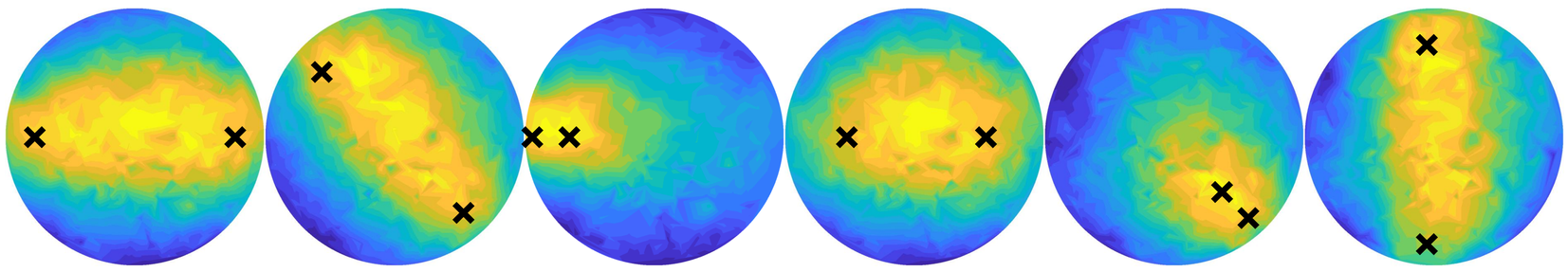
Soft robotic skins which **detect** damage, **sense** touch, and **monitor** their environment.



Material-level Sensorization of Hydrogel-based Skins using Data-Driven EIT

David Hardman, Thomas George Thuruthel, Fumiya Iida

INTRO

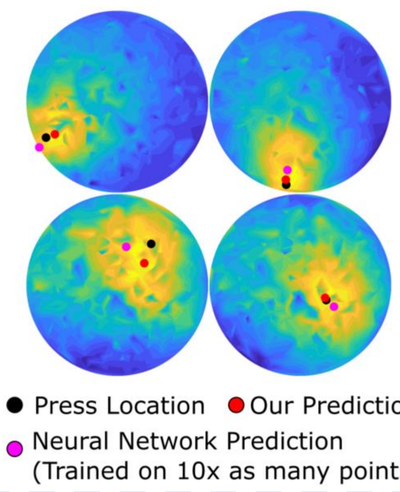
- Our gelatin-based hydrogel can detect single-axis strain[1]: here we extend its use to a multimodal skin sensing a large area.
- Electrical Impedance Tomography (EIT) attaches multiple electrodes to the material's perimeter, using the properties of the skin itself as the body's sensory layer.

METHODS

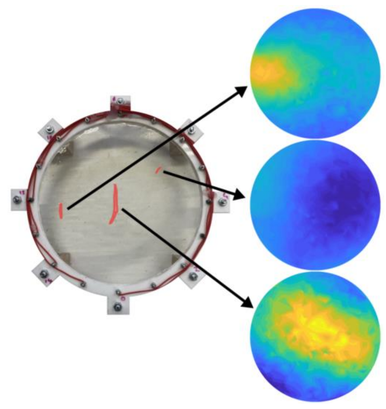
1. 16 electrodes give 192 tetrapolar measurements[2,3].
2. These are used to generate a deformation map using knowledge of prior responses.

