DES535
Ubiquitous Computing

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Google Classroom Code : pcwnf5t

Wearable Computing & Smart Systems

Module VIII

Wearable Computing : Key Attributes

- Persist and provide constant access to information services
  - Daily Use
  - Accessible with little/no effort
- Sense and model context
  - Must observe and model the user's environment, the user's physical and mental state, and its own internal state
- Adapt interaction modalities based on the user's context
- Augment and mediate interactions with the user's environment
  - For example, the wearable should automatically gather information and resources relevant to a particular physical location and filter this information based on the user's current needs and preferences.

Smart Clothings

"Kate is about to exercise at home, so she changes into a smart T-shirt of her desired fit and attaches the processing unit to it.

She wears the smart T-shirt just like a conventional workout T-shirt and finishes the workout.

The smart T-shirt logged her workout, including what exercises she did and how many repetitions each, so Kate could maintain an exercise log.

Finally, she detaches the processing unit and puts her sweaty and dirty smart T-shirt into the laundry machine.

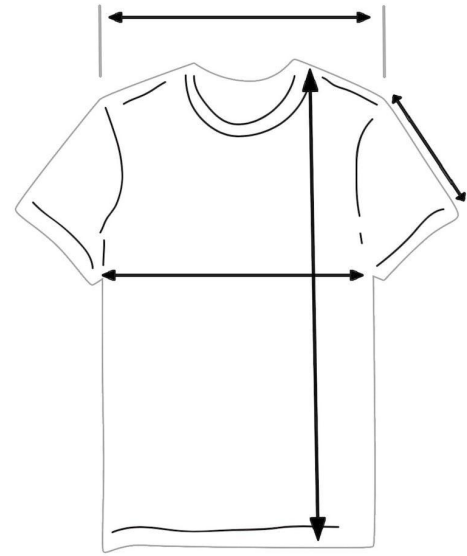*Kate can wear the clean smart T-shirt again, the ne*

Can you identify some design challenges for implementing this scenario?

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Smart Clothings : Challenges

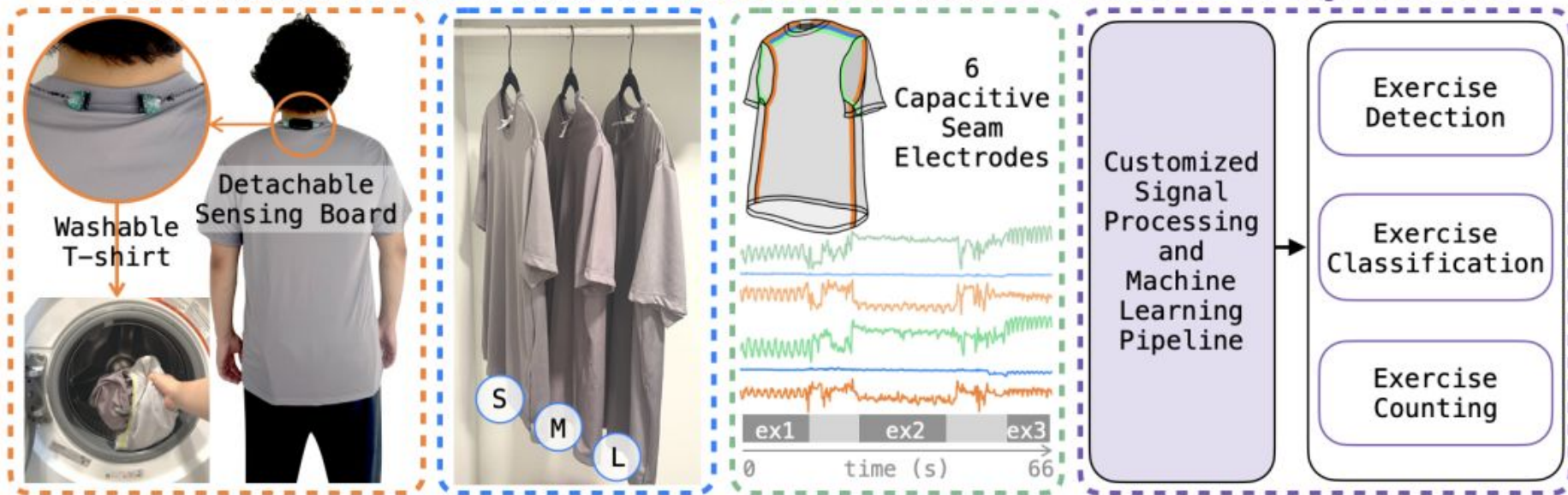**Can you identify some design challenges for implementing this scenario?**

Generalizability across Clothing Fits

Washing Durability of the End-to-End Sensing System

Smart Clothing Solution : SeamFit

SeamFit features washable T-shirts of different sizes with seam electrodes to log exercises.

