AI-on-skin: Fast and Scalable On-body AI Inference for Wearable Artificial Skin Interfaces

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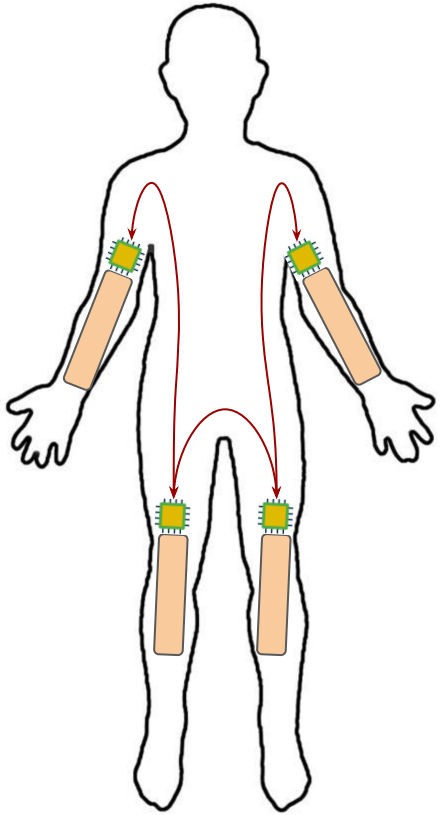
AI-on-skin: on-body AI compute architecture

❑ **Faster**

Faster On-body neural network accelerator



❑ **Distributed and Scalable to the entire body**

Multiple AI-on-skin patches communicate inferences across each other

Multiple Artificial skin interfaces scaled across the body

Alternative AI compute architecture 1: Off-body Bluetooth architecture

Laptop to compute inference

① Touch data sent via BLE

BLE Link

② Neural network inference sent back

Limit on the number of concurrent connections in BLE setup

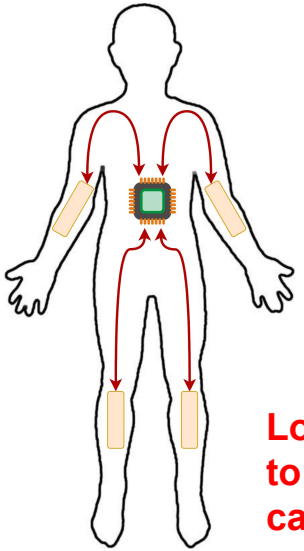
Communications delay greater than human reaction time of 150ms

Alternative AI compute architecture 2 - On-body Centralized compute

tiny, low power microcontroller

Artificial skin interface

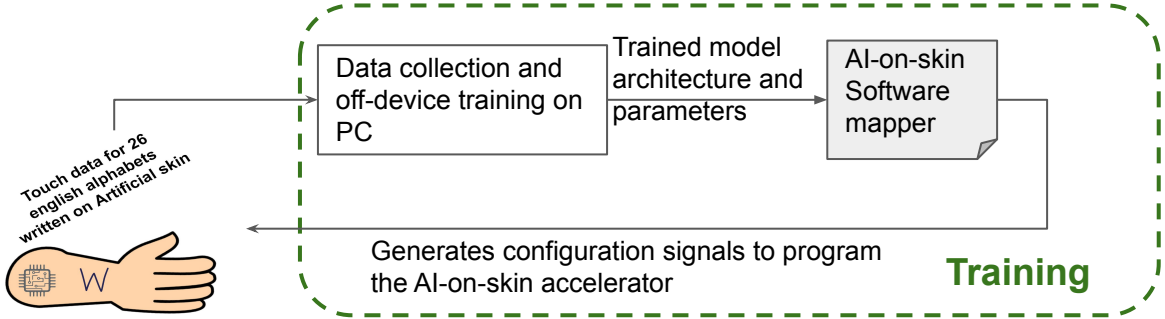
Too slow to compute inference within 150ms.