RESULTS

Single Presses



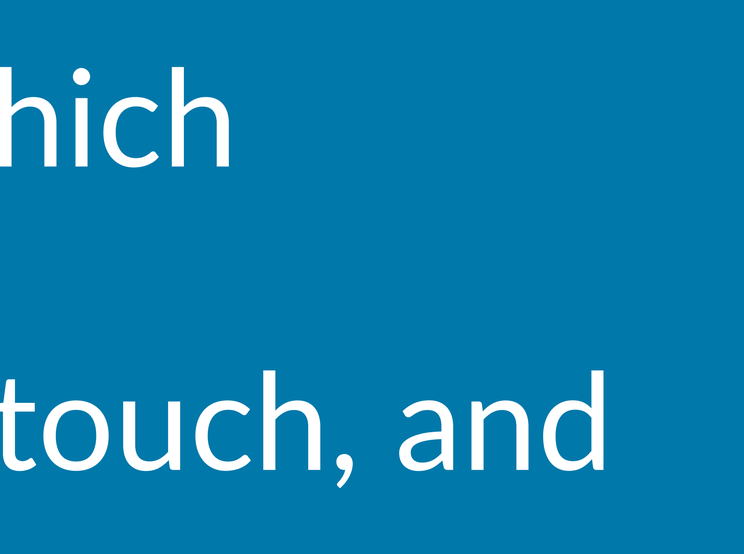
Damage Detection

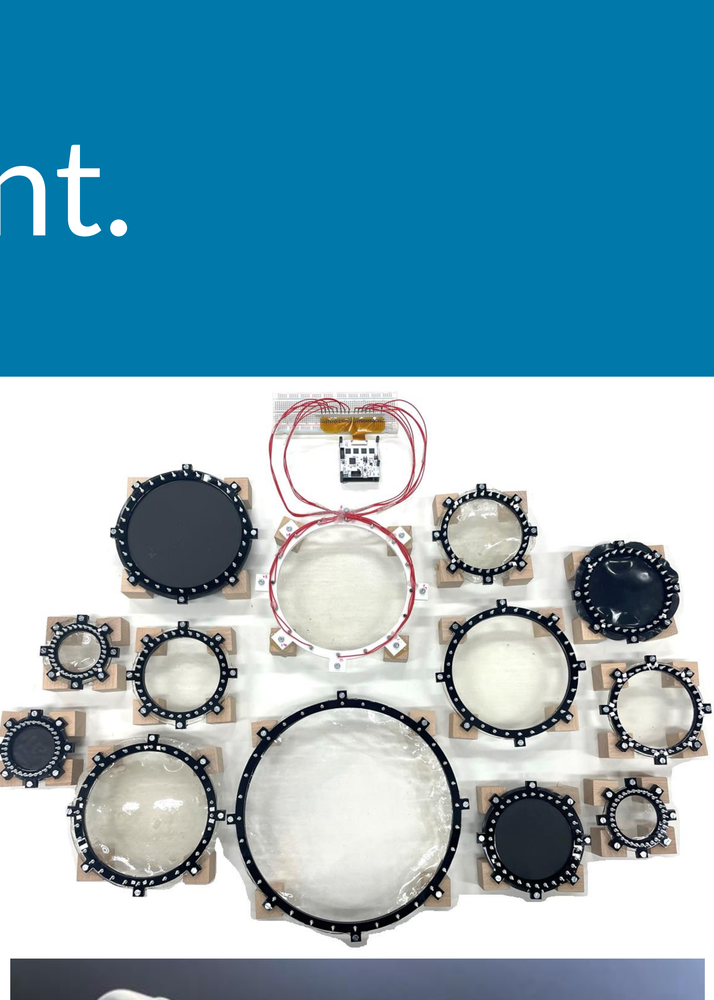


(using only single-press data)

Top bar shows multi-press results.

The minimalistic data-driven method can be extended beyond deformation detection, using functional materials to directly reconstruct multiple stimuli: temperatures, humidities, light/chemical levels, and damages.





- Predictions are made by linearly weighting and combining 500 known responses to single presses.
- We demonstrate damage detection, multi-press sensing, and environmental monitoring.

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REFERENCES

[1] Hardman et al., *Self-healing ionic gelatin/glycerol hydrogels for strain sensing applications*, NPG Asia Materials, 2022 [2] https://mindseyebiomedical.com [3] Liu et al., *pyEIT: A python based framework for Electrical Impedance Tomography*, SoftwareX, 2018