

Toward Artificial Palpation

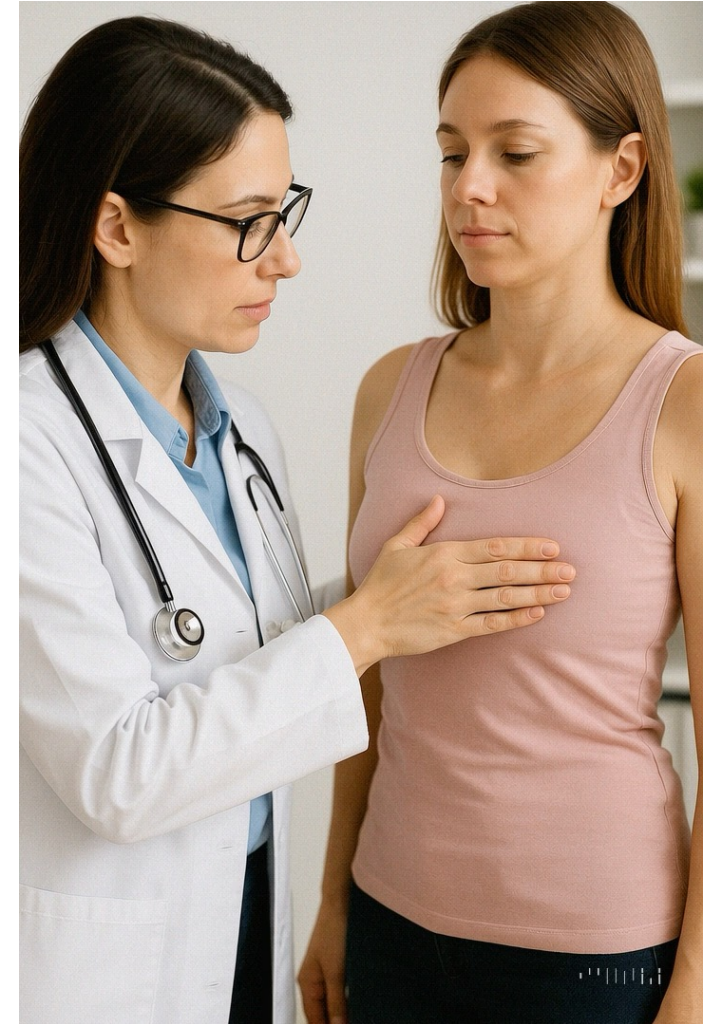
Representation Learning of Touch on Soft Bodies

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Palpation

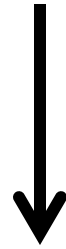
The use of touch in medical examination

- >40% of breast cancer detections [1]
- Currently no artificial solution
- No data online
- No accurate simulation