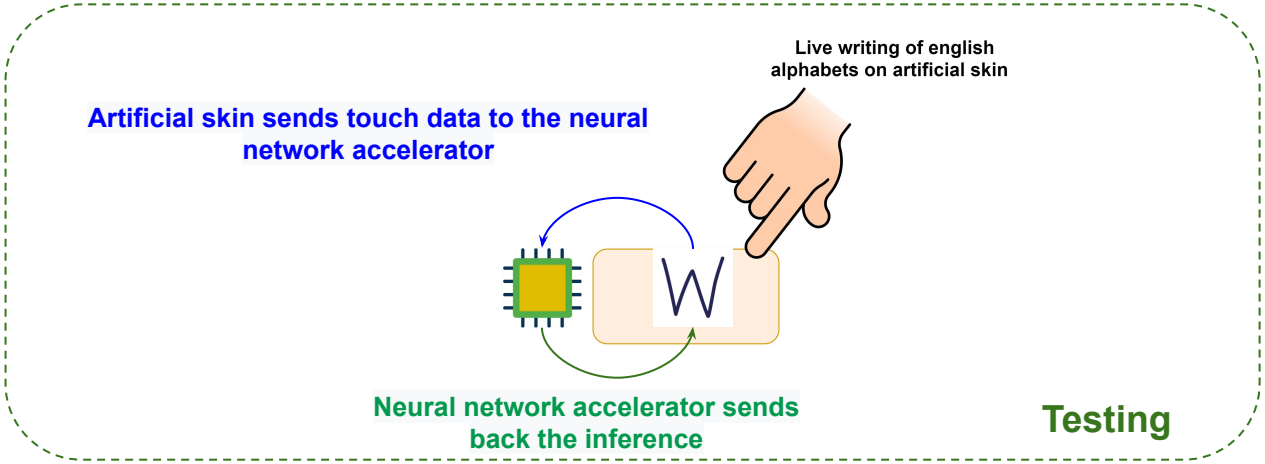


Too less I/O's for connecting all the skin patches.

Long wires form each patch to a central microcontroller causes congestion.

AI-on-skin - High level overview





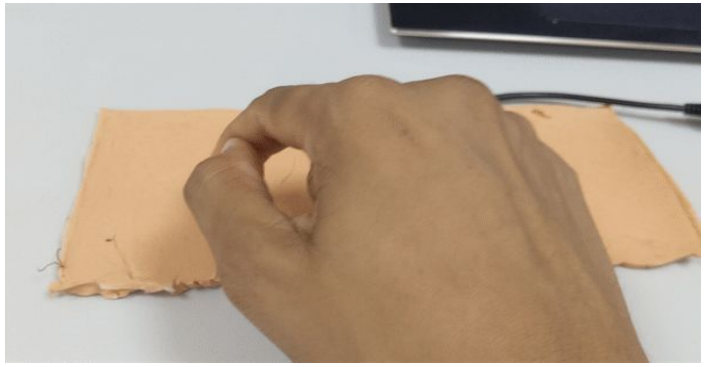
AI-on-skin prototype

12X21 touch electrodes
17X10 cm covers the entire arm

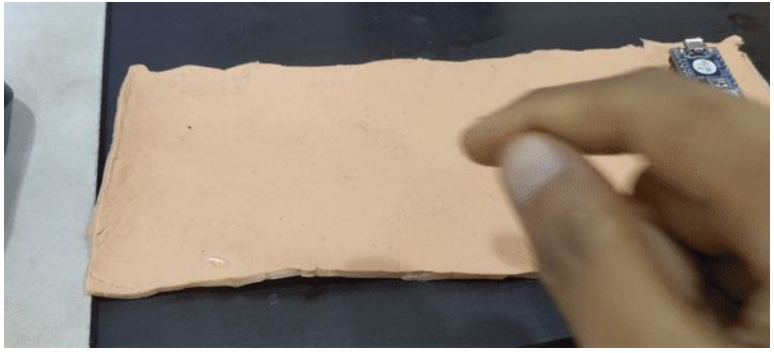
MUCA skin attached to AI-on-skin accelerator implemented on a FPGA.

Applications

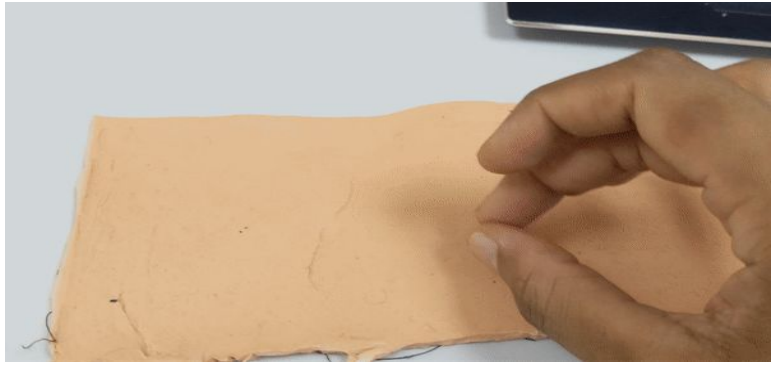
Handwritten word recognition



Handwritten alphabet recognition



Handwritten gesture and shape recognition



- AI-on-skin provides 20X speed up against alternative AI compute architectures.
- Inference is computed within 4-5 ms.

Future Work

1. Gloves overlaid with AI-on-skin patch to recognize Objects, shape etc. from holding the object.
2. Full body suit with multiple AI-on-skin patches for continuous health sensing.

For more details: visit https://AIonskin.github.io or email us at ananta@comp.nus.edu.sg or peh@nus.edu.sg


THANK YOU