Tactile Sensing with a Tendon-Driven Soft Robotic Finger

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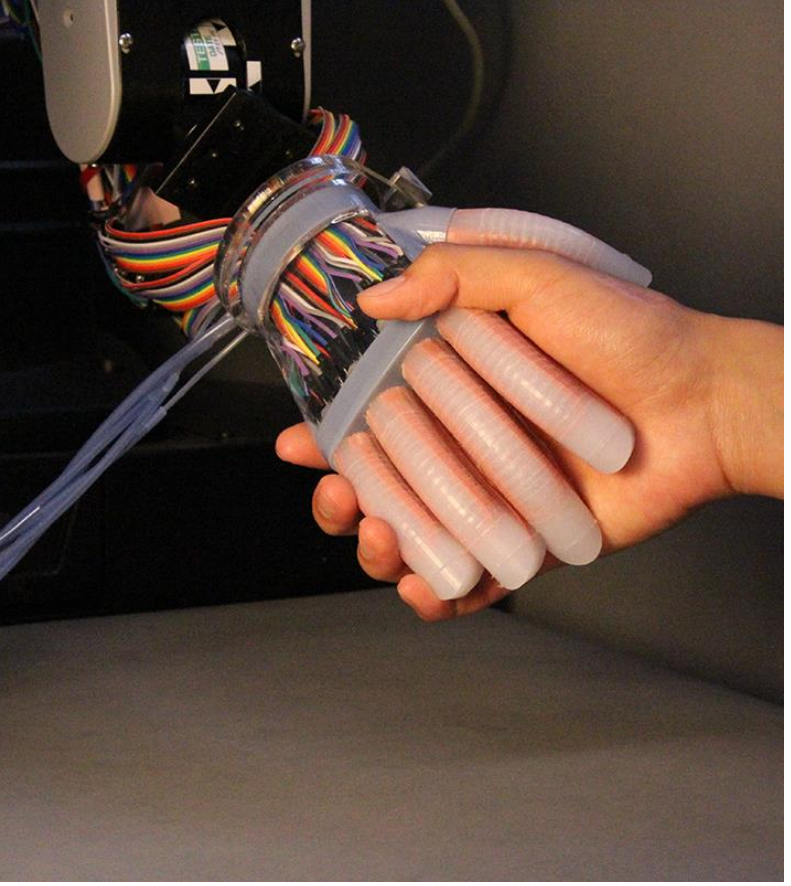
