

Scalable, Customizable Sensory Solutions for Dexterous Robotic Hands

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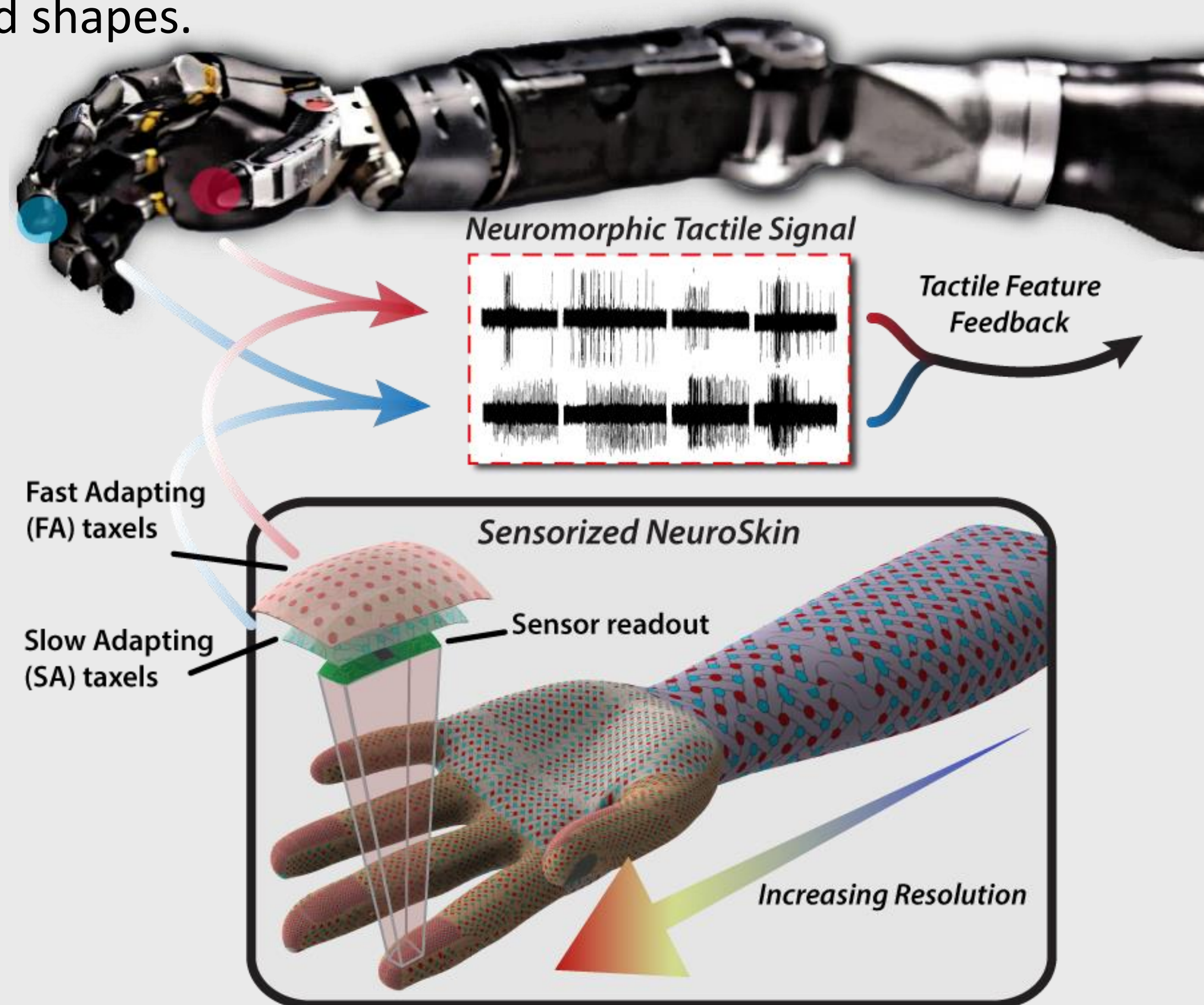
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SUMMARY

Our central focus is to provide enhanced tactile sensory perception through sensor-enabled dexterous robotic hands. We incorporate high density of sensors to build two paradigms: 1) *scalable biomimetic sensors* with digital output mimicking sensorized skin and 2) *flexible neuromorphic sensing and decoding* to provide perception and understanding of textures and shapes.