Towards Artificial Palpation

Scalable Tactile Data Collection

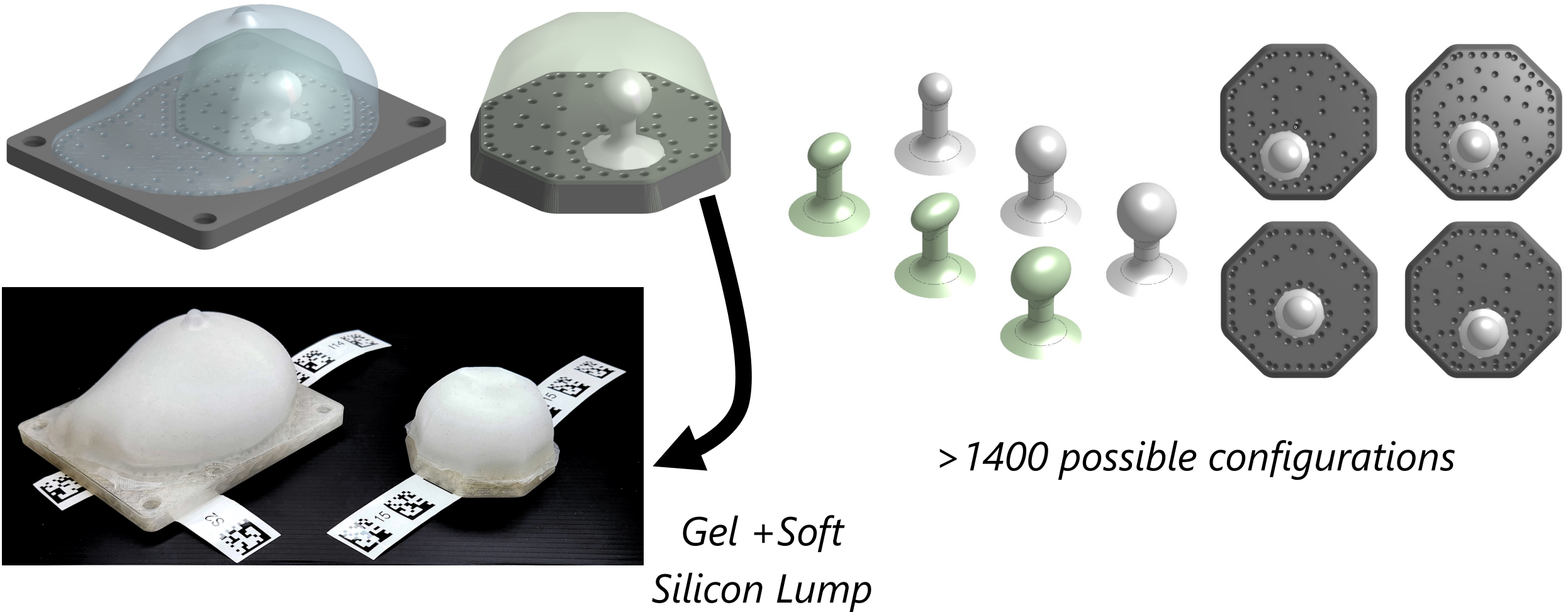


Representation Learning

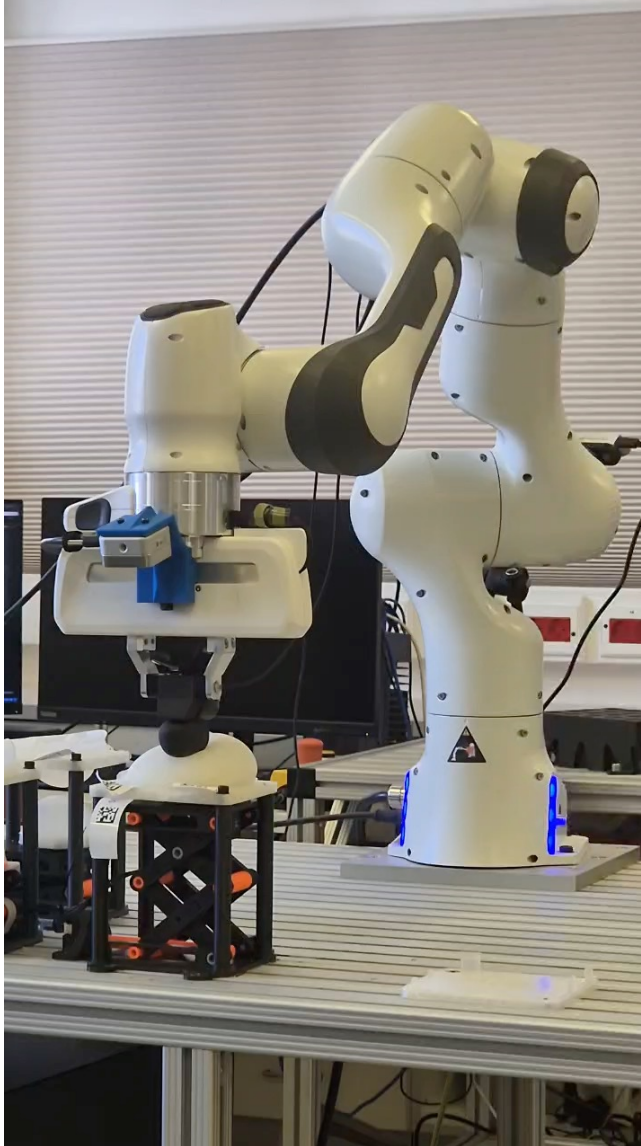
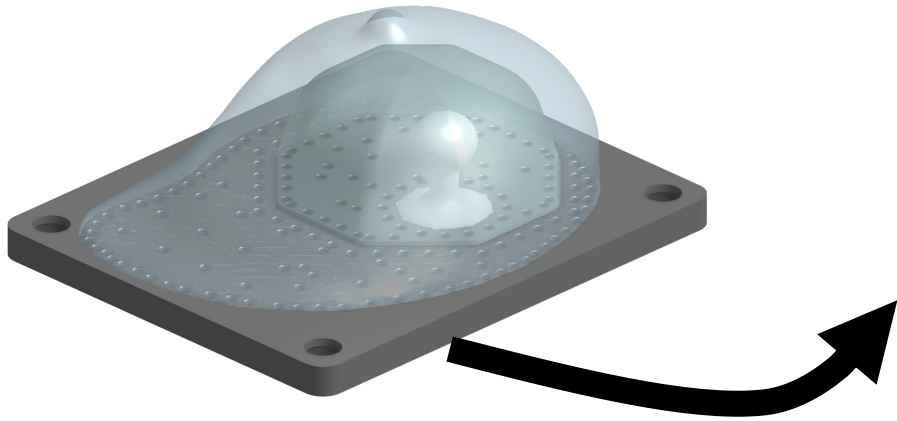