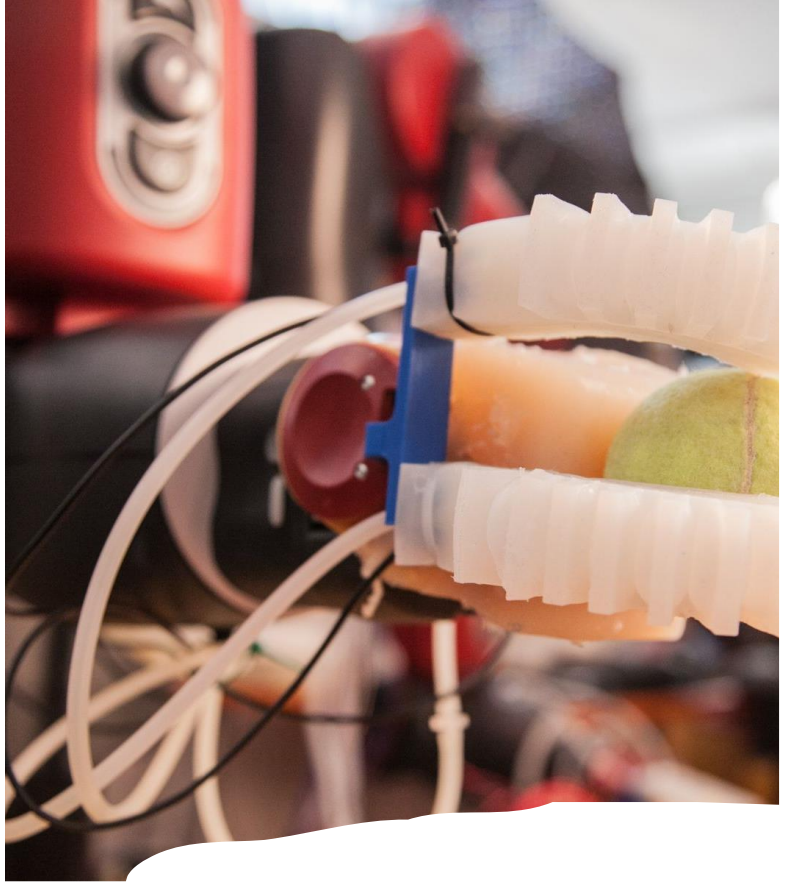
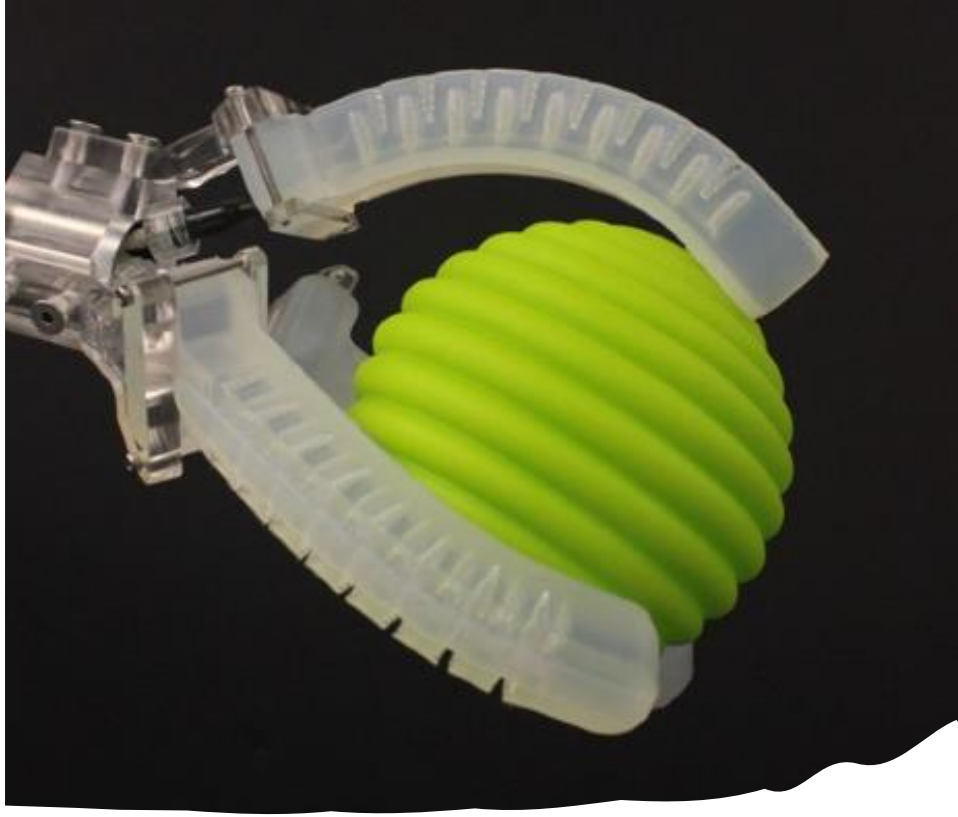
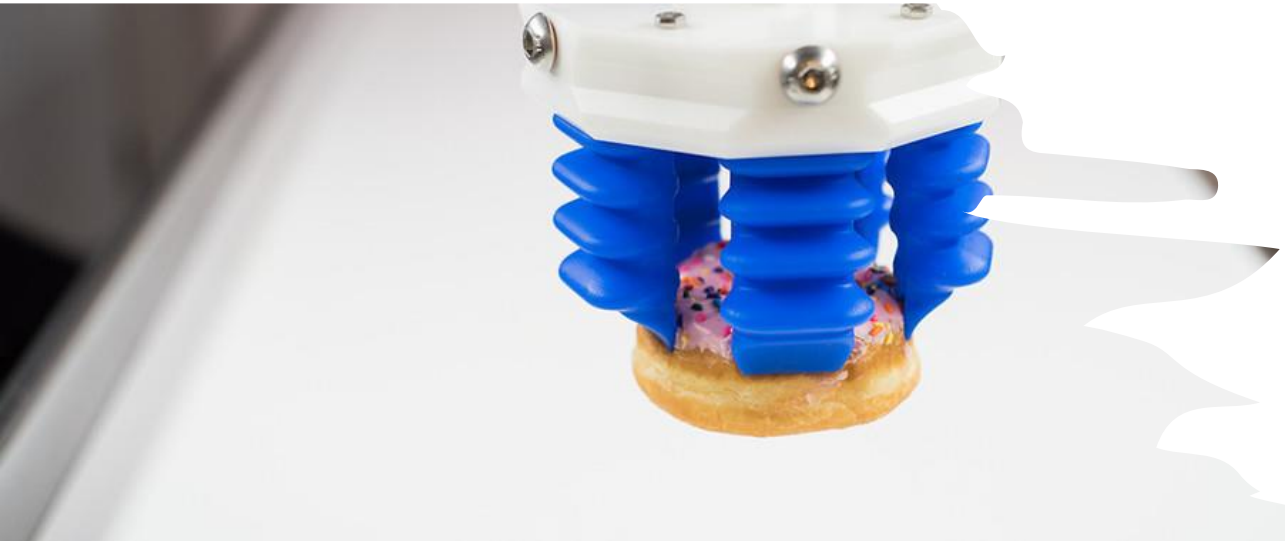




