

Workshop: Machine Learning Processing for Wearable Data in Healthcare

Classification and Regression Cases in Rehabilitation Event Detection

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WS Day 1: Feature Extraction in Healthcare Data for ML Modelling

Content and Learning Outcomes:

1. Healthcare monitoring and data in the rehabilitation process.
2. Introduction to learning from patient data.
 1. Classification algorithms: Basics of boundaries and similarity metrics in latent spaces (reduced dimensions)
3. Time series data preprocessing and classification methods
 1. Preprocessing steps: Imputation, Labelling check,
4. Tutorial with multimodal time-series data in activities of daily living.
 1. Introduction to the dataset – scai-sensei
 2. Pre-processing steps: .
 3. Toolbox for feature extraction
 4. Decisions in pre-processing (windowing, normalization, quality)

WS Day 2:

Evaluation Metrics for Acceptable Machine Learning

Content and Learning Outcomes:

1. Data-driven model principles: Bias variance trade-off, model training, and generalization. Yanke Li
2. An introduction to data quality assessment and model evaluation metrics with a focus on explainability, robustness and generalization. Diego Paez
3. Tutorial for model training and feature selection methods in time-series
 1. Feature Selection Methods
 2. Building Classification Models

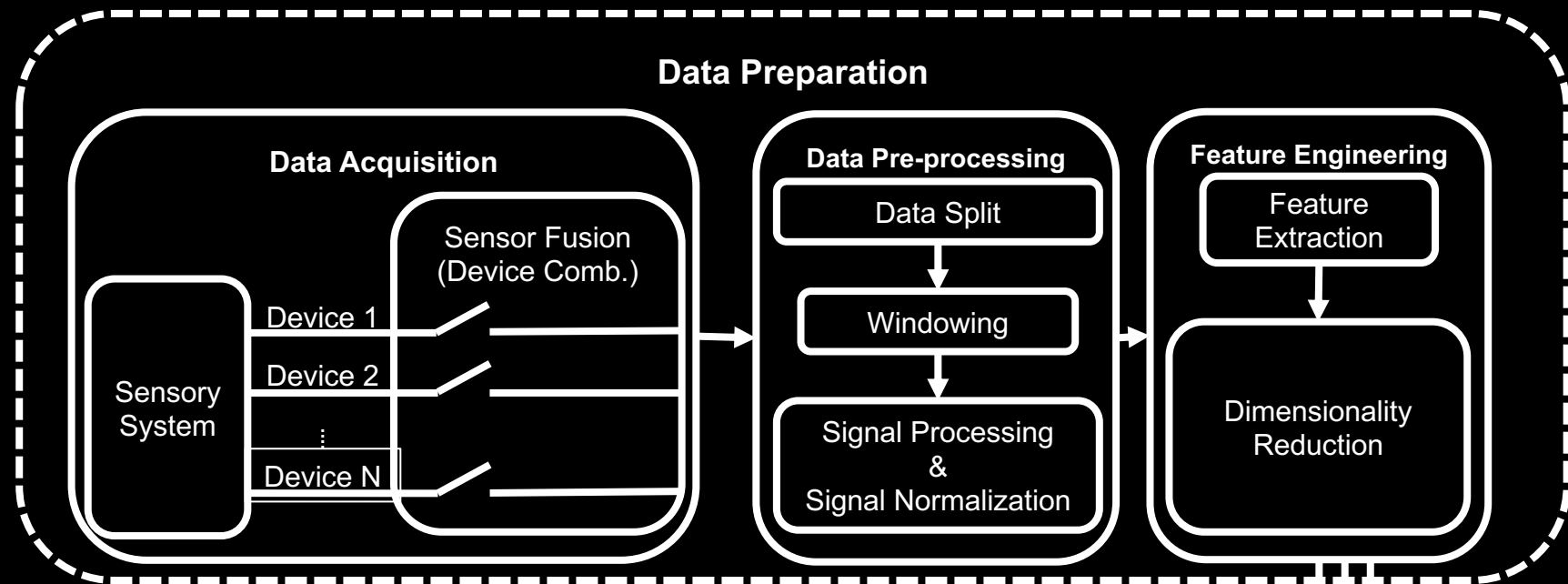
WS Day 3:

