

# Framework and Tools for Human Knee Cartilage Morphometrics

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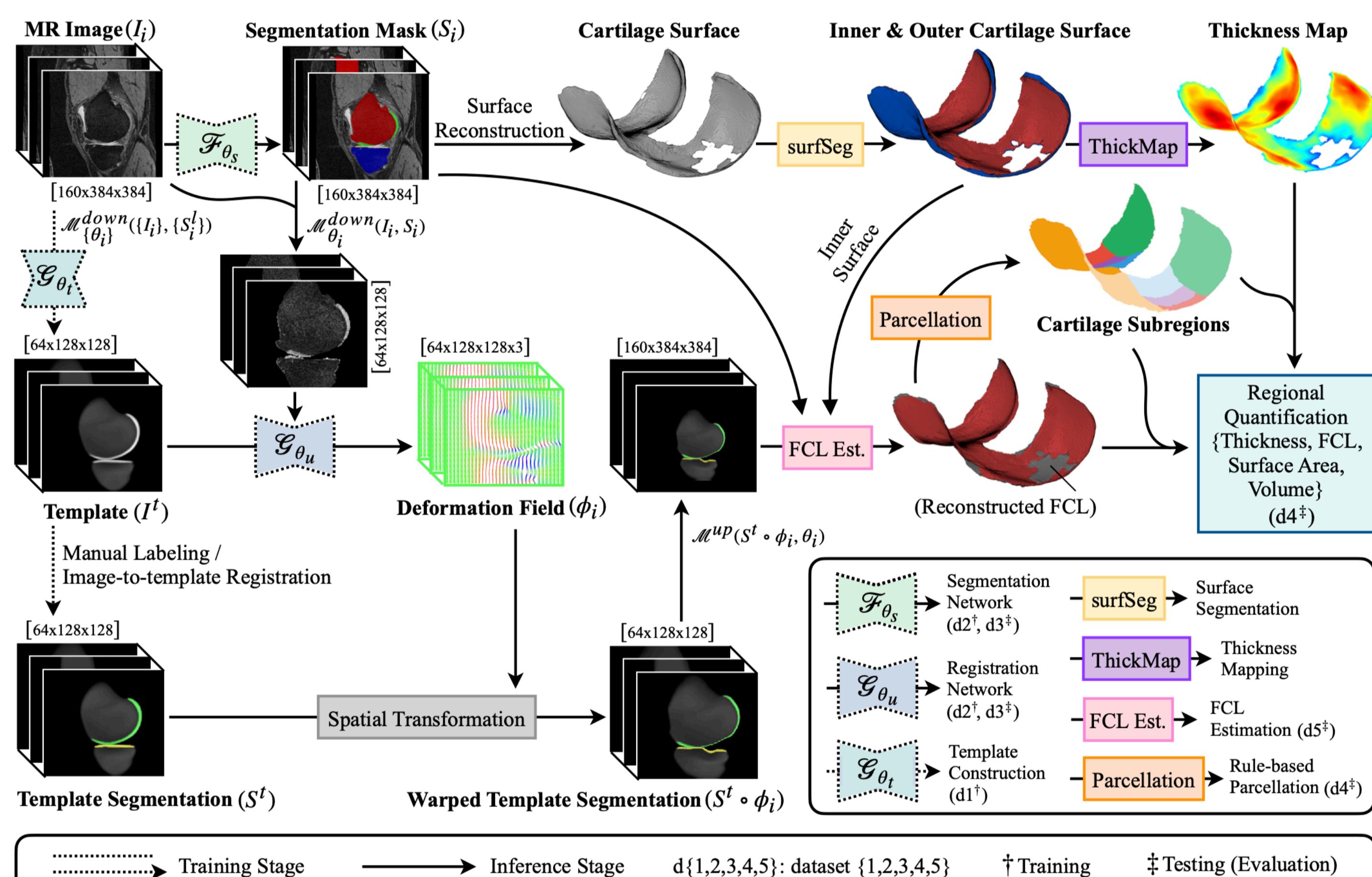
UK Research  
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## 1. Objective

Quantitative metrics and imaging biomarkers derived from medical images can benefit early disease detection and intervention, disease monitoring, clinical practice, and the development of new treatments and disease-modifying drugs. Our objective is to develop a deep-learning-powered out-of-the-box solution for knee cartilage morphometrics.