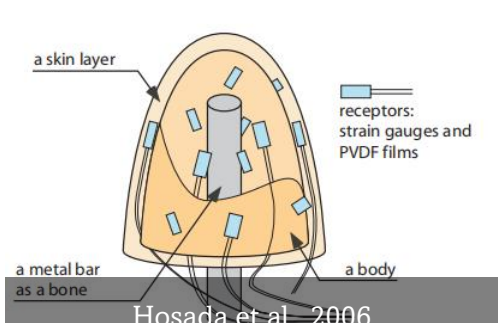




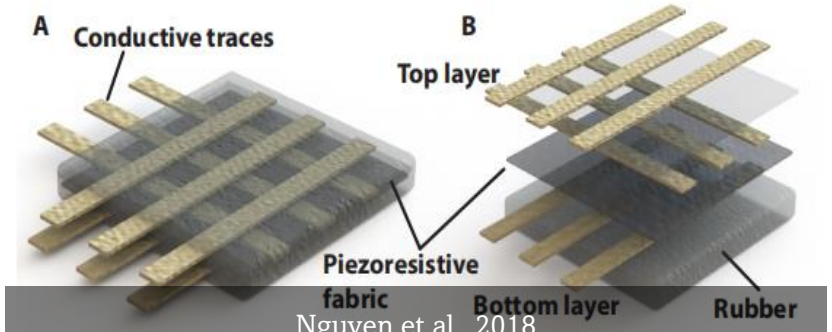
Background

Sensory feedback in Soft Robotics

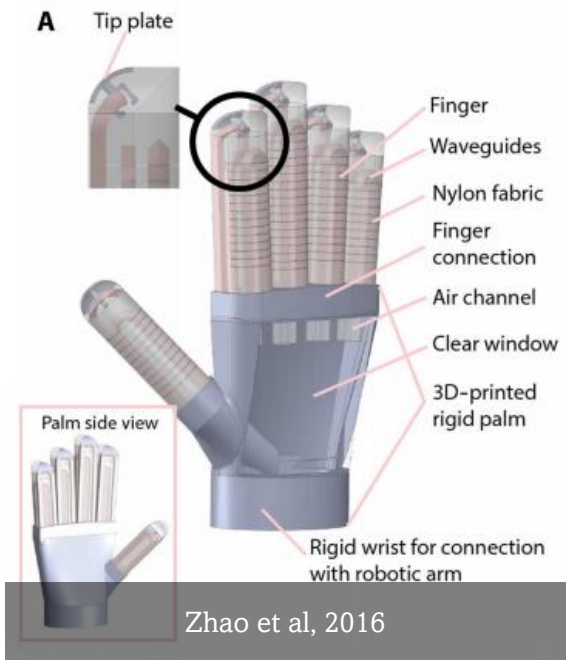
Previous work



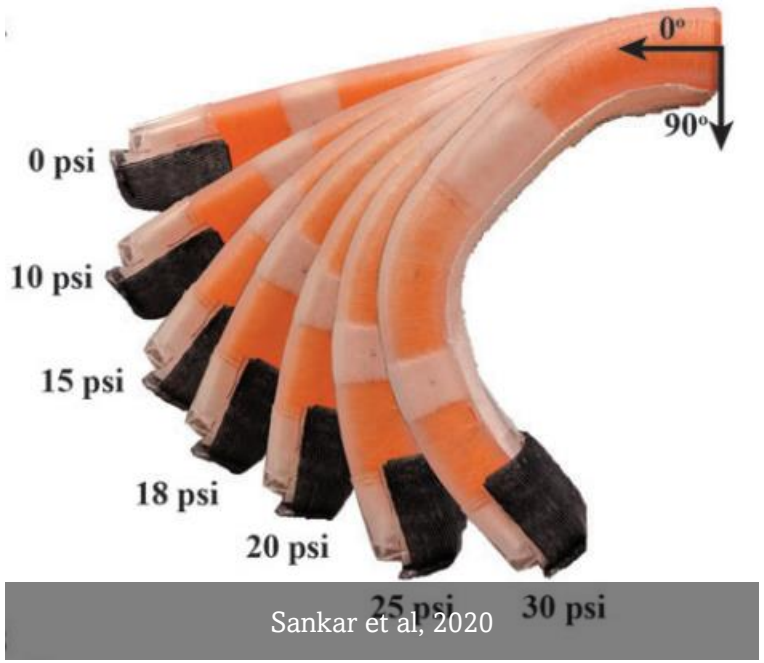
Hosada et al., 2006



Nguyen et al., 2018



Zhao et al, 2016

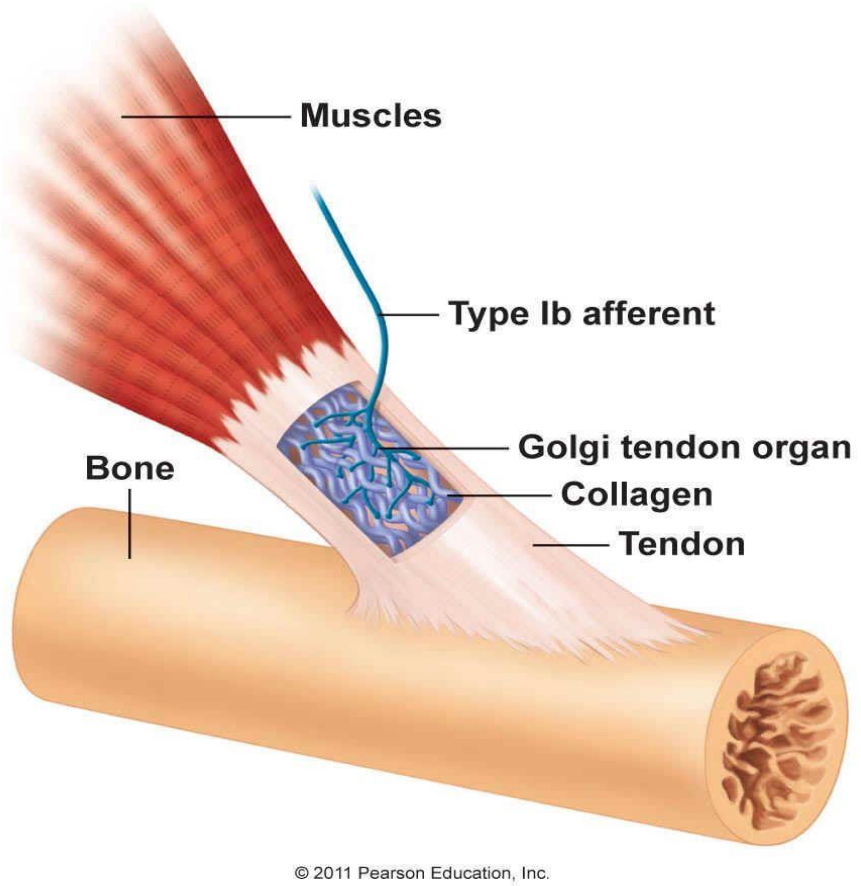


Sankar et al, 2020

Motivation

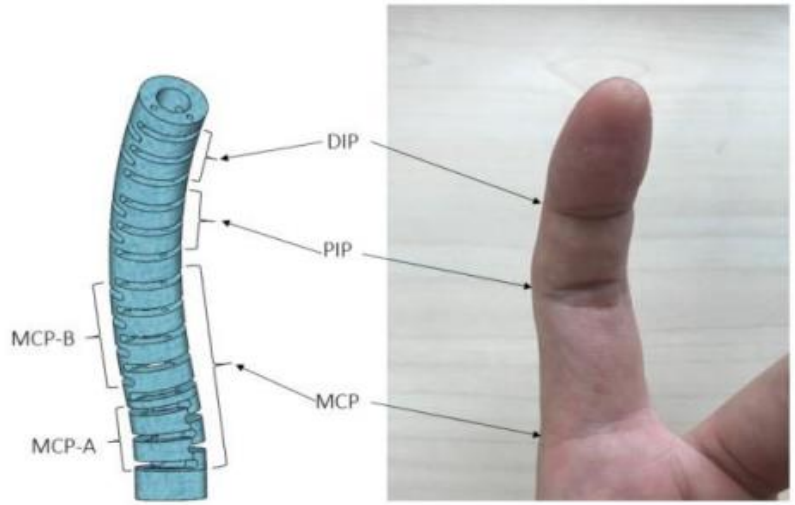
- **What are some other ways to embed the sensors?**

