ActionNet

https://action-net.csail.mit.edu

A Multimodal Dataset for Human Activities Using Wearable Sensors

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Overview and Goals

Rich multimodal sensing focused on wearable devices

Motion

Tactile Sensing

Muscle Activity

Body and Finger Tracking

Eye Tracking

RGB+D Video

Audio

Activity Labels

Peel cucumbers
Slice cucumbers
Set table
Load dishwasher

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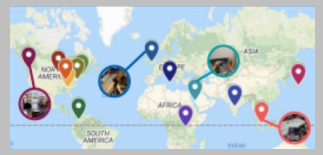
Insights about how humans interact with physical or virtual worlds

- Train robot assistants
- Train people
- Interactive simulations
- Smart textiles

Related Datasets

Large-Scale Image/Video



Ego4D: Grauman et al., 2022

EPIC-KITCHENS-100: Damen et al., 2022
Action Genome: Ji et al., 2020
ActivityNet: Heilbron et al., 2015

Multimodal with Wearables

MMAct: Kong et al., 2019

Stanford ECM: Nakamura et al., 2017
UTD-MHAD: Chen et al., 2015
CMU-MMAC: de la Torre et al., 2009

Data-Driven Robotics Applications

Levine et al., 2018

Pinto et al., 2016
Finn et al., 2016
Agrawal et al., 2016

Simulation

BEHAVIOR: Srivastava et al., 2021

Meta-World: Yu et al., 2020
VirtualHome: Puig et al., 2018
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Demonstrations

MIME: Sharma et al., 2018

RoboMimic: Mandlekar et al., 2021

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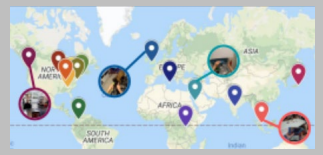

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- Highly multimodal
- Wearable and global
- Activity labels
- Structured tasks
- Parsing and recording frameworks