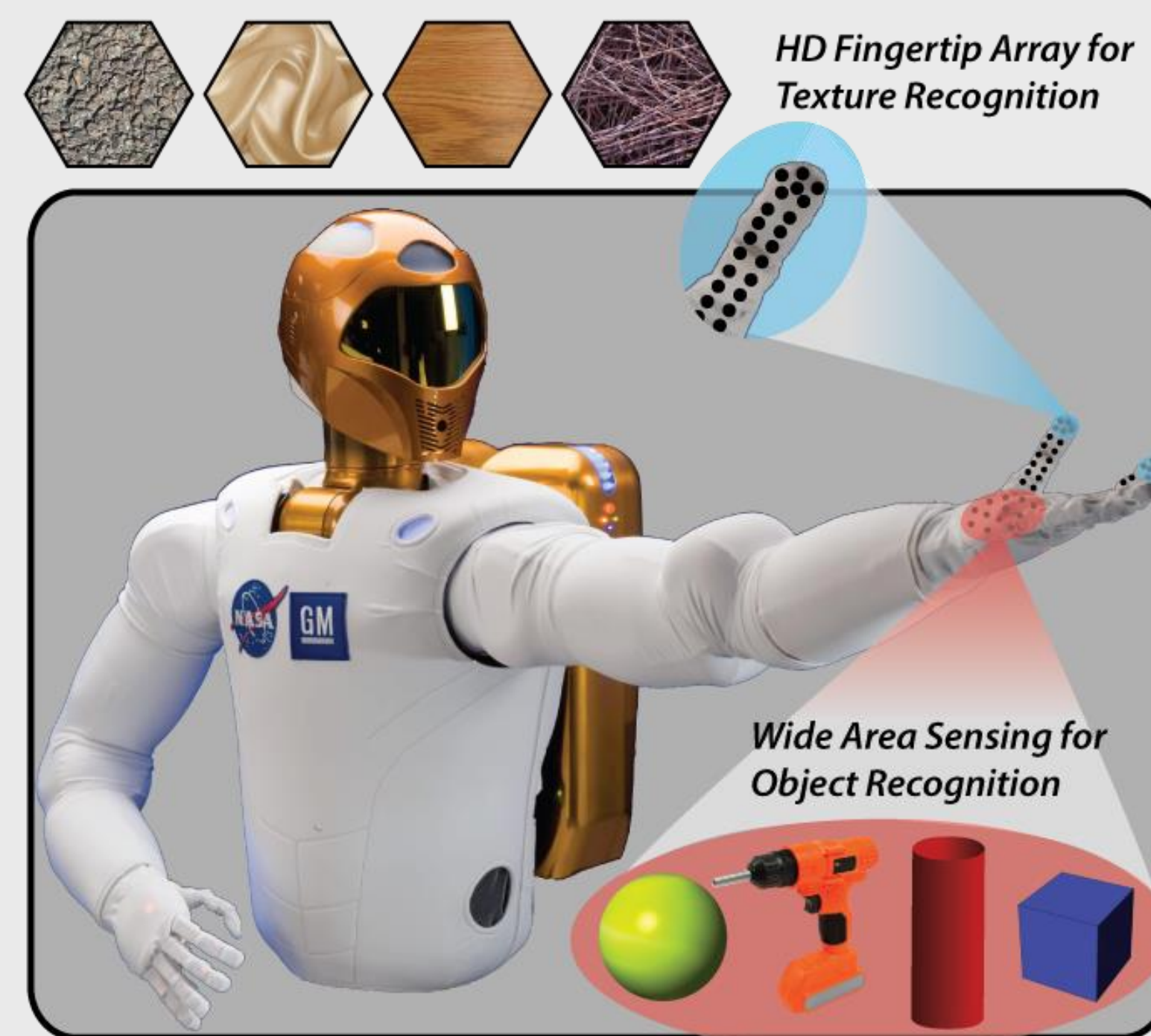


KEY PROBLEMS

- Scalable tactile sensing and high-density (HD) taxel arrays
- Modeling mechanoreceptors and developing methods for neural encoding and sensory feedback
- Pattern recognition of tactile features
- Translation to prosthesis and robot applications