Washable T-shirt — Detachable Sensing Board

6 Capacitive Seam Electrodes

ex1 ex2 ex3

0 time (s) 66

Customized Signal Processing and Machine Learning Pipeline

Exercise Detection

Exercise Classification

Exercise Counting

S M L

SeamFit : How it Works

- Seams originally are inside of the shirt, so they are invisible when worn.
- Repurposing seams does not alter the visual and material (e.g., breathability, which is essential for exercising) characteristics of the clothing surface.
- Though the changes are minimal, seams placements highly correlate with body joints and thus enable fine-grained tracking

SeamFit : How it Works [Contd…]

6 Electrodes Around the Shoulders, Along the Sleeves, on the Sides of the Torso. The threads are TPU-Coated Silver-Nylon.
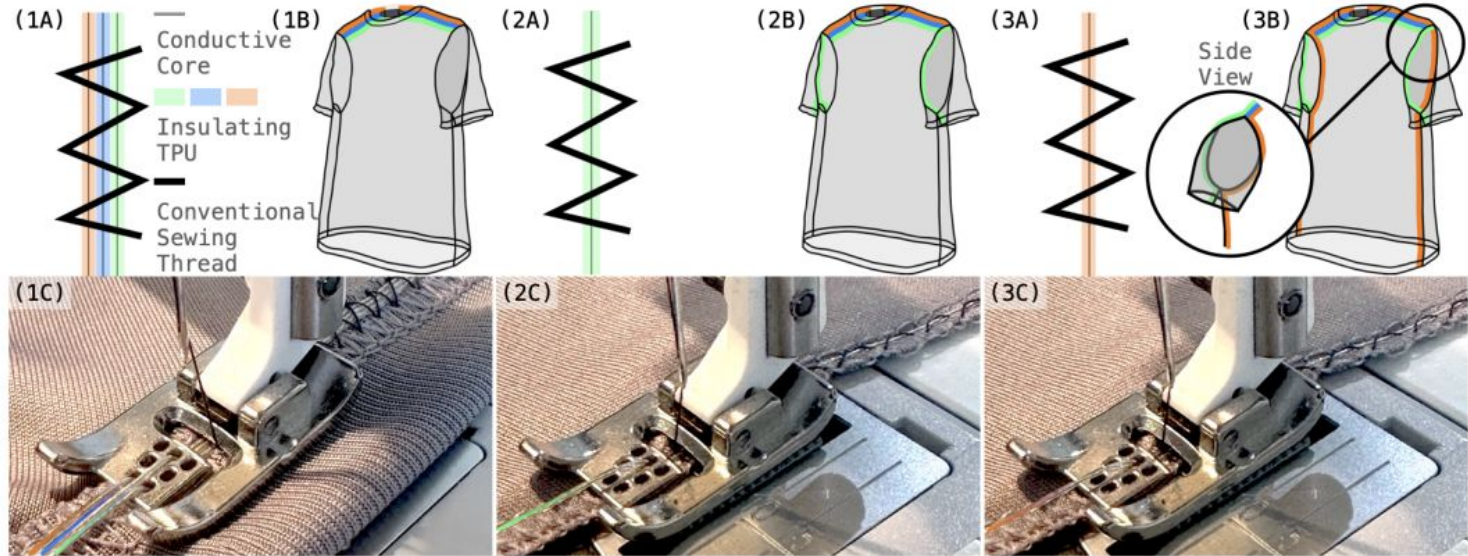

Top–Back–Torso Electrode (TBTE)

Top Electrode (TE)