Proprioception Framework

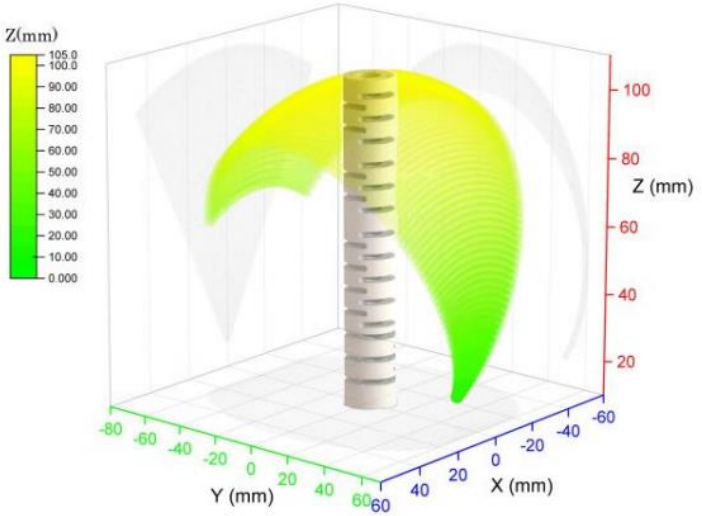


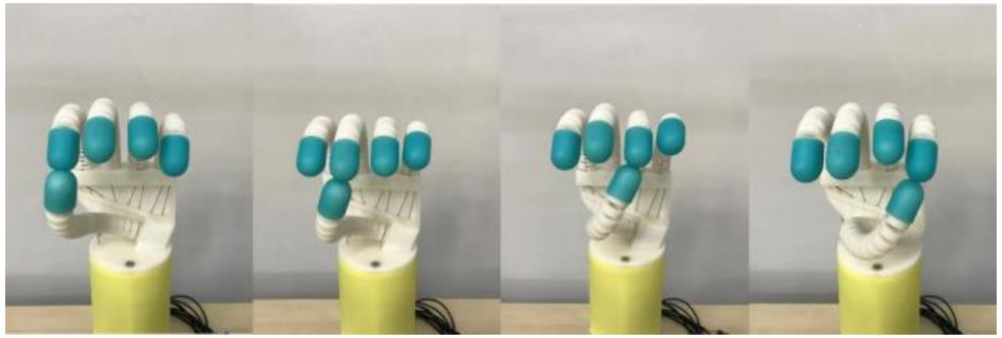
Golgi Tendon Organ: Senses load on tendon

