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Quality control for fetal brain MRI

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CONTEXT

The multi-FACT study in a few words

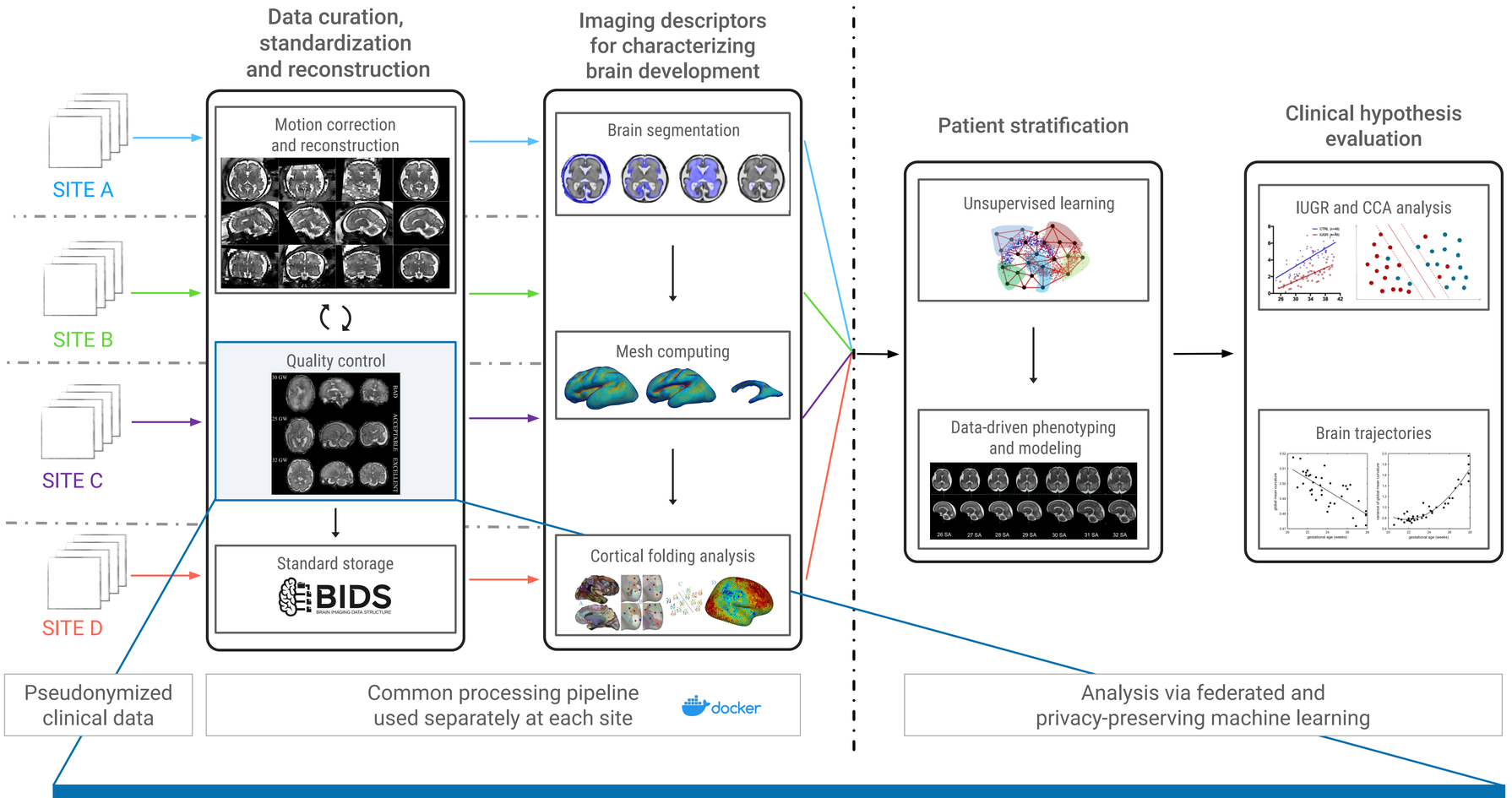
Goal. Characterize fetal abnormal brain trajectory using MRI in a large scale, multi-centric retrospective study

Challenge. Privacy concerns, cannot share data between centers

Solution.