Downstream Tasks

Data Collection – Modular Design



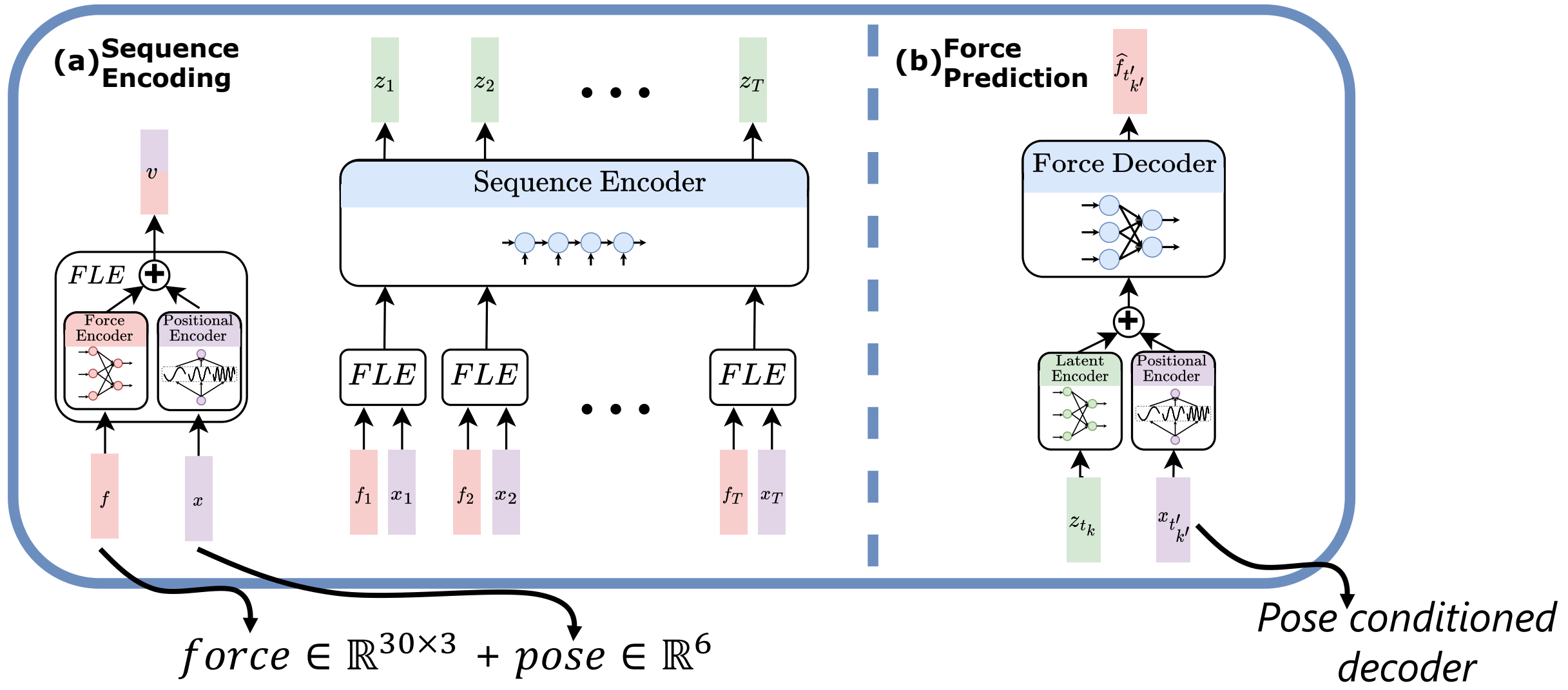
Data Collection – Automatic Poking