Tendon-Driven Soft Finger

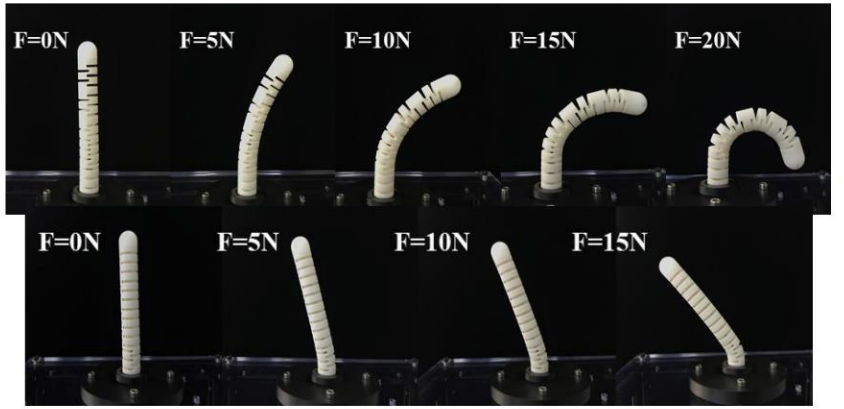


Workspace



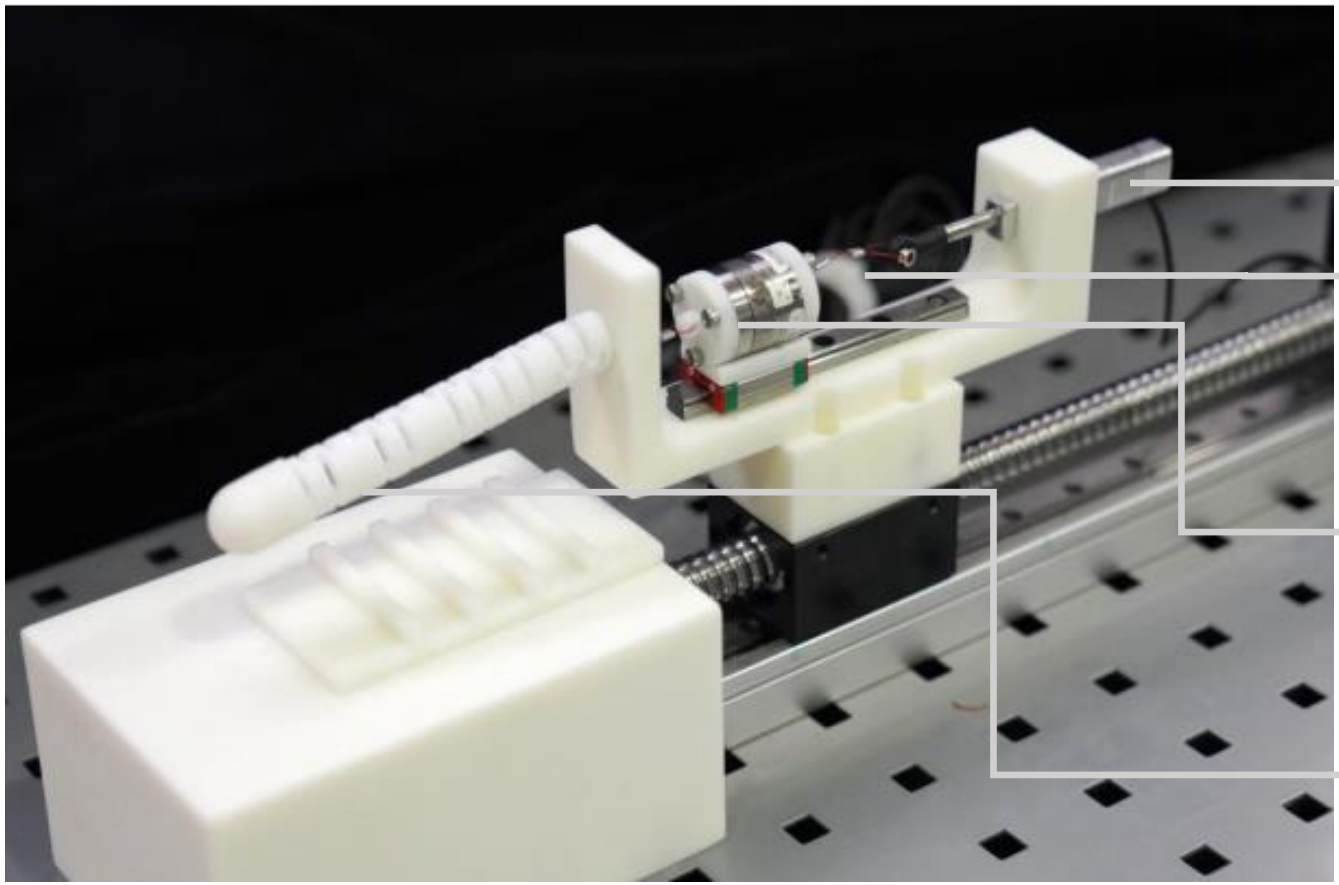


Kinematics



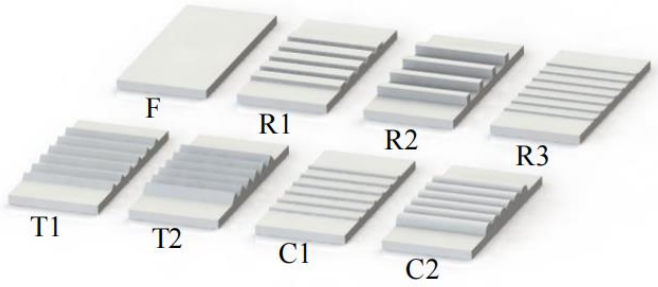
Yan et al., 2020

Palpation System

