical to the first app. The main panel has a title 'QC Segmentation' and a subtitle 'Regions with outlier metrics for this subject (using z score and cov):'. It displays three brain slices with segmented regions. Below the slices is a video player showing a scrolling MP4 of the segmentation. A section titled 'Answer the questions below:' contains four questions (Q1-Q4) with radio button options. Q1 asks if main brain structures are correctly segmented. Q2 asks if there are any major errors or artifacts. Q3 asks for overall segmentation quality. Q4 asks if the subject is analyzed. A 'Deploy' button is in the top right corner.

Outlier-flagged regions highlighted · Scrolling MP4 or PNG modes · Structured review form per subject

Built to Last

Software engineering best practices · from the start



Version Control

GitHub · feature branches · PR reviews



CI/CD

Continuous integration and deployment pipeline



User-driven Design

Iterative feedback from data managers across LMIC & HIC sites



Modular Architecture

Each module independently maintainable



Provenance

Software, gear & analysis IDs logged per output



Open-source

Locally deployable · accessible on GitHub

Impact & What's Next

40+

MRI sites
across HIC & LMIC

4+

Integrated
workflow modules

0

Lines of code
required by users

What Changed

- **Reproducibility**
- Reducing the technical burden and democratizing collaborator participation
- Freeing up time for the (*very small*) RSE support team



What's next

- Contributor guidelines
- Public Roadmap
- **Security!**



unity-app.streamlit.app



github.com/hajerkr/unity-genie

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