Sensors: Wearable Devices

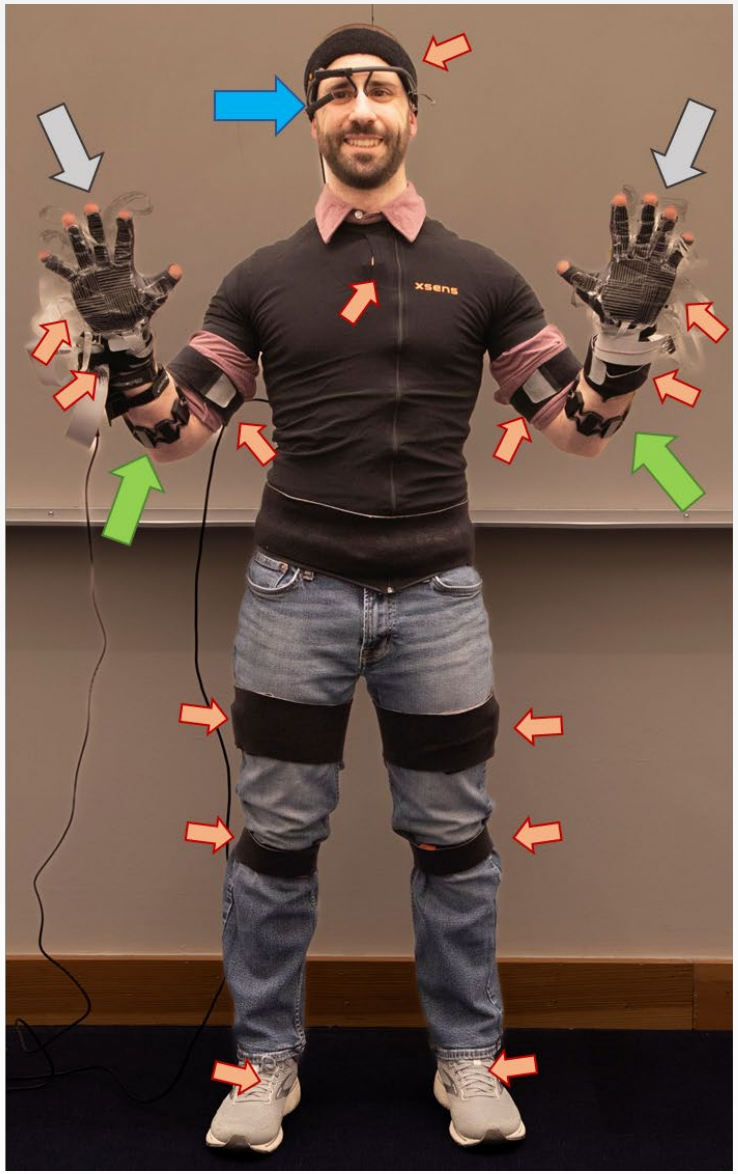
Motion Tracking

Xsens Awinda body tracking

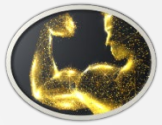
Manus Gloves finger tracking

Interaction Forces

Custom tactile sensors



Myo Armband muscle sensor

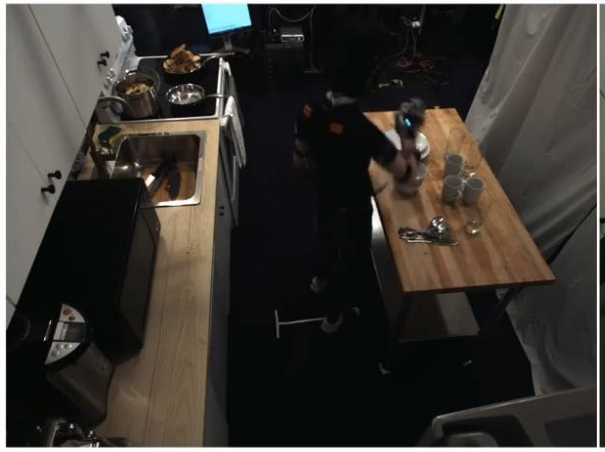


Muscle Activity

Pupil Labs eye tracking and first-person video

Attention