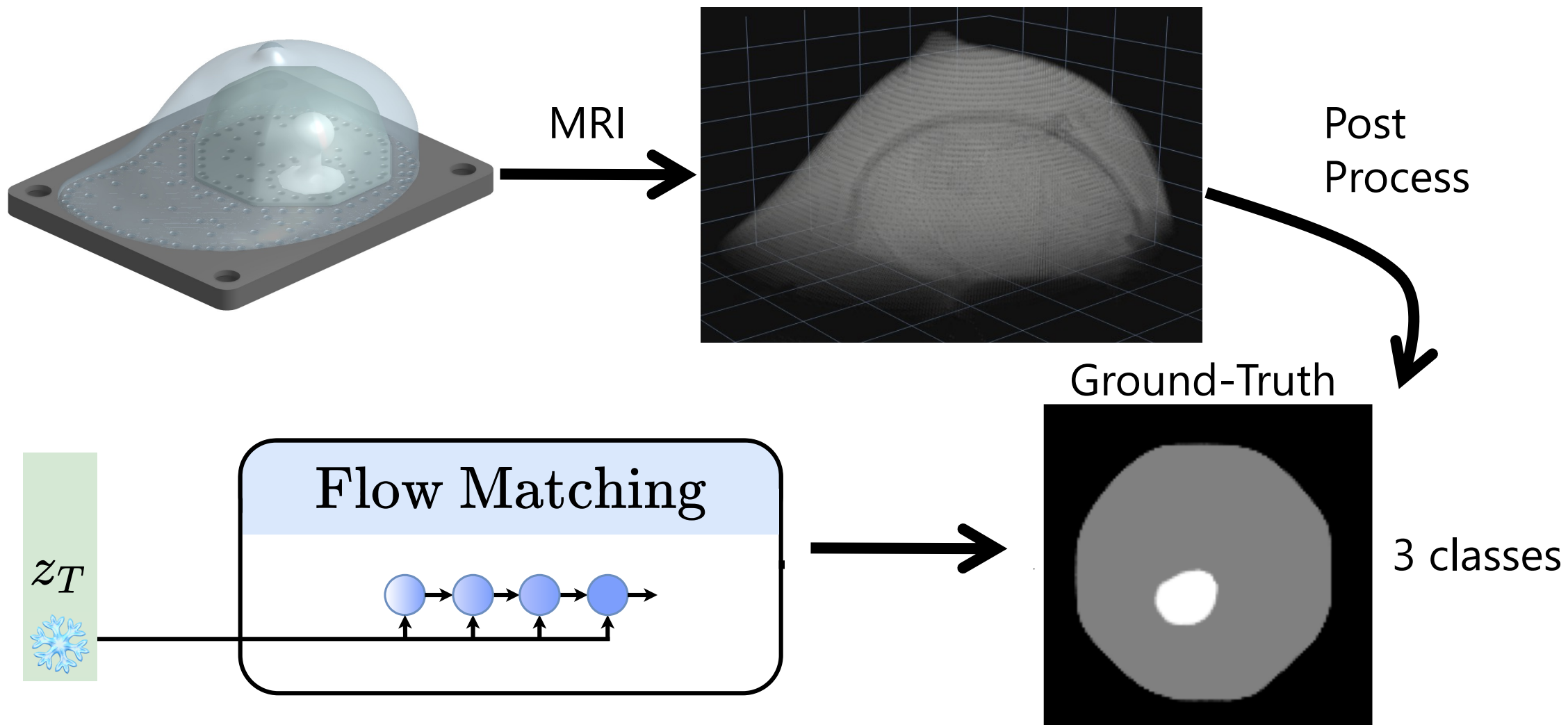
>250 interaction hours

Representation Learning

We consider a spatio-temporal time series (~ 1000 time steps)