Top–Font–Sleeve Electrode (TFSE)
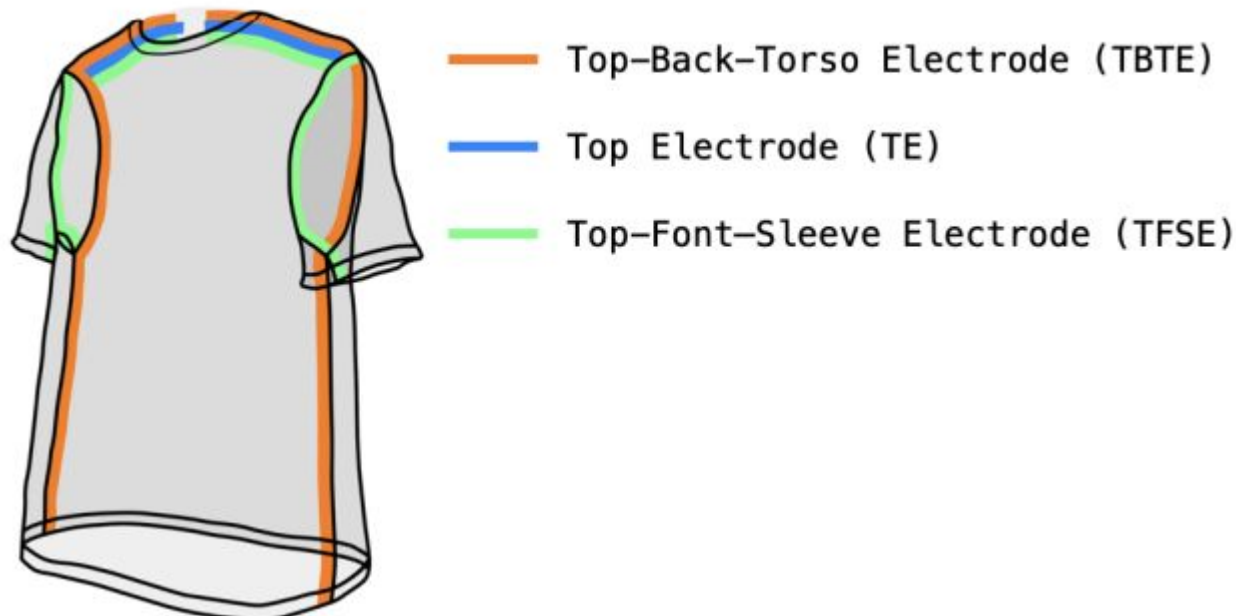
SeamFit : How it Works [Contd…]

6 Electrodes Around the Shoulders, Along the Sleeves, on the Sides of the Torso. The threads are TPU-Coated Silver-Nylon.