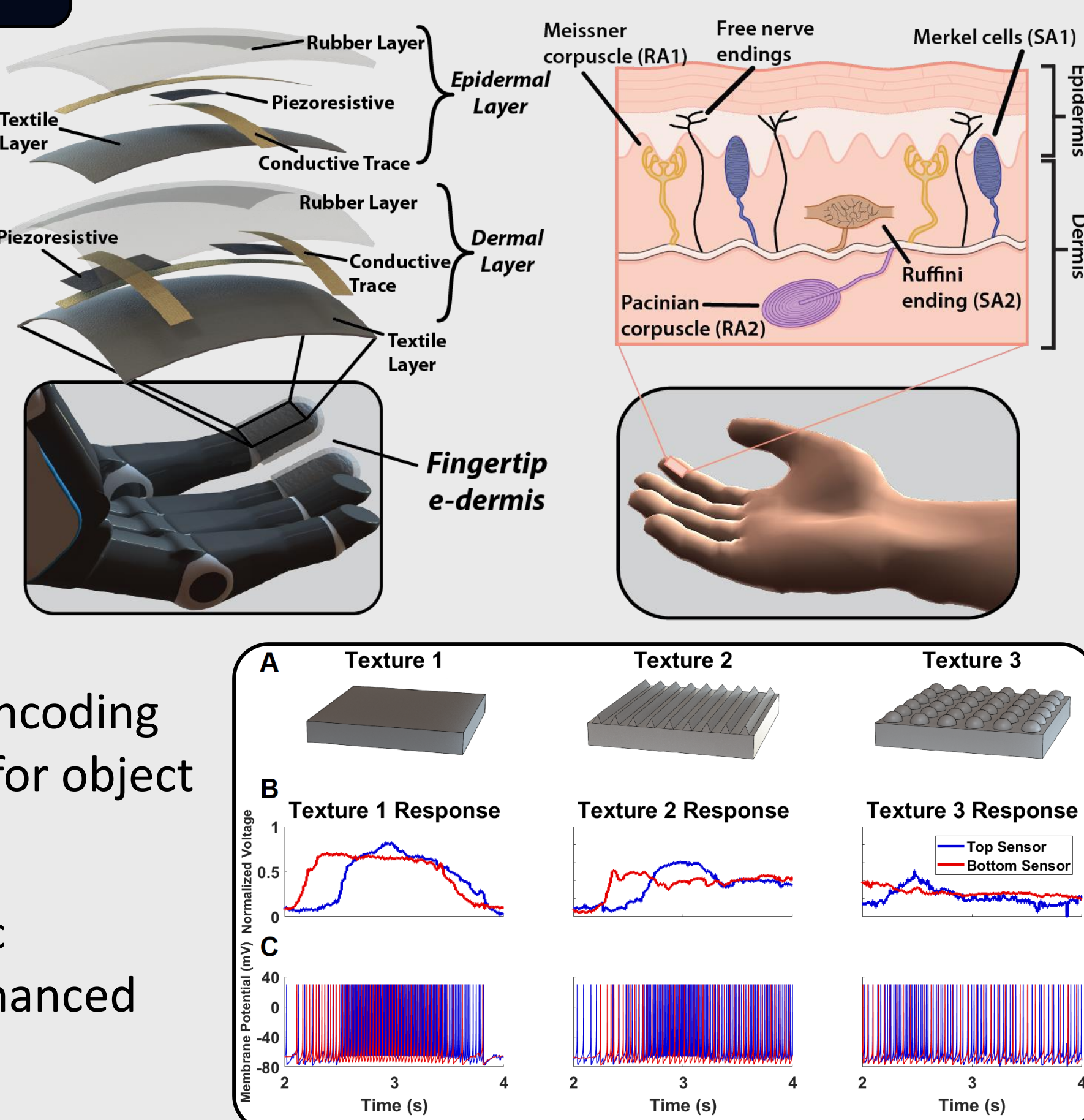
SCIENTIFIC IMPACT

- HD taxel system will enable multisensory capability for prostheses and humanoid robots
- Sensory feedback for amputees and more natural touch, texture, shape, and object recognition in wearable gloves and even spacesuits
- Provide human-like sensory perception to humanoid systems and robotic manipulators