## 2. Framework: CartiMorph [1]

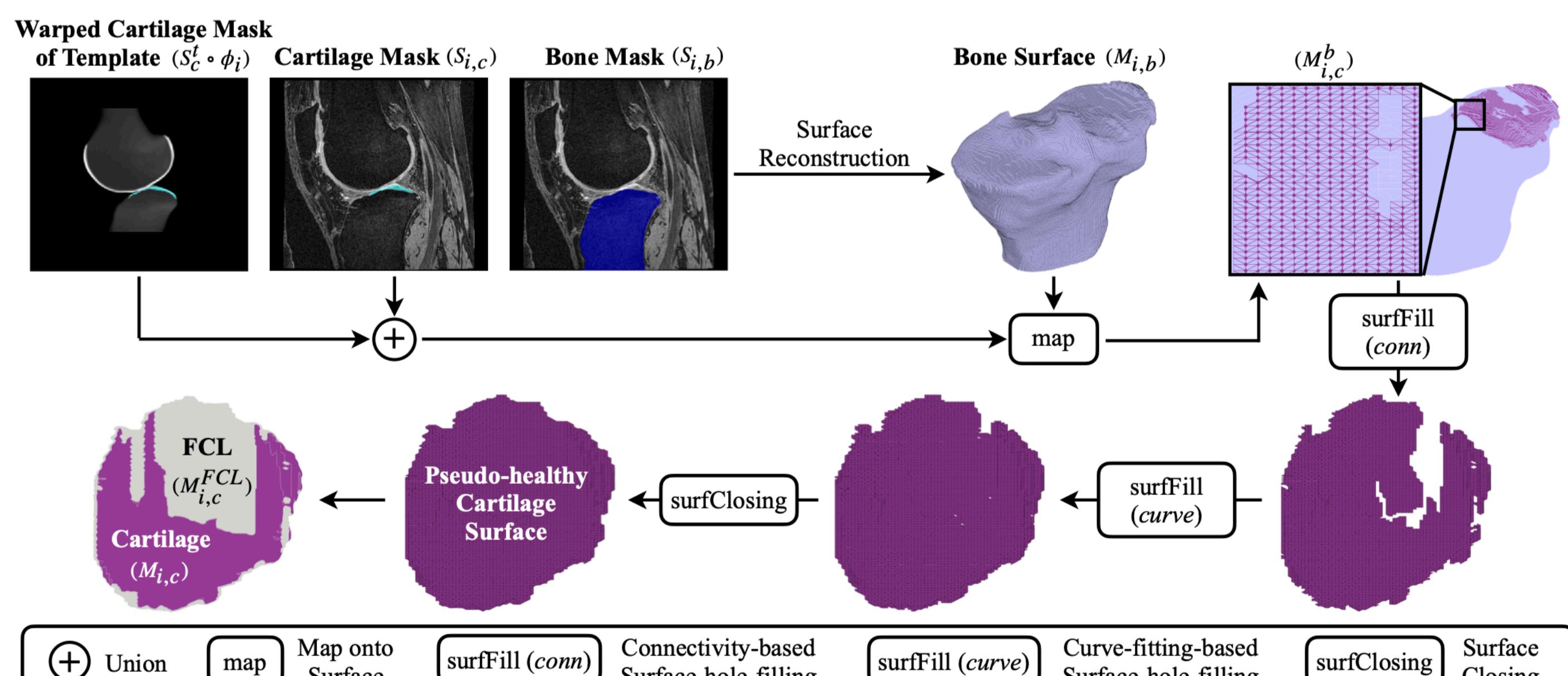
The proposed framework is designed to output quantitative regional metrics from knee MR images. We trained models for segmentation, registration, and template learning on the OAIZIB dataset. We developed algorithms for thickness mapping, lesion quantification, and subregion partitioning.



## 3.1 Methods & Results

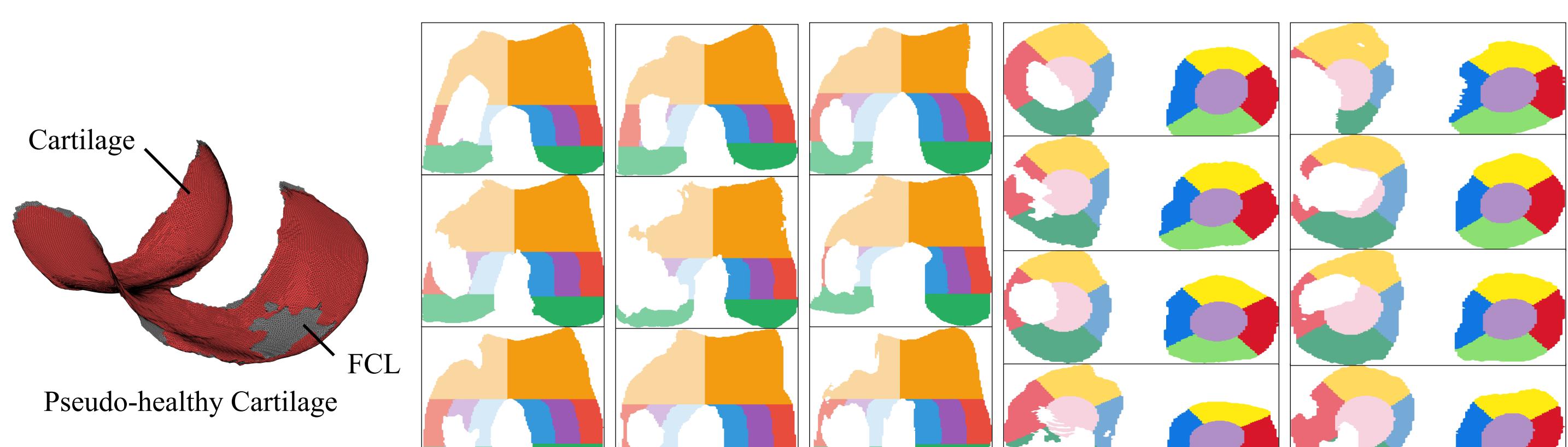
### Q: How to estimate Full-thickness Cartilage Loss (FCL) ?