Sensors: Global Perspectives





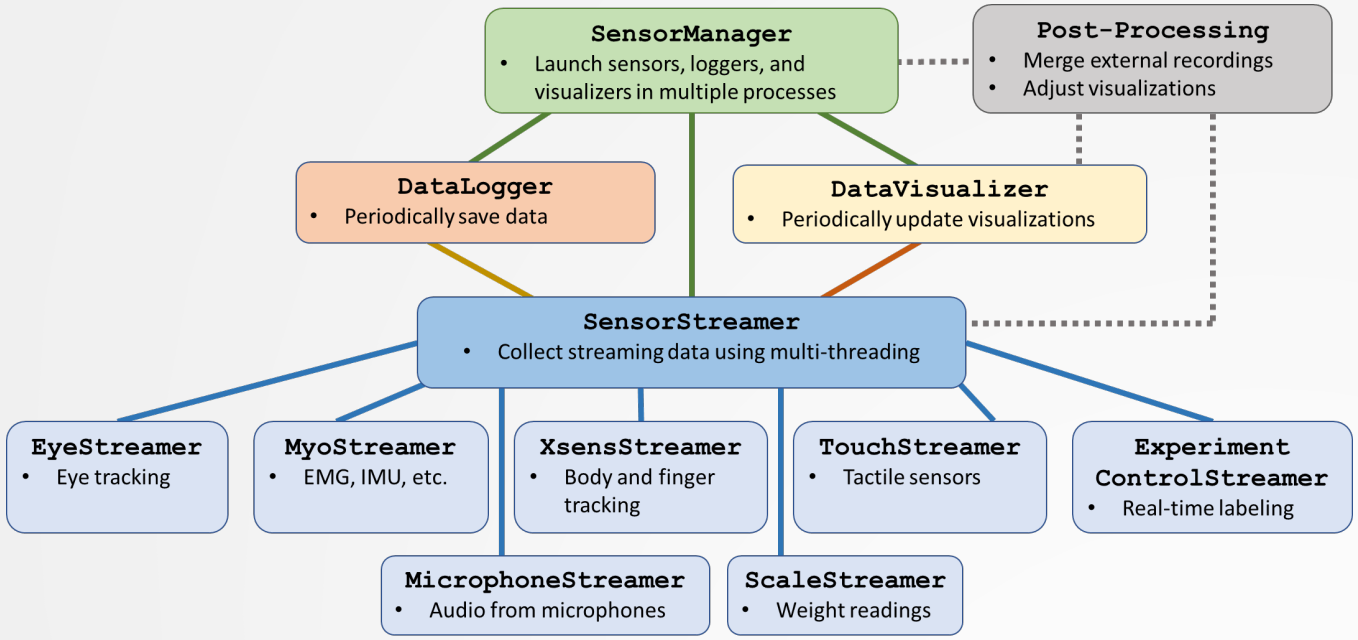

5x

- 5 RGB cameras
- 1 RGBD camera

- 2 microphones

Software Infrastructure: Recording

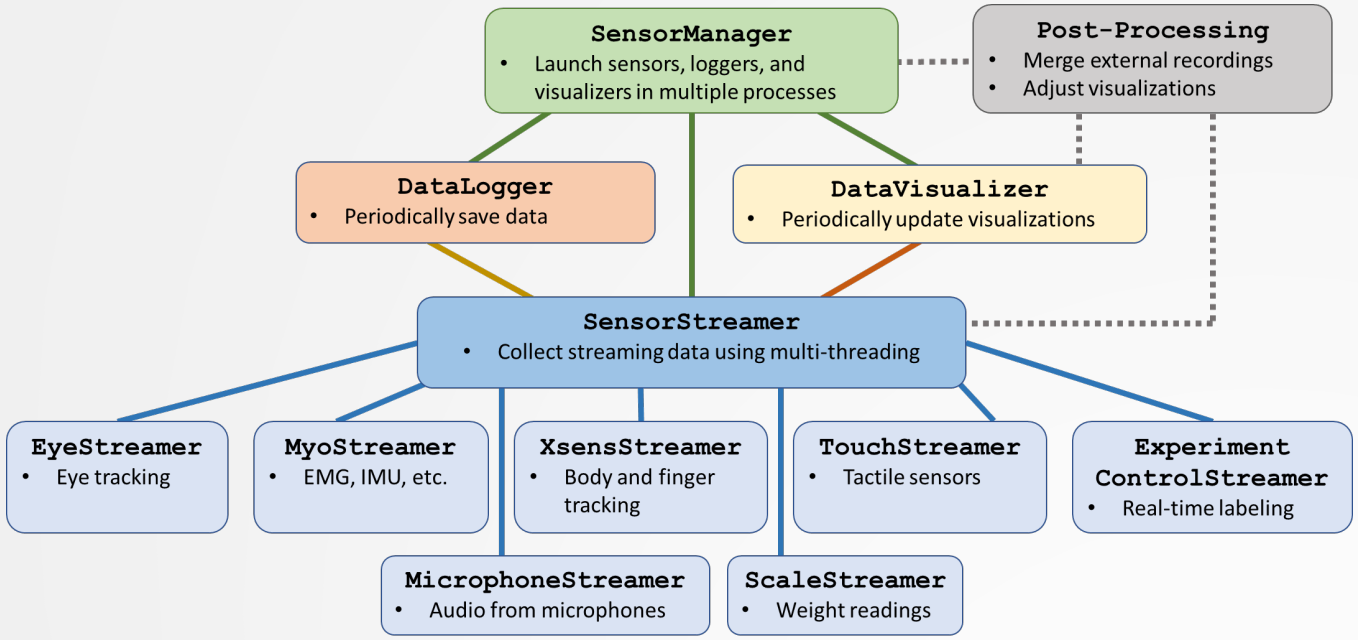
Extensible Recording Framework



- Stream, synchronize, save, and visualize data from all sensors
- Post-processing for higher-quality data
- Easily add or replace sensors