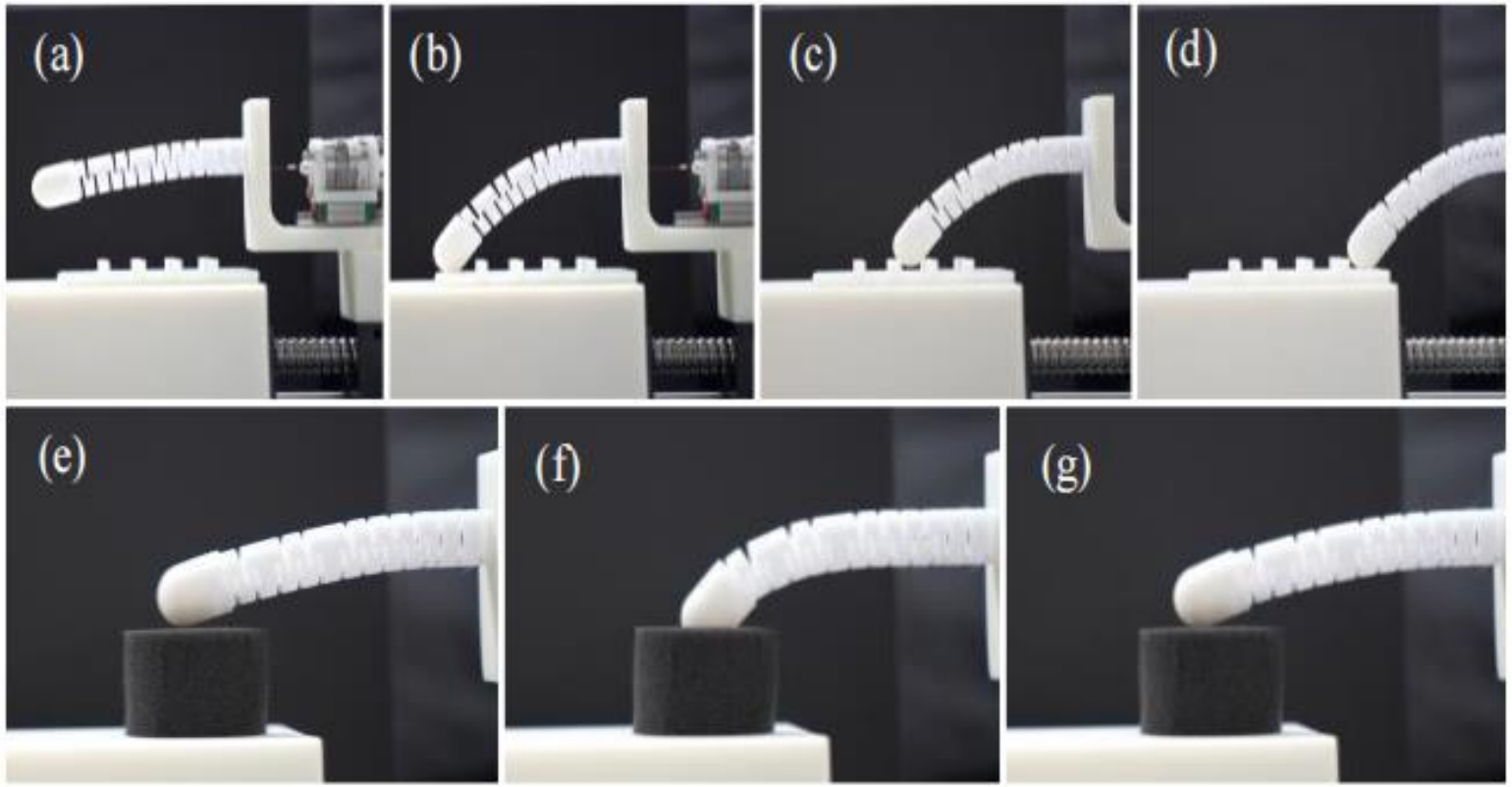


Procedure

Texture Group



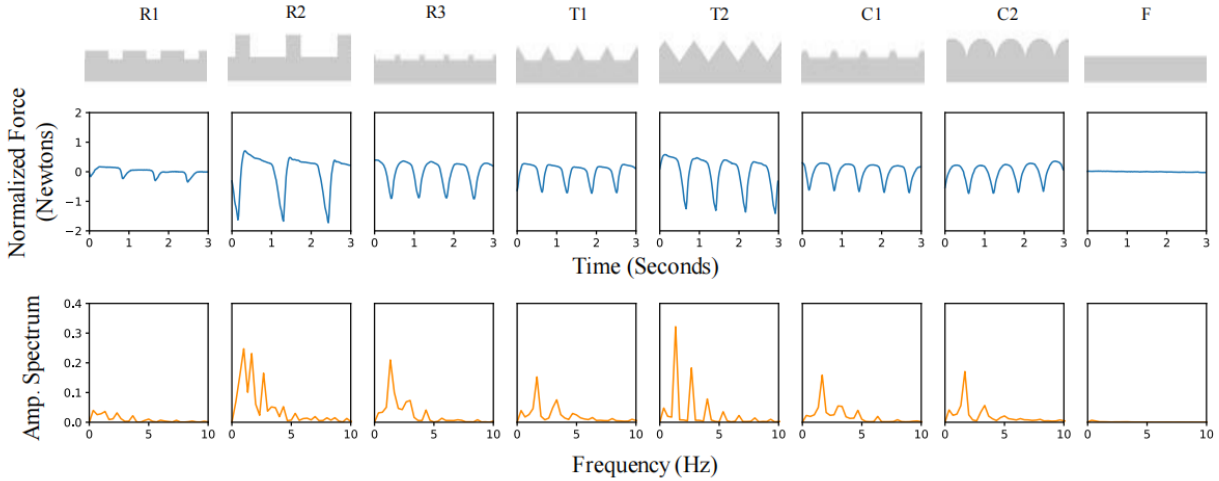
Stiffness Group



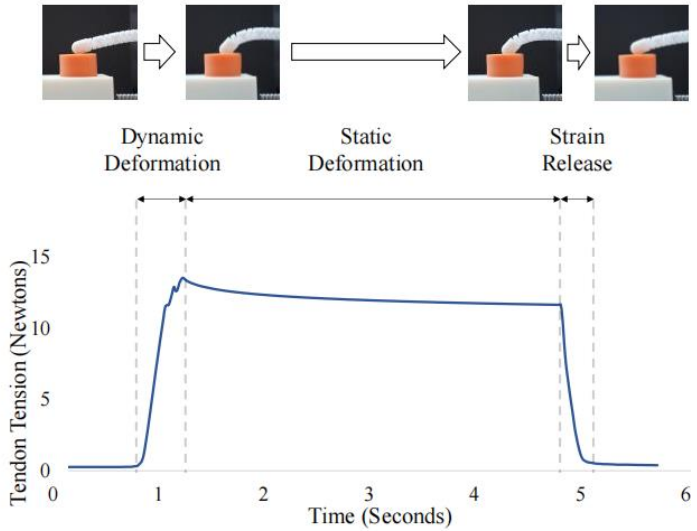
The Finger bends to palpate the tested object