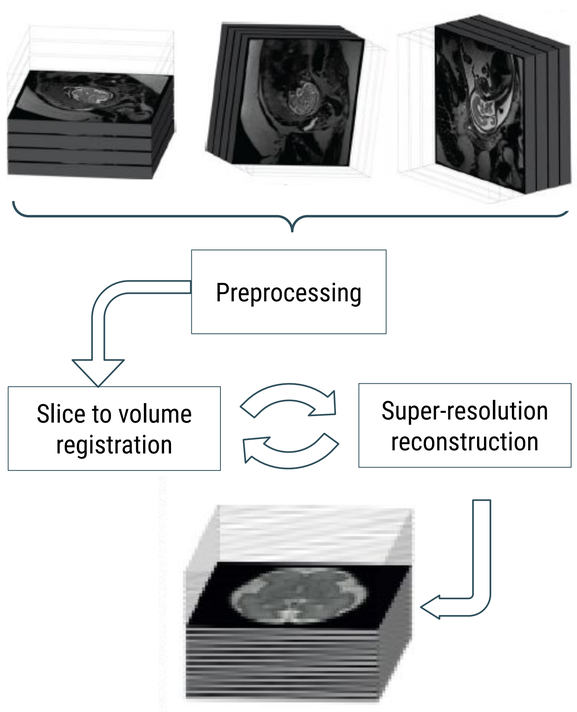
1. Data standardisation
2. Privacy preserving ML

The project just started!



RECONSTRUCTION

From low-resolution (LR) series (thick slices in various orientations) to high resolution (HR) volumes:



QUALITY CONTROL

Issue

Bad quality *input* ⇨ Bad quality *output*
Quality can vary *drastically* between stacks.

Proposed Solution

1. **Fetal QC.** Collect quality ratings on LR series
2. **Quality control model.** Learn to predict quality ratings

Fetal QC

A easily-shareable tool to *facilitate* quality annotations and *standardise* QC for fetal brain MRI, based on MRIQC [1].

Quality control model

1. Extract features from images (*image quality metrics* - IQMs)
2. Predict quality ratings (regression model)

Focus on image quality metrics

Assessing the quality of LR fetal brain series requires *specialized* metrics.

Examples include

- Brain mask centroid across slices
- Low-rank representation of the brain [2]
- Normalized Cross-Correlation across a series [3]
- Mutual information across a series [3]
- Pretrained NN for slice-wise quality assessment [4]