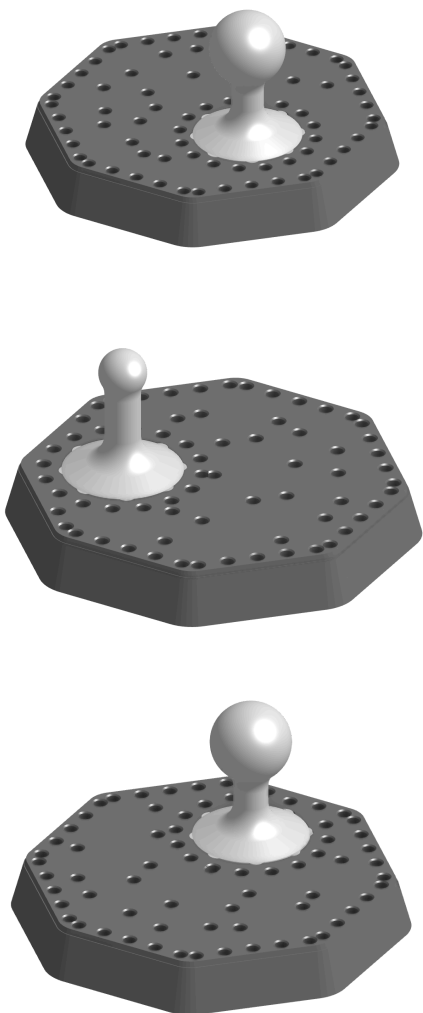


Tactile Imaging

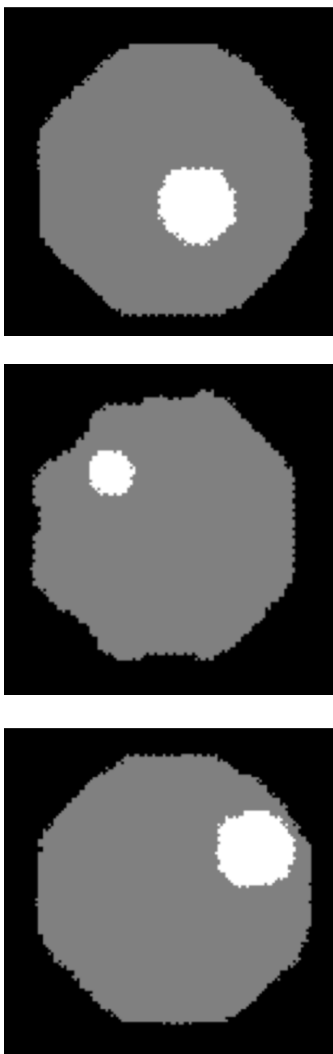


Experiments – Tactile Imaging

Lump Configuration



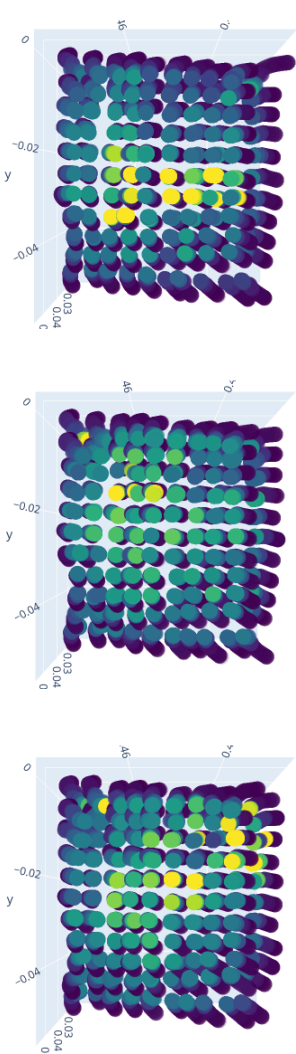
MRI Scan



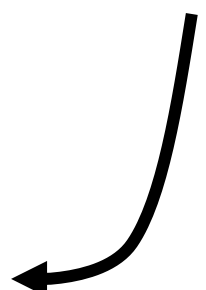
Tactile Imaging



Force Map