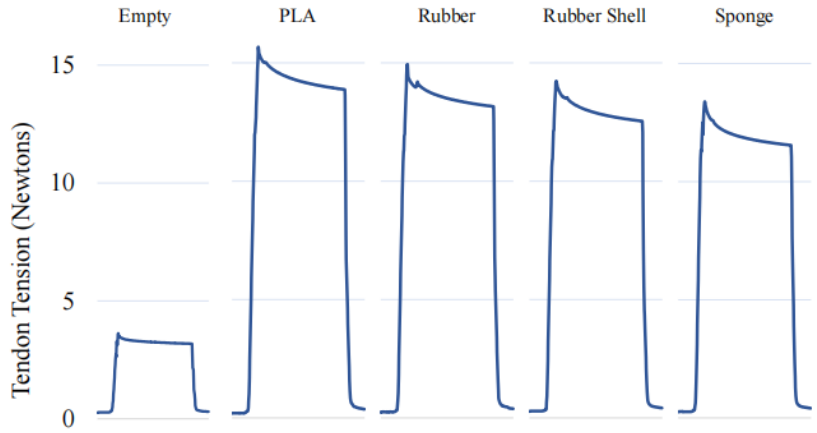
Feature Extraction

Texture Groups



Stiffness Groups



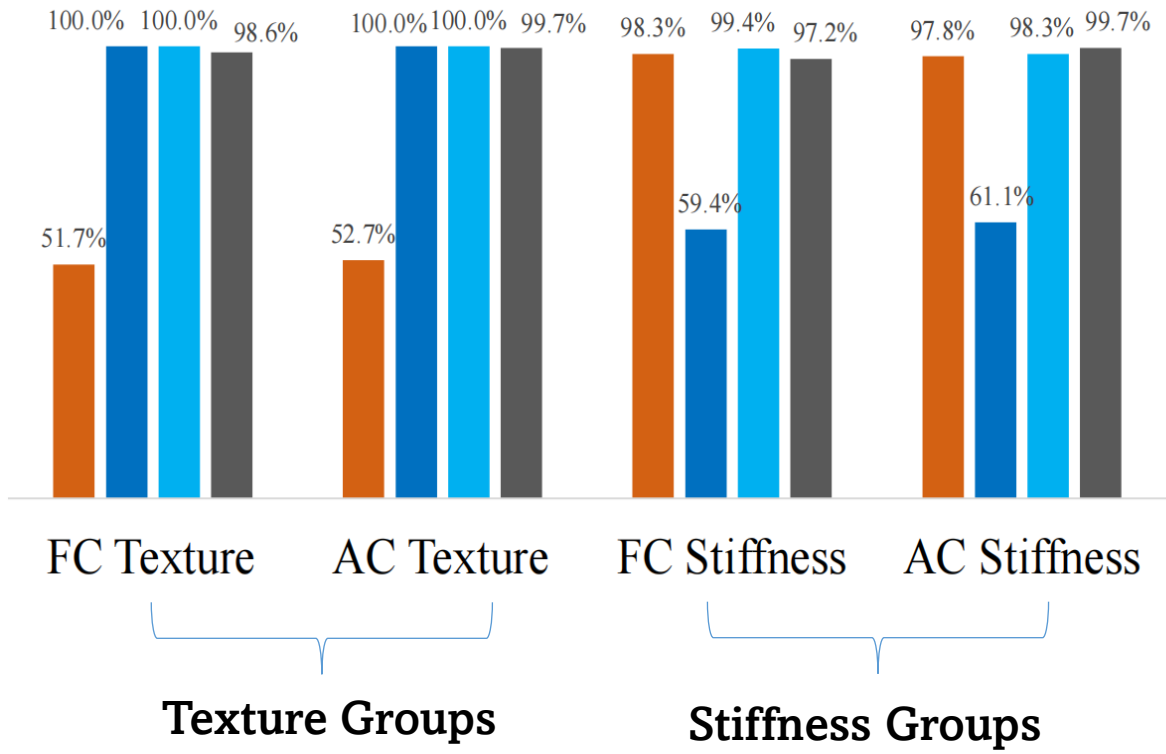


Classification Results

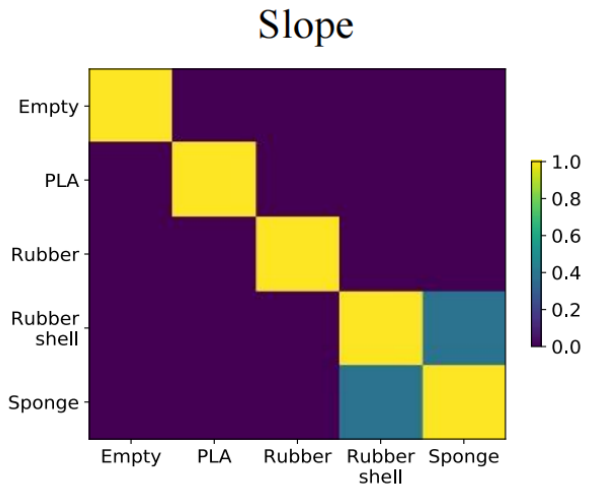
Four types of classifiers:

- Support Vector Machine (Linear Kernel)
- Support Vector Machine (RBF Kernel)
- K-Nearest Neighbor
- Decision Tree

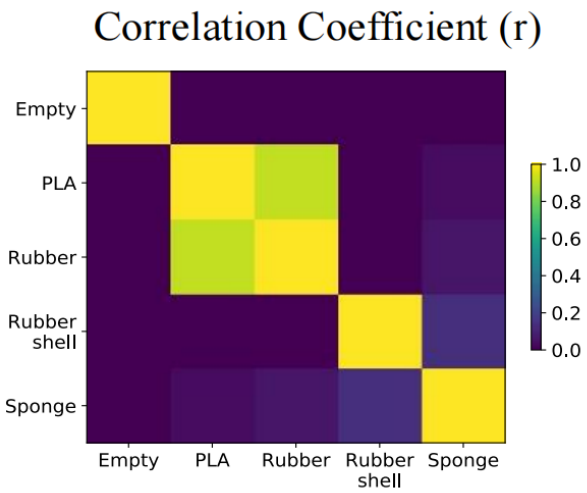
Cross-Validation was used to calculate the accuracy