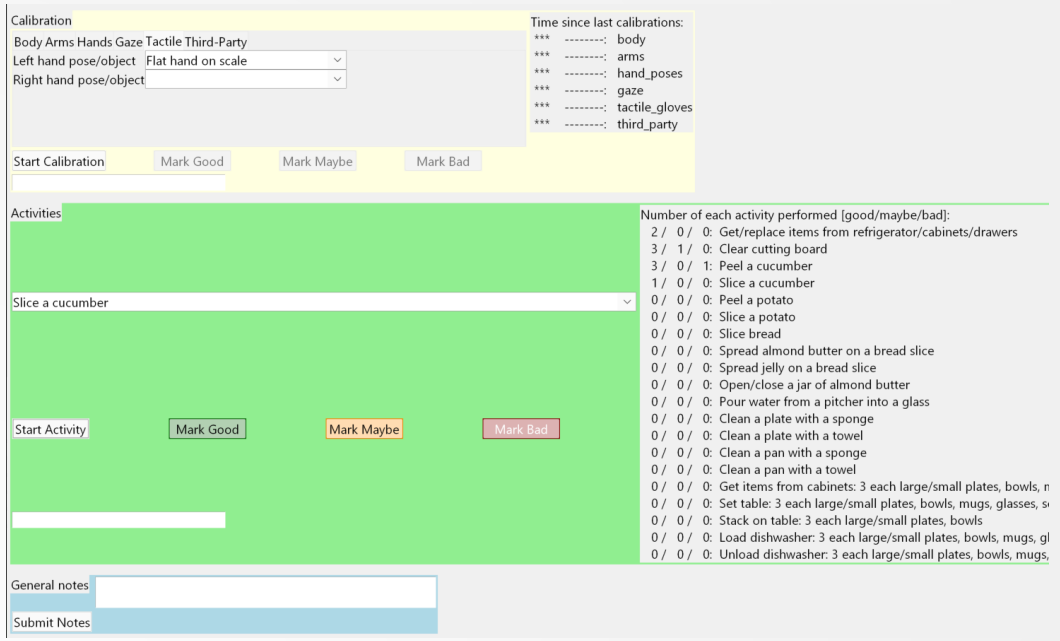
Software Infrastructure: Labeling

Extensible Recording Framework



- Stream, synchronize, save, and visualize data from all sensors
- Post-processing for higher-quality data
- Easily add new sensors

Experiment Control and Real-Time Labeling



- Interactive GUI for synchronized ground truth
- Label, rate, and annotate activities as they occur
- Keep track of experimental flow