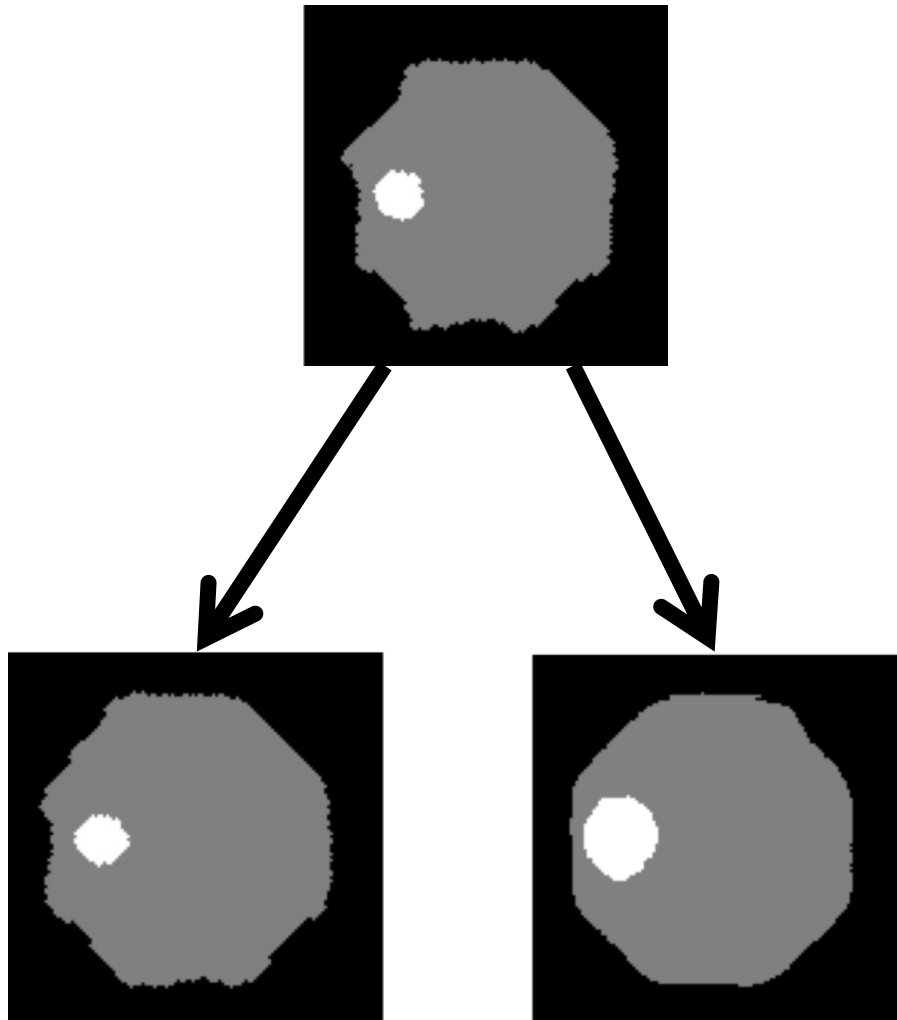


Experiments – Data Scaling

	0.5× MRI Data	1× MRI Data	F1 Scores 
0.5× Interactions	65.3 ± 0.1	74.5 ± 1.7	
1× Interactions	72.7 ± 0.3	74.4 ± 0.1	

*More self-supervised data is
almost as good as more (hard to
obtain) labeled data*