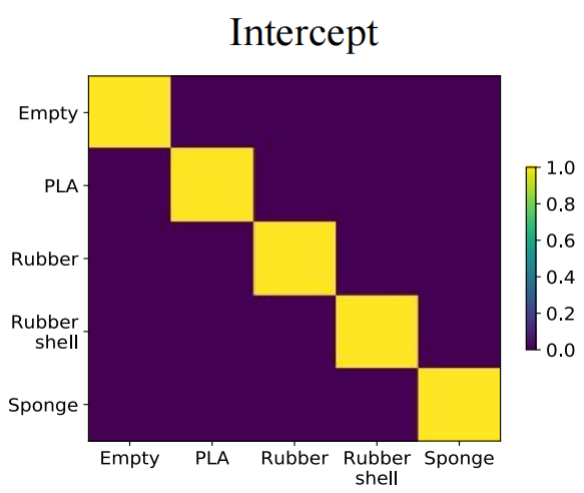


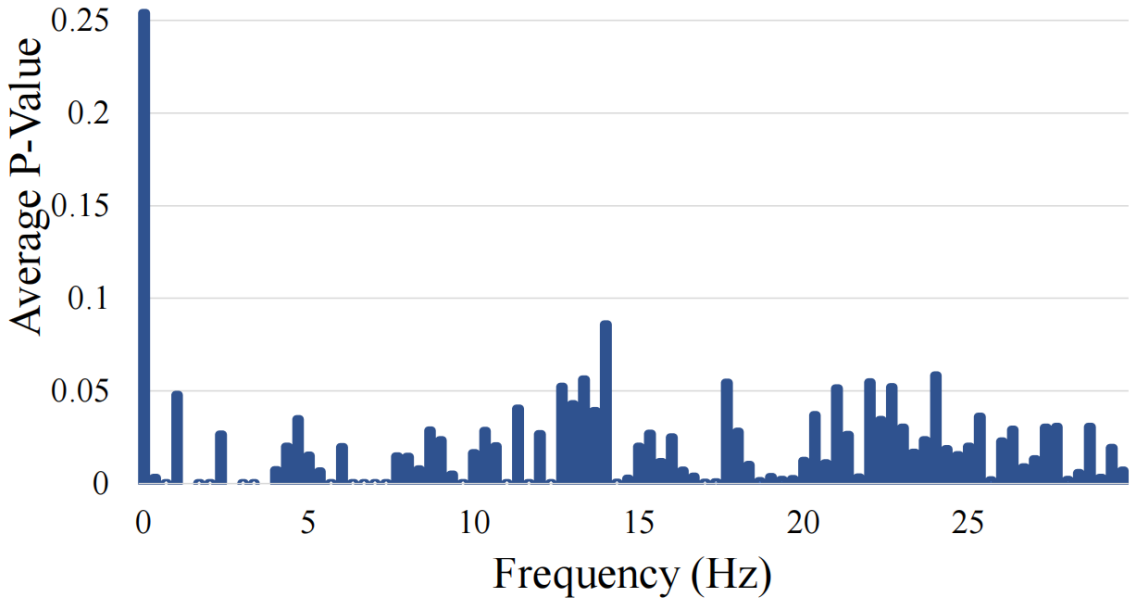
Post hoc Analysis



To understand what features contributed the most to the texture/stiffness recognition

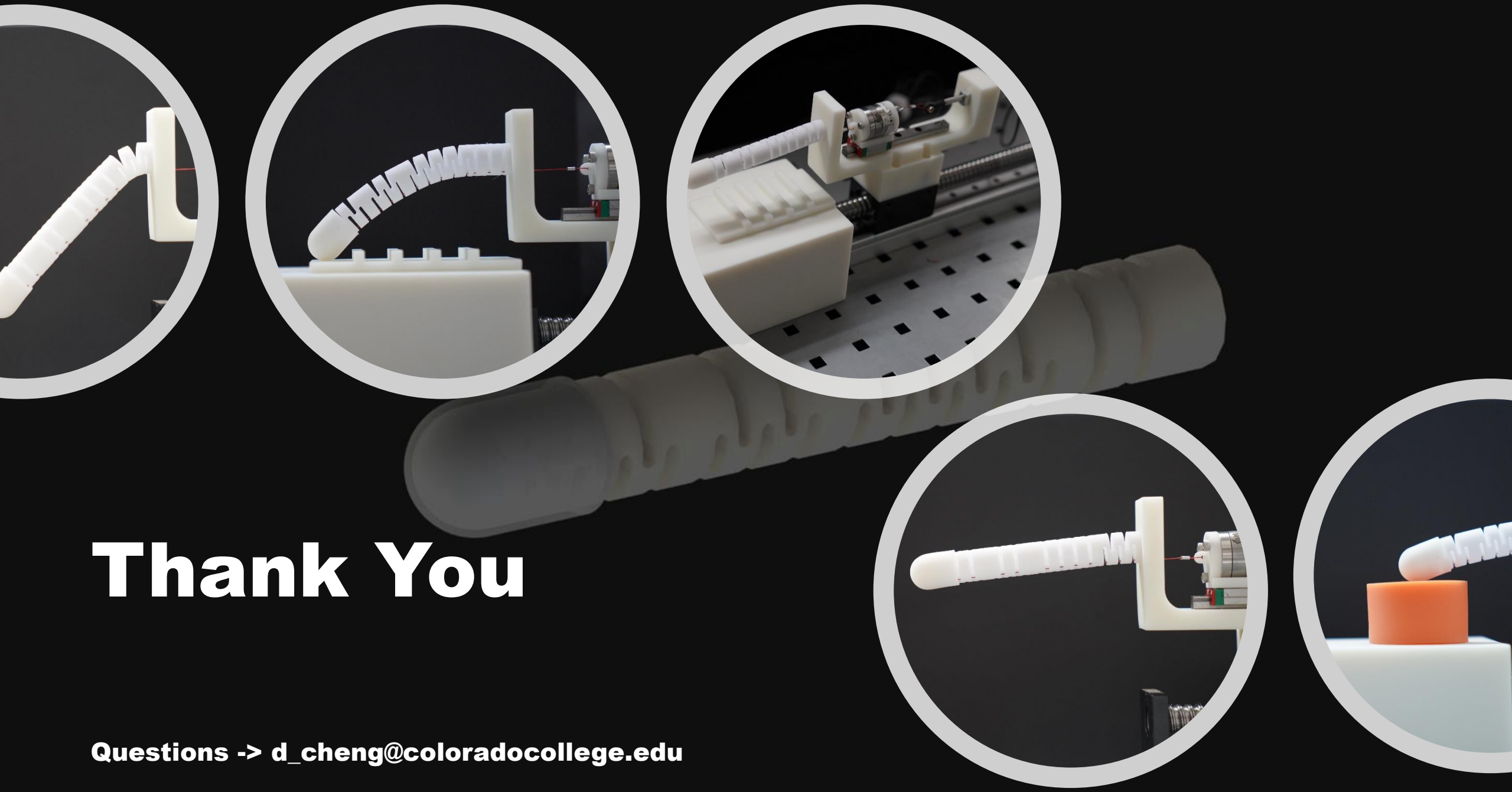






Conclusion

- Novel bio-inspired mechanism to sensory feedback on soft robotic fingers
- Texture & Stiffness Detection → Slippage & Rolling Detection



Thank You

Questions -> d_cheng@coloradocollege.edu