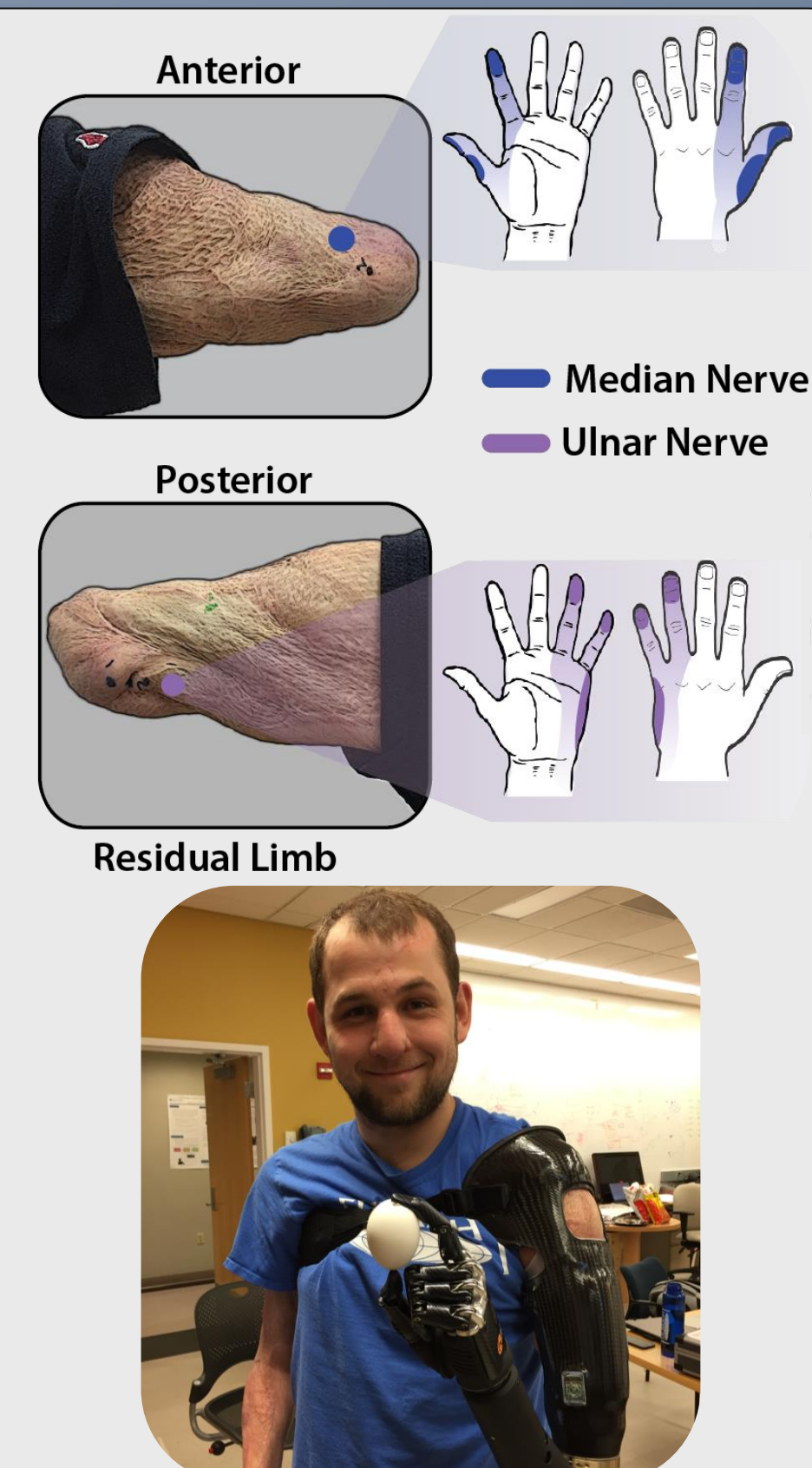
SOLUTION

- Flexible, multilayered electronic skin
- Biomimetic artificial receptors for tactile sensing
- Neuromorphic encoding and stimulation for object detection
- Receptor specific modeling for enhanced performance



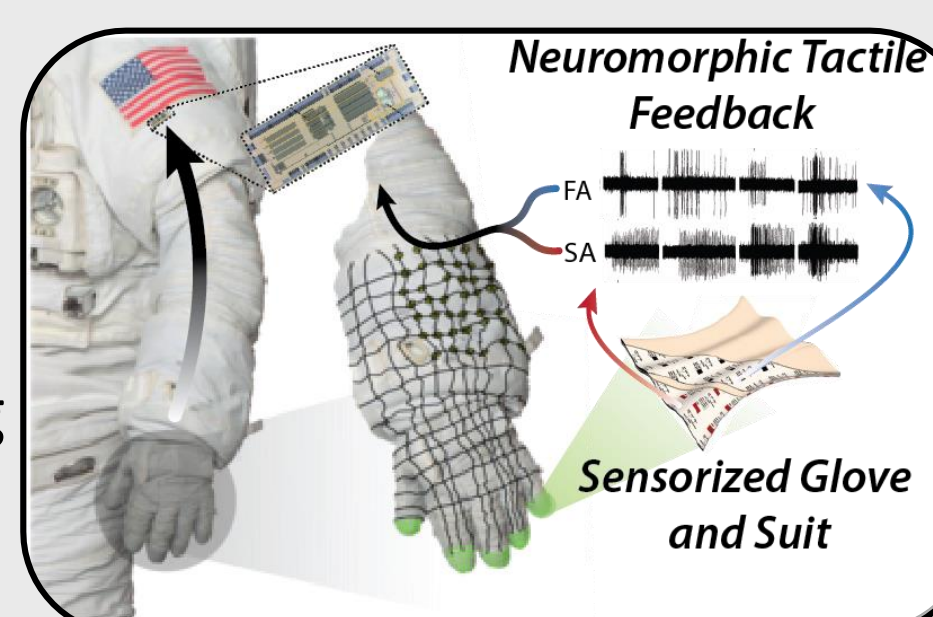
BROADER IMPACT

- Natural tactile sensory feedback for upper limb amputees
- Foundation for multisensory skin and sensory perception in autonomous sensorized robots and human interactions
- Educational impact through *prosthesis workshops* and *student training* (Society of Women Engineers and REUs)
- Sharing of data and sensor design to maximize impact



FUTURE PLANS

- Create HD tactile sensor array for environment palpation and exploration
- Tactile pattern recognition with Incremental Learning, enabling dictionary expansion during tactile exploration
- Scalability and customizability with sensor and neuromorphic algorithm designs (i.e. spatial and temporal scaling)



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