Dataset Activities: Kitchen Tasks

Food Preparation


Peel a Cucumber


Peel a Potato


Clear Cutting Board


Spread Almond Butter


Slice a Cucumber


Slice a Potato


Slice Bread


Spread Jelly

Cleaning Tableware



Clean a Plate with a Sponge or Towel



Clean a Pan with a Sponge or Towel

Manipulations


Open/Close a Jar


Pour Water

High-Level Tableware Tasks


Fetch Tableware


Fetch/Return Items

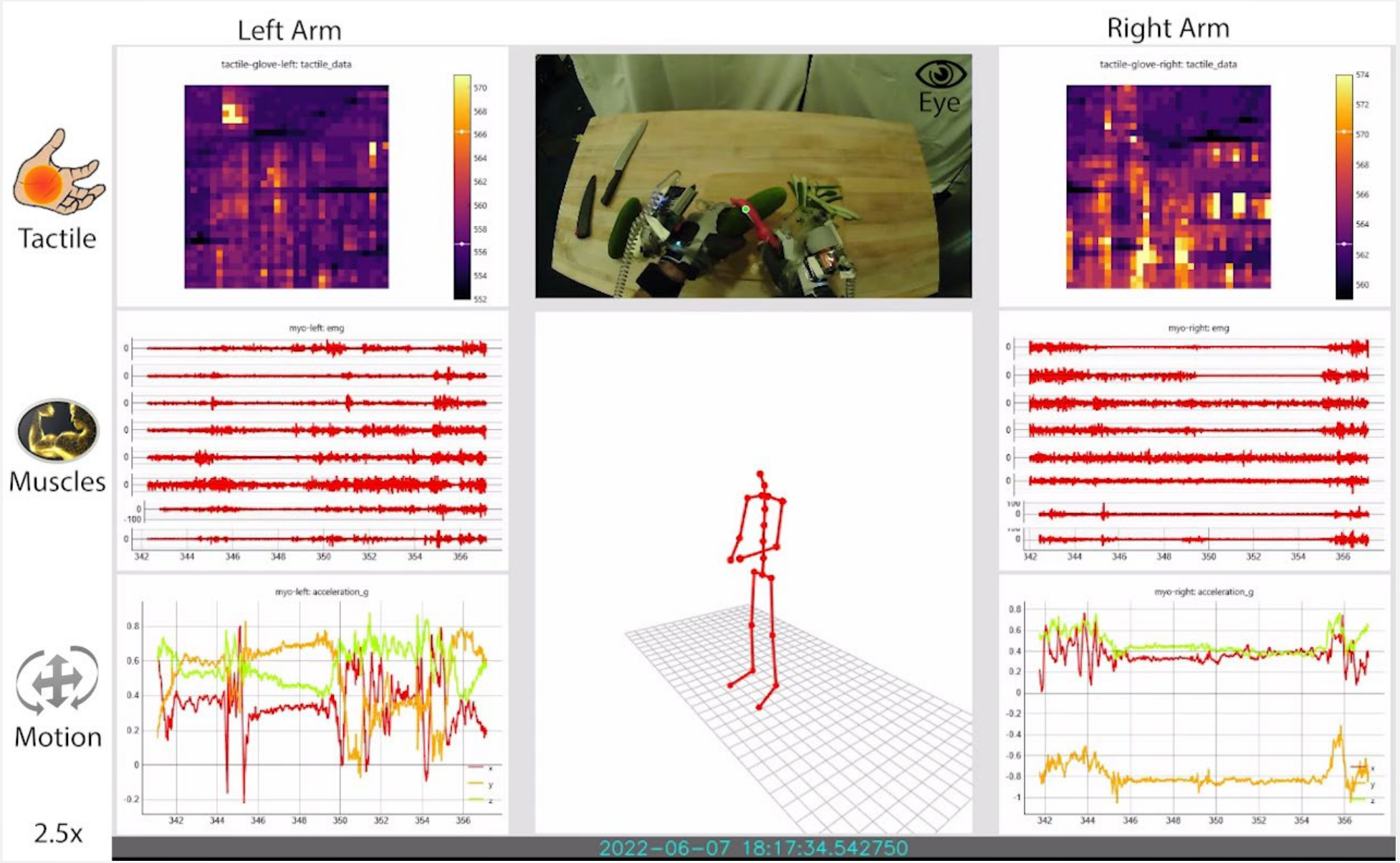