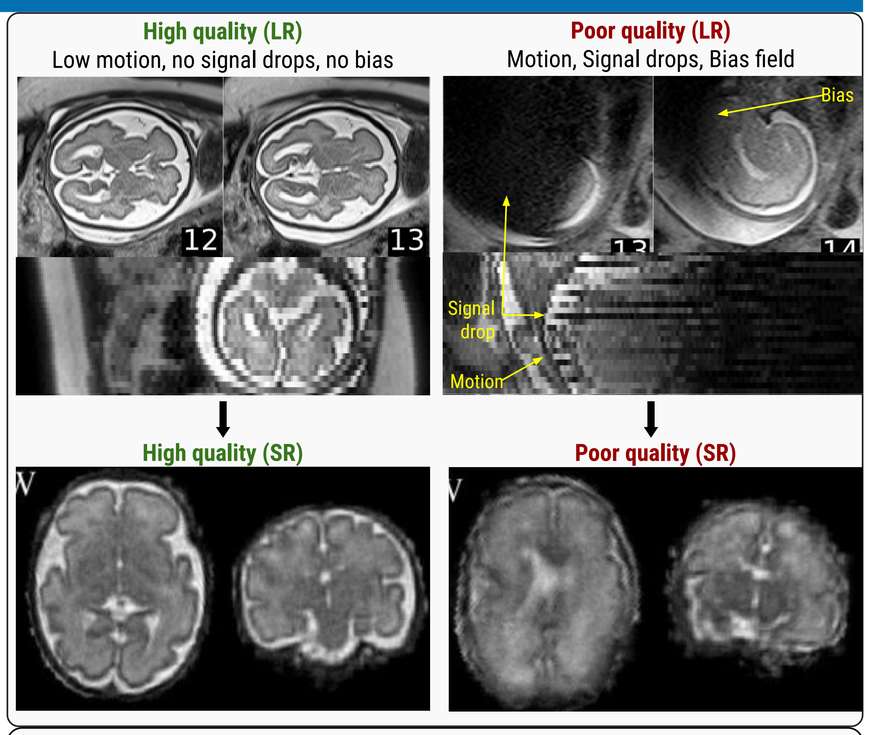
Preliminary results

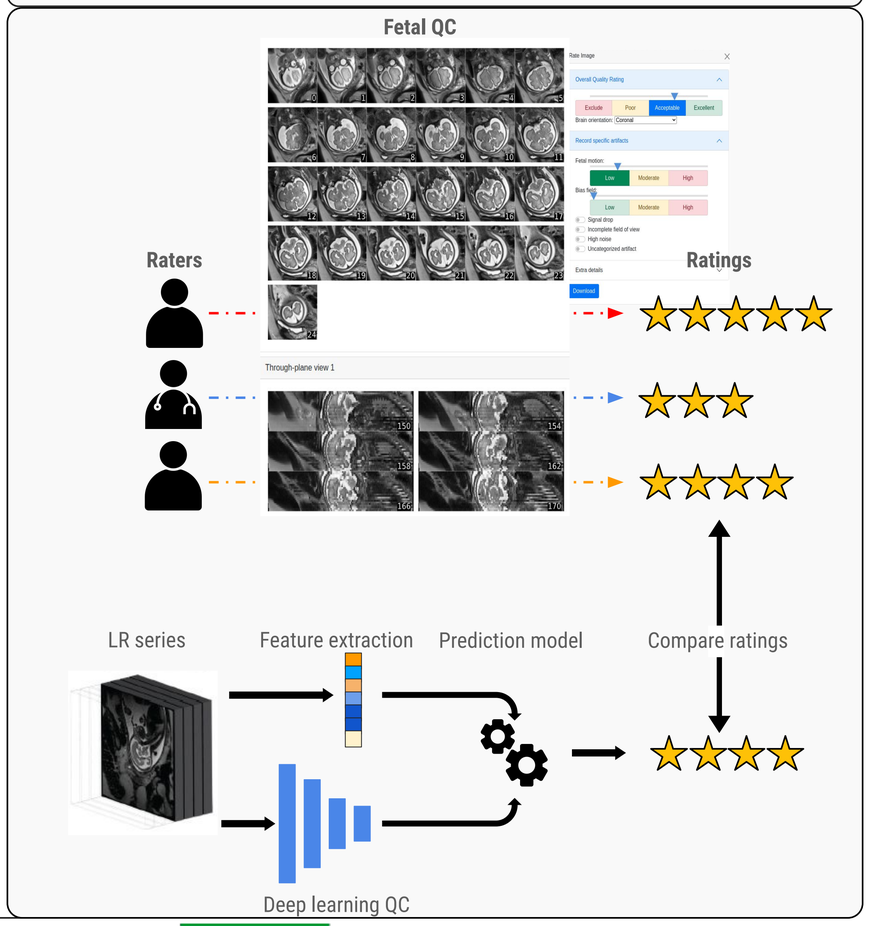
(N=50 scans)

Feature-based prediction reaches *60%* accuracy
Fair inter-agreement rater (0.459)

Preliminary Conclusion

1. Need a larger scale evaluation
2. Need a rating *protocol* to increase rater agreement
3. Need additional quality metrics





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REFERENCES

[1] Esteban, Oscar, et al. (2017). *PloS one*.
[2] Kainz, Bernhard, et al. (2015). *IEEE TMI*.
[3] Ebner, Michael, et al. (2020). *NeuroImage*.
[4] Xu, Junshen, et al. (2020). *MICCAI*.

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