

## MICCAI Special Interest Group Biomedical Image Registration (SIG-BIR)

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### Motivation/ Mission

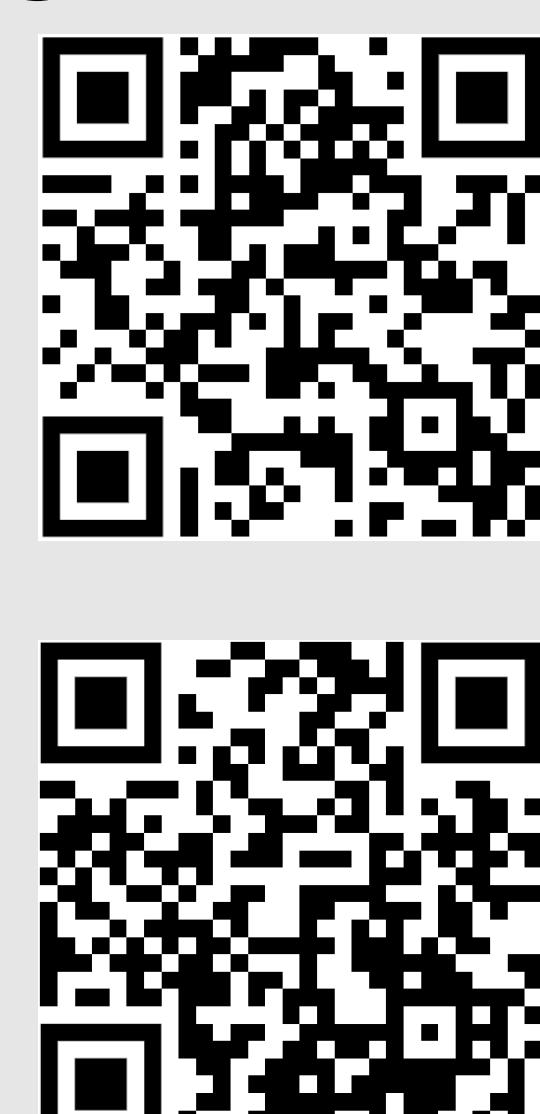
Image registration's importance in medical imaging is underrepresented at MICCAI, attributed to the complexity of applying deep learning to its ill-posed nature w/o ground truth.

There is still much **scope for novel methods** (research gap) to **improve clinical impact**.

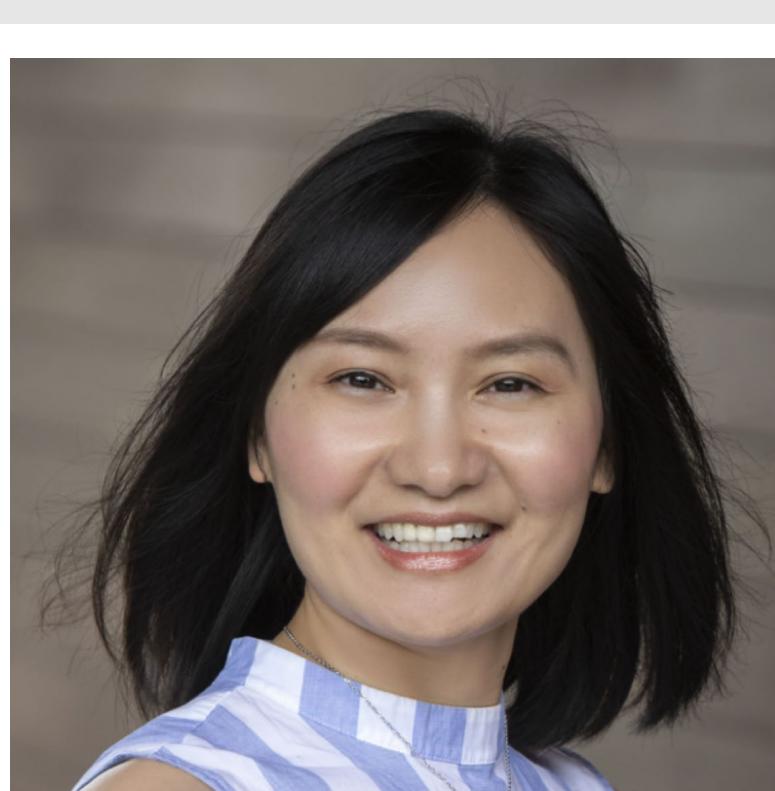
Not yet a one-fits all solution available. The fragmented image registration community would **benefit from specialized gatherings** to enhance collaboration and research ties.