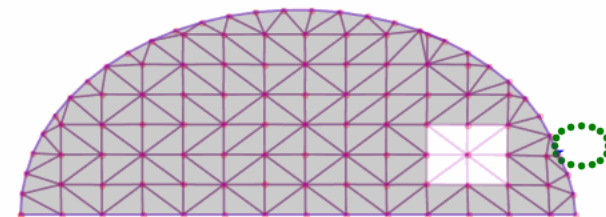
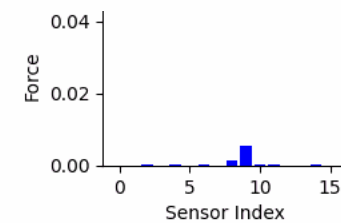
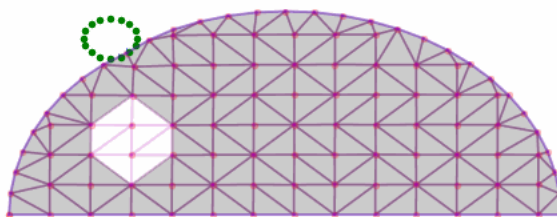
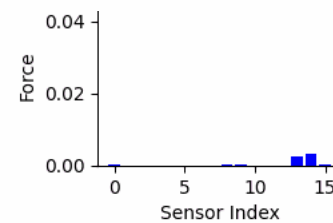
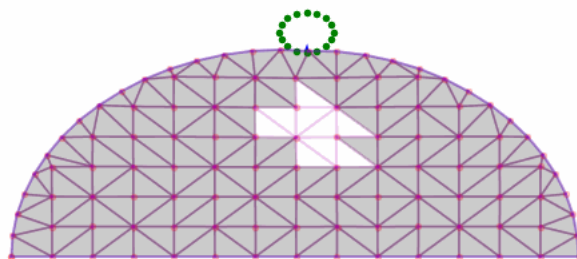
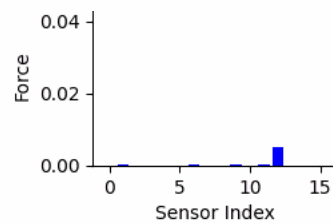
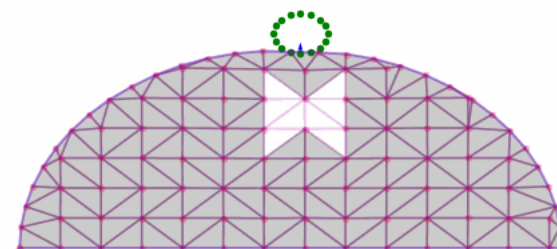
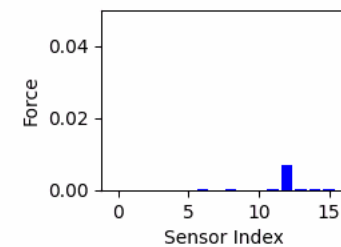
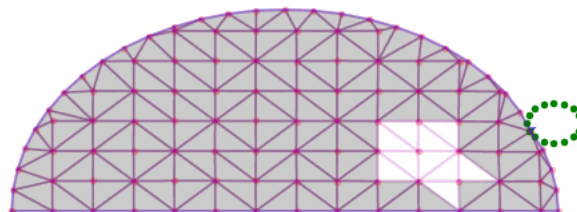
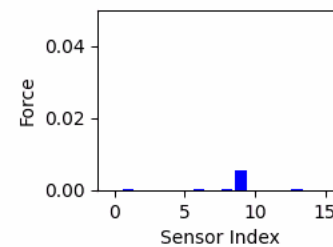
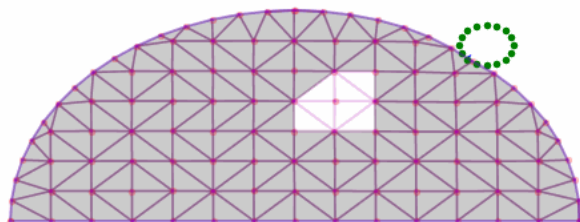
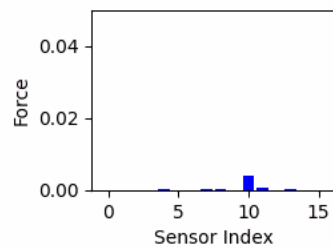
Experiments – Change Detection



	Humans	Ours
FAR $\left(\frac{\#FN}{\#N}\right) \downarrow$	0.32	0.19
Recall $\left(\frac{\#TP}{\#P}\right) \uparrow$	0.62	0.82

Sensor's spatial density is $\sim 100\times$ smaller than the human finger

PalpationSim



Thank You!
Come find us in the poster session

Code is available:

github.com/zoharri/ArtificialPalpation

Check out our website:

zoharri.github.io/artificial-palpation