Fig. 3. Machine-Sewing Steps. For each side, we use the chording presser foot to first couch the three electrodes from the back of the neck to the tip of the shoulder (1A-C), then couch the top-front-sleeve electrode (TFSE, 2A-C) and top-back-torso electrode (TBTE, 3A-C), individually.
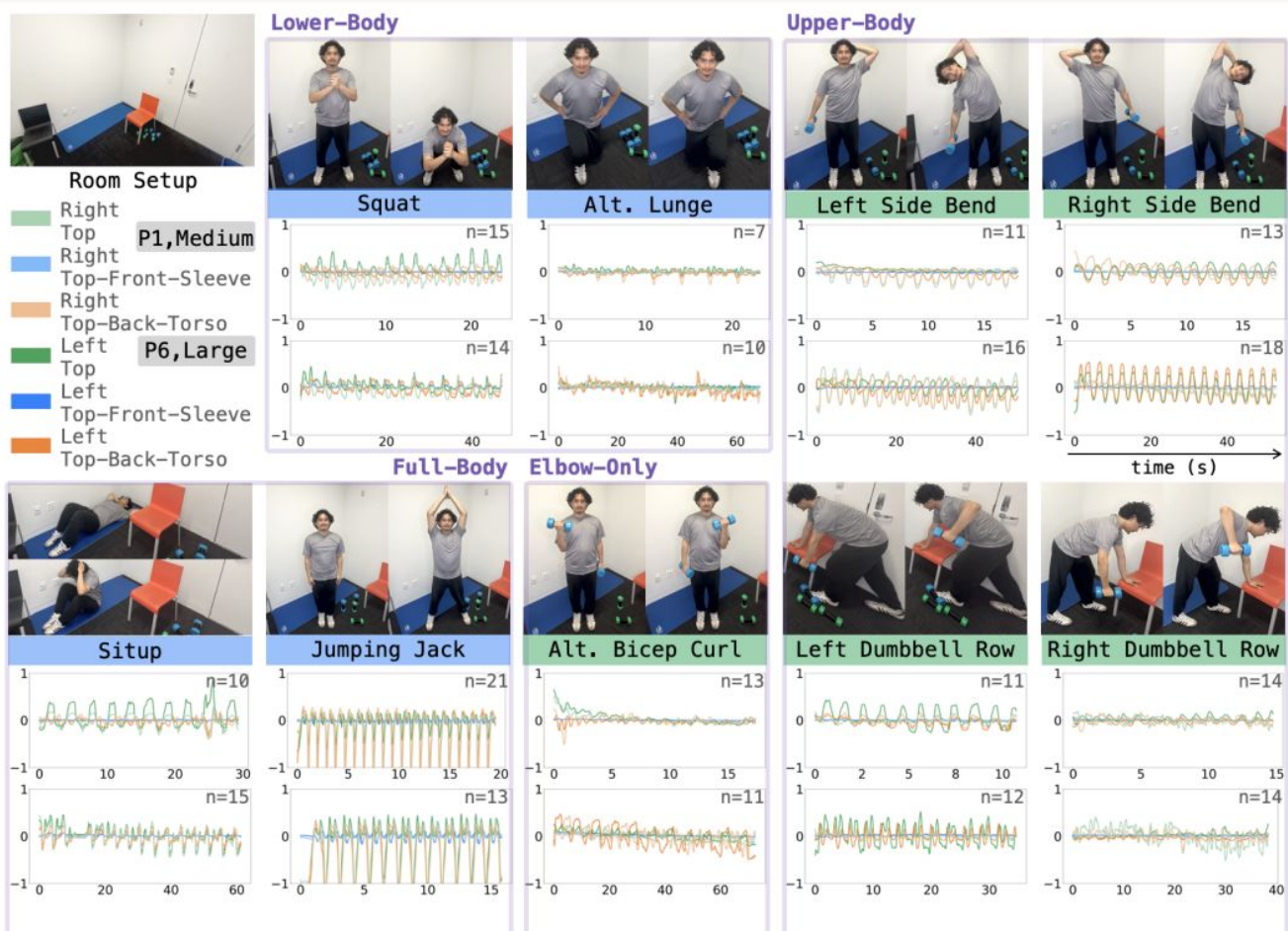
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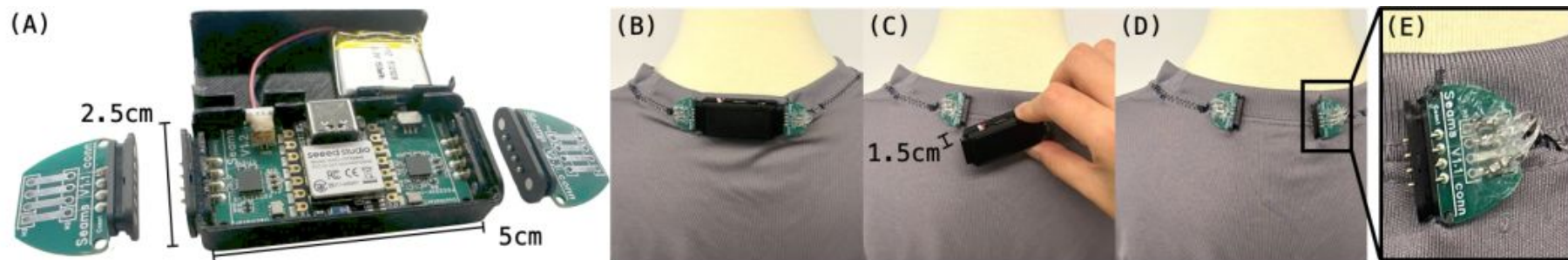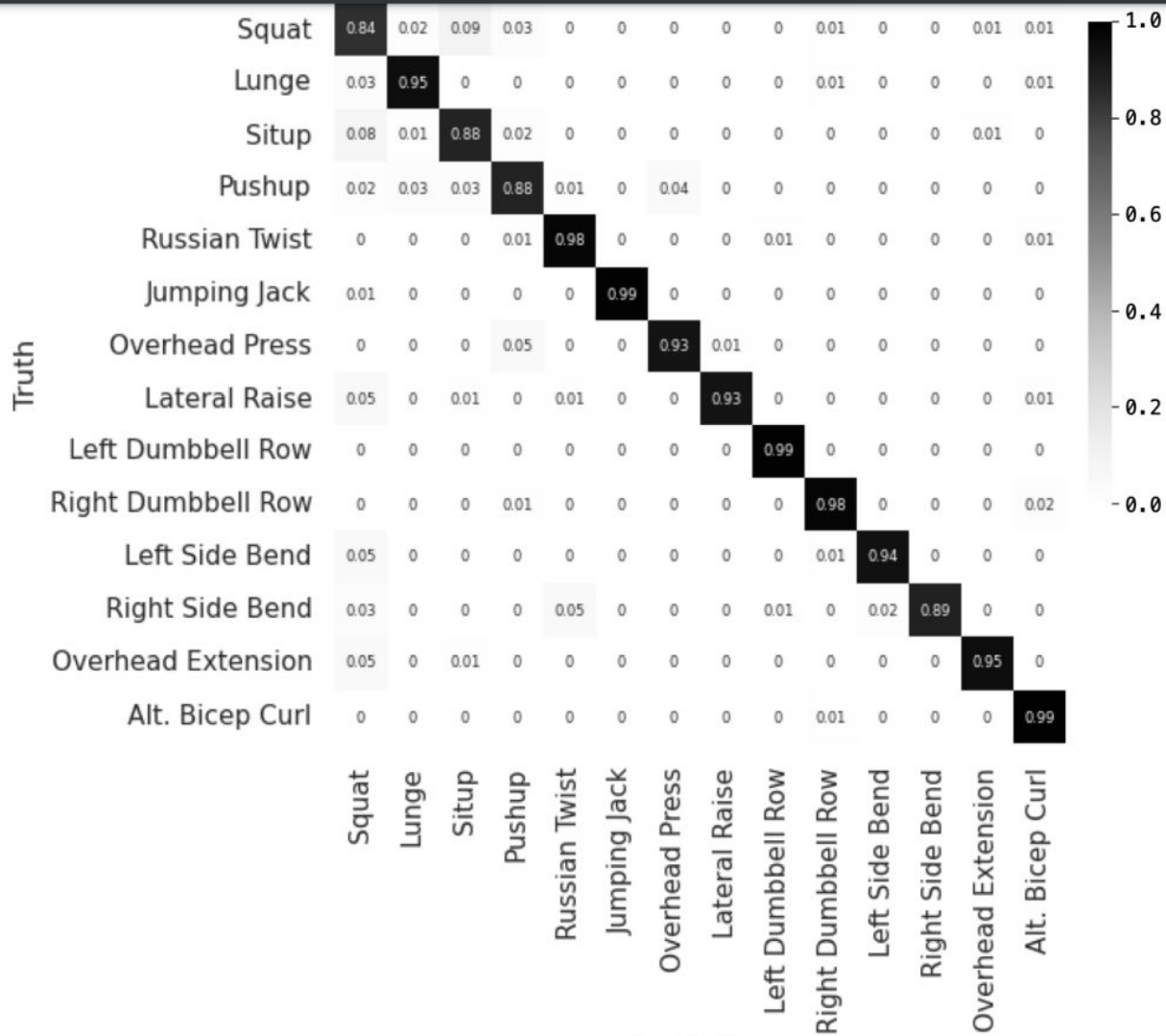
SeamFit : Model
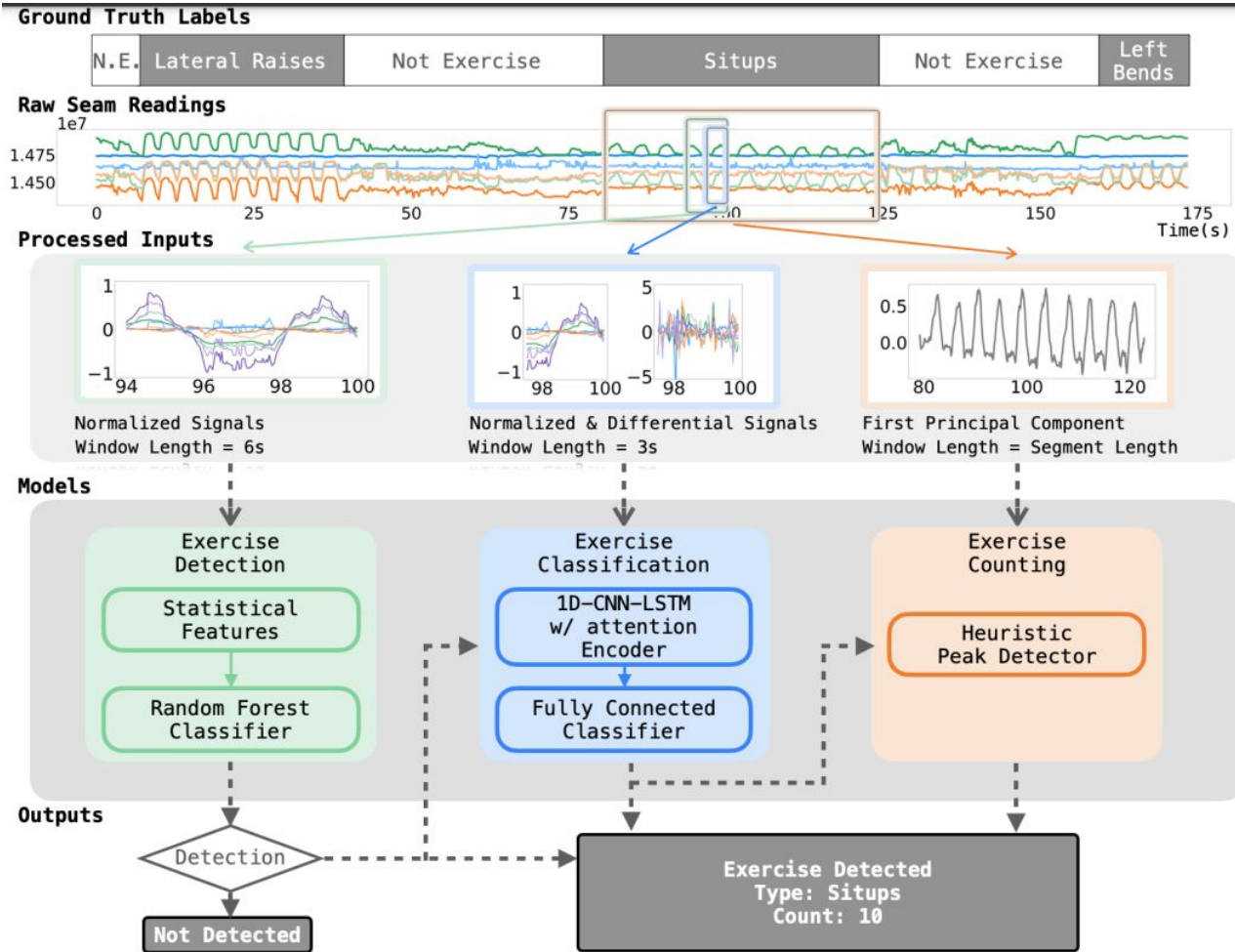
SeamFit : Results