### Learn2Reg 2024

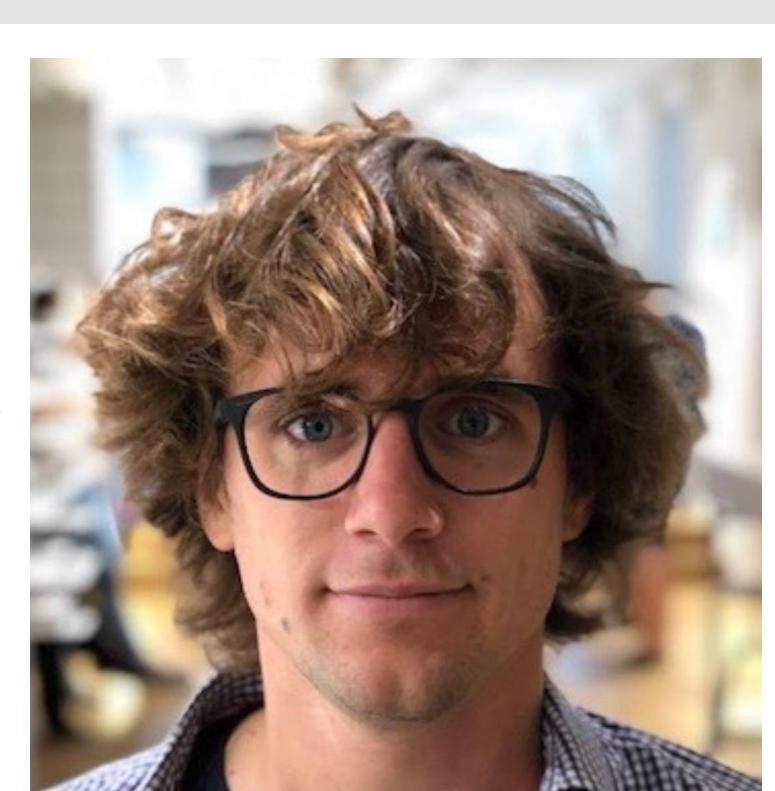
- Earlier editions (2020–2023) revealed gaps in **scale, modality diversity, and task complexity**.
- 2024 introduced three new tasks:**
  - ReMIND2Reg:** multimodal iUS–MRI alignment for brain surgery, hundreds of scan pairs, post-resection focus.
  - LUMIR:** large-scale unsupervised inter-subject brain MRI registration.
  - COMULISglobe:** first microscopy benchmark, expanding beyond radiology.
- Inspired new methods: **invertibility constraints, pyramid features, keypoint alignment, instance optimization**.
- Broadened scope drives **robust, generalizable algorithms** with direct clinical relevance.
- See our papers summarizing **Learn2Reg 2024**:
  - [1] L. Hansen *et al.*, "Learn2Reg 2024: New Benchmark Datasets Driving Progress on New Challenges," arXiv:2509.01217, 2025.
  - [2] J. Chen *et al.*, "Beyond the LUMIR Challenge: The Pathway to Foundational Registration Models," arXiv:2505.24160, 2025.