A: Segmentation + Template Learning + Registration + Surface Processing



### Q: How to partition cartilages with severe lesions ?

A: Pseudo-healthy Cartilage Reconstruction + Rule-based Partitioning



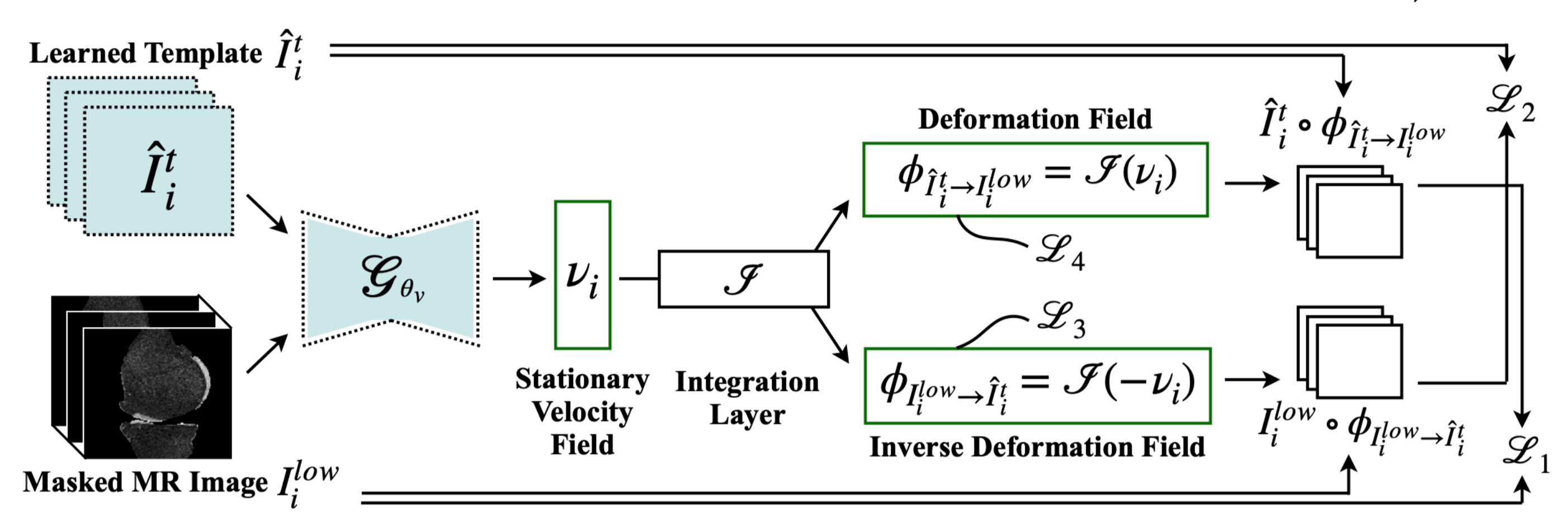
## 3.2 Methods & Results

### Q: How to measure cartilage thickness?

A: Segmentation + Surface-normal-based Thickness Mapping

### Q: How to learn a template?

A: a model with a learnable template  $\hat{I}_i^t$  and a registration subnetwork  $\mathcal{G}_{\theta_v}$



## 4. Tools: CMT & CMV

- ❖ Implement CartiMorph
- ❖ Models training, fine-tuning, evaluation, inference, sharing
- ❖ Auto-configuration & standardisation
- ❖ Built-in data visualisation
- ❖ Standalone data visualisation
- ❖ Multiple platforms support



## 5. Summary

- ❖ CartiMorph: a framework for knee cartilage morphometrics
- ❖ CartiMorph-Toolbox: an image-to-metrics data processing tool
- ❖ CartiMorph-Viewer: a standalone visualisation tool

## Acknowledgement

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## Reference & Resources

1. Yao, Yongcheng, et al. "CartiMorph: A framework for automated knee articular cartilage morphometrics." *Medical Image Analysis* 91 (2024): 103035.



CartiMorph



CMT



CMV



video