SeamFit : Results

In a 15-participant 14-exercise user study, SeamFit demonstrated an exercise detection accuracy of 89%, exercise classification accuracy of 93.4%, and an average exercise count error of 0.9 counts, independent of users, washes, and fits.

SeamFit

Critically evaluate the proposed approach

Early Example of Smart Clothing: The Shift to Wearable Computing

The author and his wearable multimedia computer/personal visual assistant. The apparatus includes a miniature computer screen and sensor array in the eyeglasses, Internet connection, and a multimedia computer with special-purpose video processing hardware.
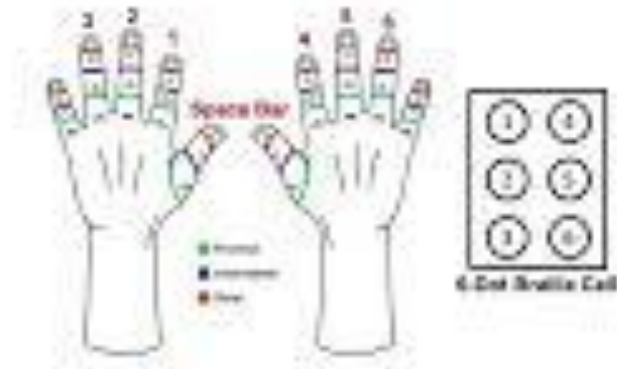
More Applications of Wearable Computing

https://www.youtube.com/watch?v=j8uLddsKROU

More Applications of Wearable Computing

https://www.youtube.com/watch?v=EQ-_bWjDKC4

More Applications of Wearable Computing

she can calm him with her profound and slow breathing

https://www.youtube.com/watch?v=giYfG9DmNxE

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Challenges of Wearable Computing

- Power use
- Heat Dissipation
- Networking
- Privacy
- Interface Design

"Those who design systems which handle personal information therefore have a special duty: They must not design systems which unnecessarily require, induce, persuade, or coerce individuals into giving up personal privacy in order to avail themselves of the benefit of the system being designed"
- *Leonard Foner*

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