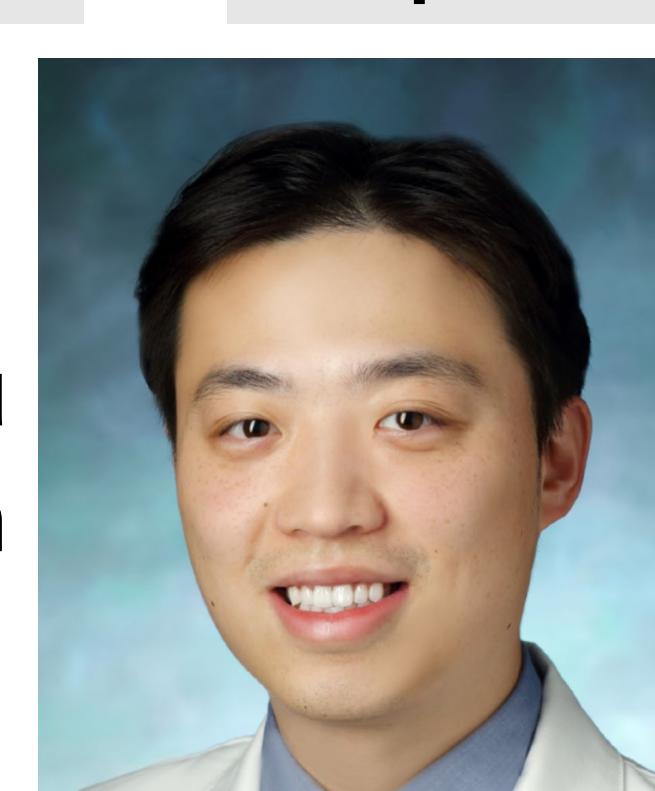
Miaomiao  
Zhang



Mattias  
Heinrich



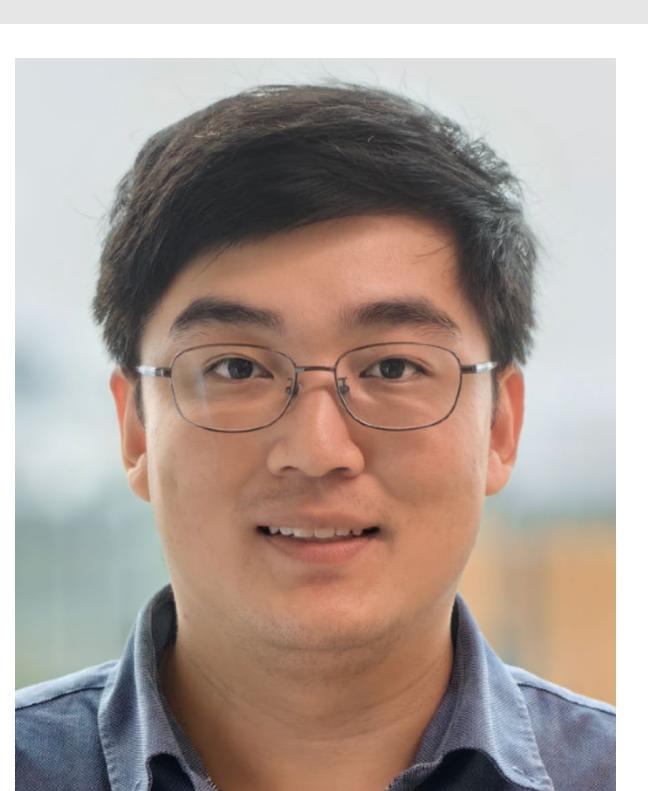
Junyu  
Chen



Alessa  
Hering



Tony  
Mok



### Learn2Reg 2025

#### ReMIND2Reg 25:

- Extended from 2024 with **larger dataset** (155 training, 10 validation, ~40 test)
- Targets **post-resection iUS ↔ pre-op MRI alignment**
- Emphasis on handling **brain shift** and **large deformations**

#### LUMIR 25:

- Builds on LUMIR 2024 dataset (3,384 training subjects)
- Expanded validation:** high-field MRI, pathology, and multimodal T1↔T2
- Zero-shot benchmark extended:** >1,500 unseen test subjects
- Stronger test of **generalization across contrasts and domains**

### Keynote at Learn2Reg 2025

Prof. Mirabela Rusu, Ph.D.

Assistant Professor of Radiology, Stanford University

📍 DCC2-3F-301 (DCC 2) | 🕒 27 Sept. 2025, 13:30 - 15:30



#### Title: "Are we there yet?" in multimodal registration?

**Abstract:** Multimodal image registration is a preprocessing step in many clinical applications, that remains technically challenging while carrying major downstream implications for patient care. AI approaches for image registration have many advantages over conventional iterative approaches but are not perfect. Studies have shown the benefit of registering radiology and pathology to label radiology images with pathology labels allowing the training of AI model for cancer detection on MRI. Other clinical studies have shown the utility of registering MRI and ultrasound for mapping of biopsy target lesions from MRI onto real-time ultrasound to guide procedures. These are just a few examples from my team where we developed AI-based registration methods focused on facilitating cancer detection. This talk will present some lessons learned and discuss the future on registration in the context of clinical needs (e.g., cancer detection).

### Join SIGBIR

We **always welcome new members to SIGBIR**,  
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invited to our next meeting or you can reach our  
president at [mattias.heinrich@uni-luebeck.de](mailto:mattias.heinrich@uni-luebeck.de).