Stack Tableware


Set Table


Load Dishwasher

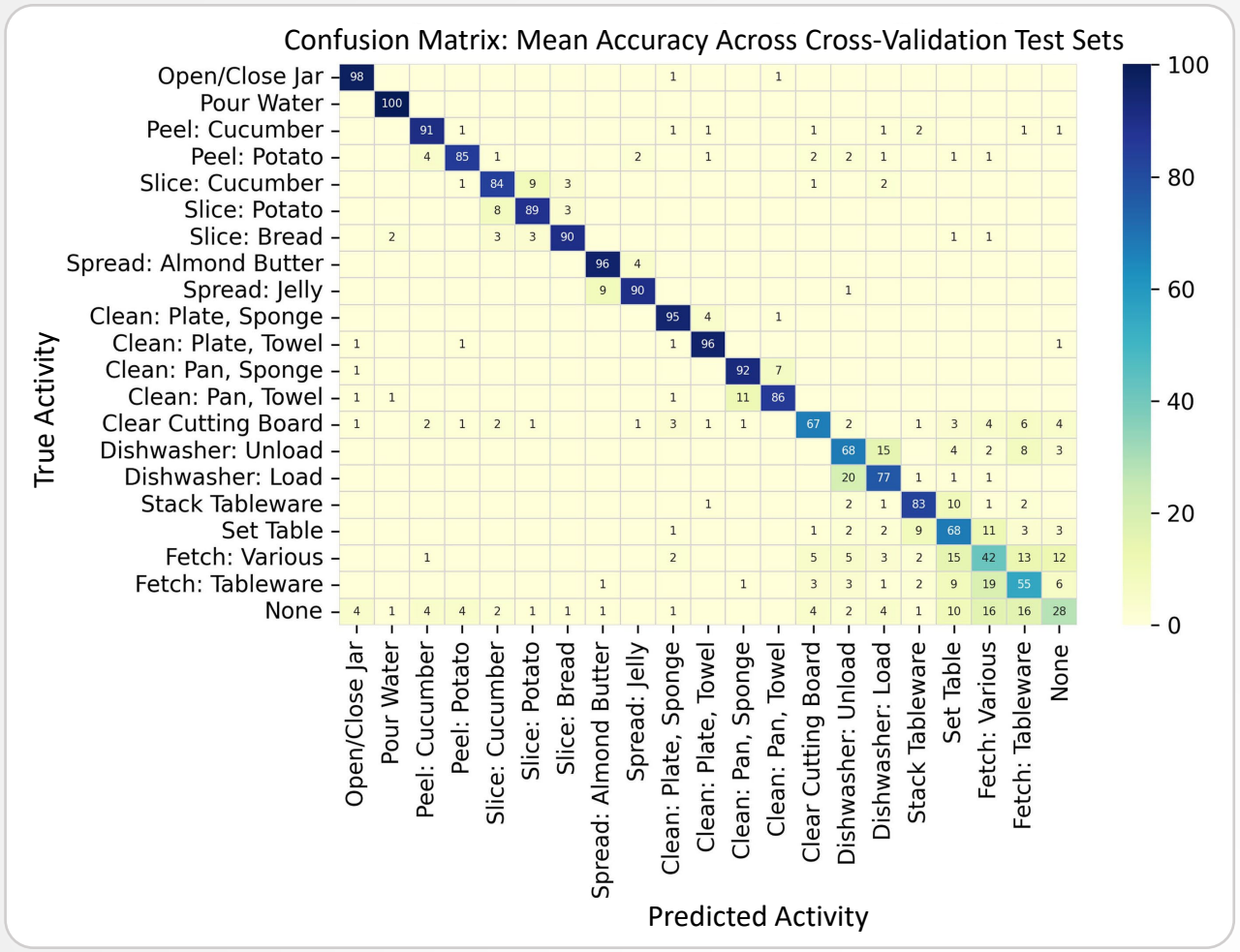

Unload Dishwasher

Visualizations: Multimodal Wearable Data



Applications: Classification and Modality Studies

Activity Classification and Modality Ablations Using LSTMs



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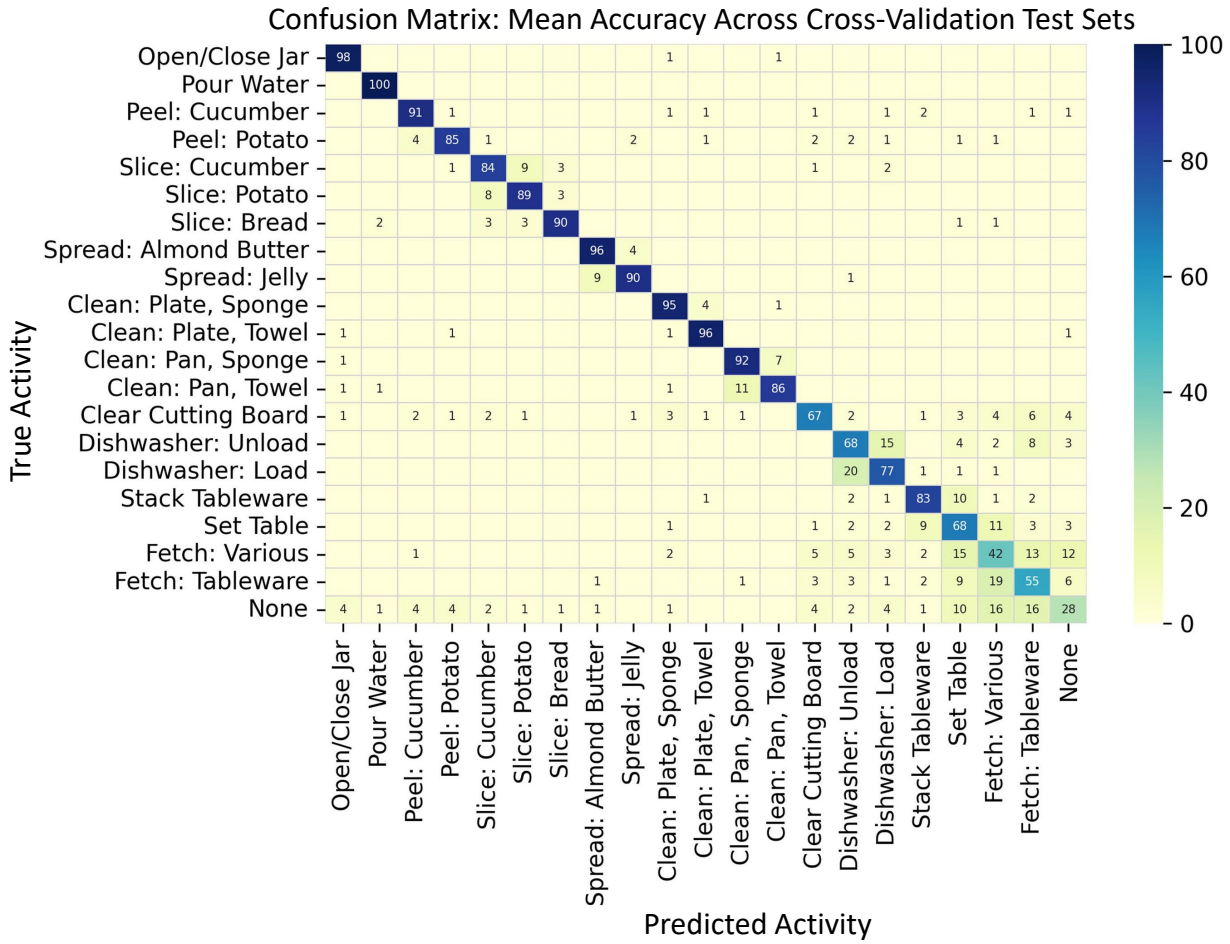
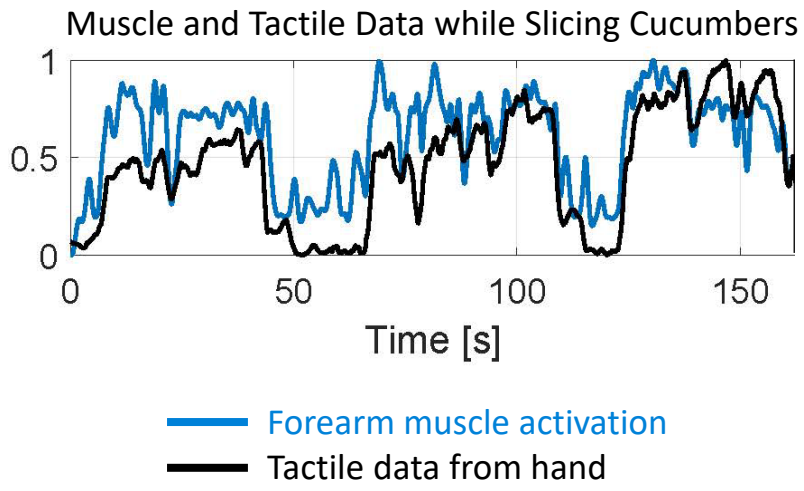


Cross-Modal Analysis



Conclusion and Future Work

- Multimodal dataset focused on wearable devices and common household tasks
- Synchronized global data and ground-truth labels
- Extensible recording and processing framework

Models and analysis
- Cross-modal predictions
- Sequence reasoning

Teaching from demonstrations
- Robotic assistants
- Personalized training

Extensions and integrations
- Immersive simulations
- New task domains