Learning Interpretability and Explainability Metrics

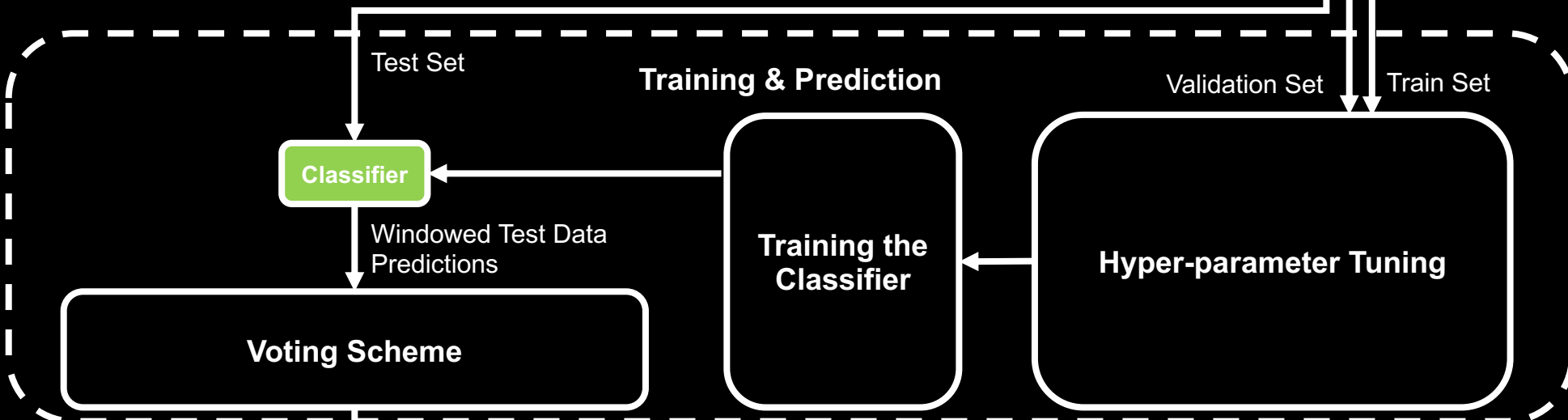
Content and Learning Outcomes:

1. Transparency and Explainability in AI for Healthcare
2. Causal feature selection in time series (Markov Blanket) as an explainability method for Robust transferability across datasets. Yanke Li
3. Tutorial for explainable methods in classification:
 1. LIME
 2. SHAP Values
4. Presentations by groups:
 1. Model results, explainability and generalization

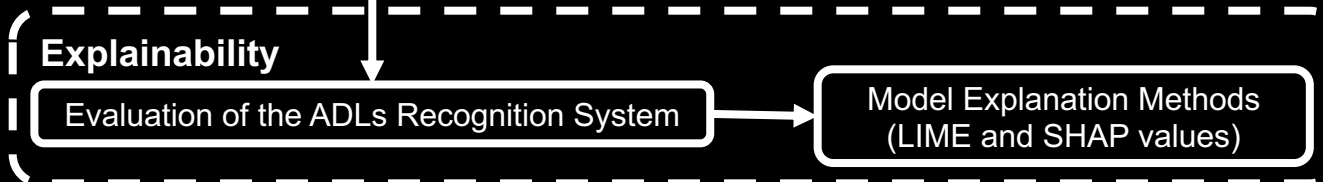
WS Day 1



WS Day 2



WS Day 3



Group Building and Environment Setting



ADL Detection - N2N-video-based

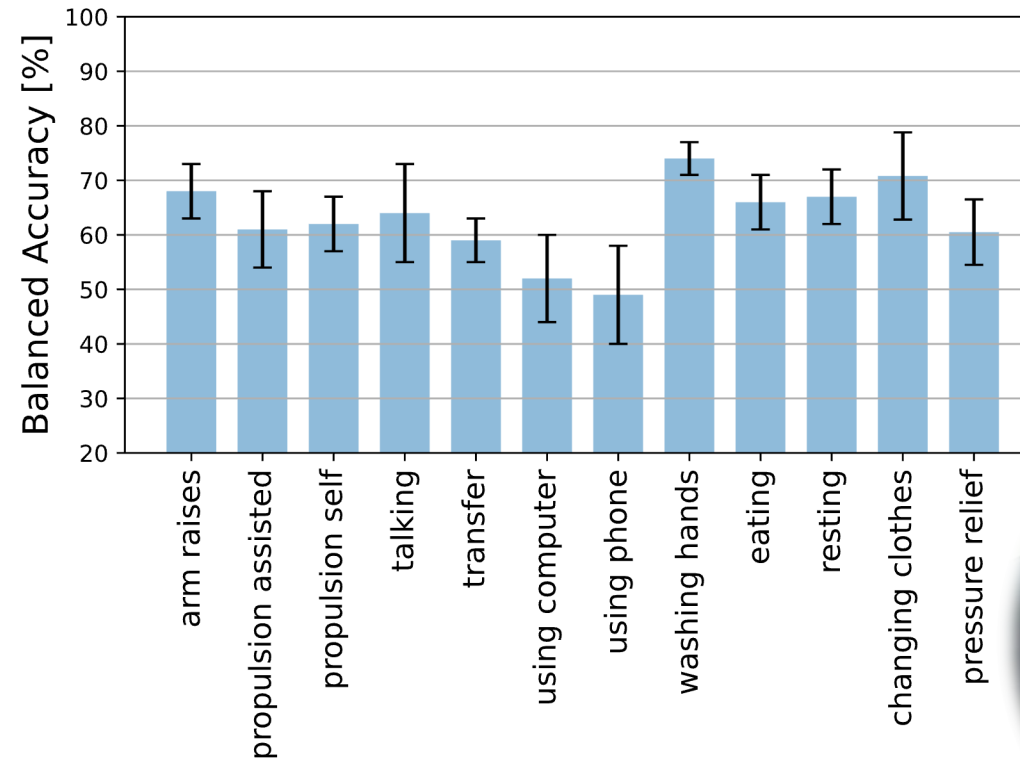
Fine-tuned Slow-fast Network

Dataset

Classes	12
Participants	3 wheelchair + 21 healthy
Total Videos	485

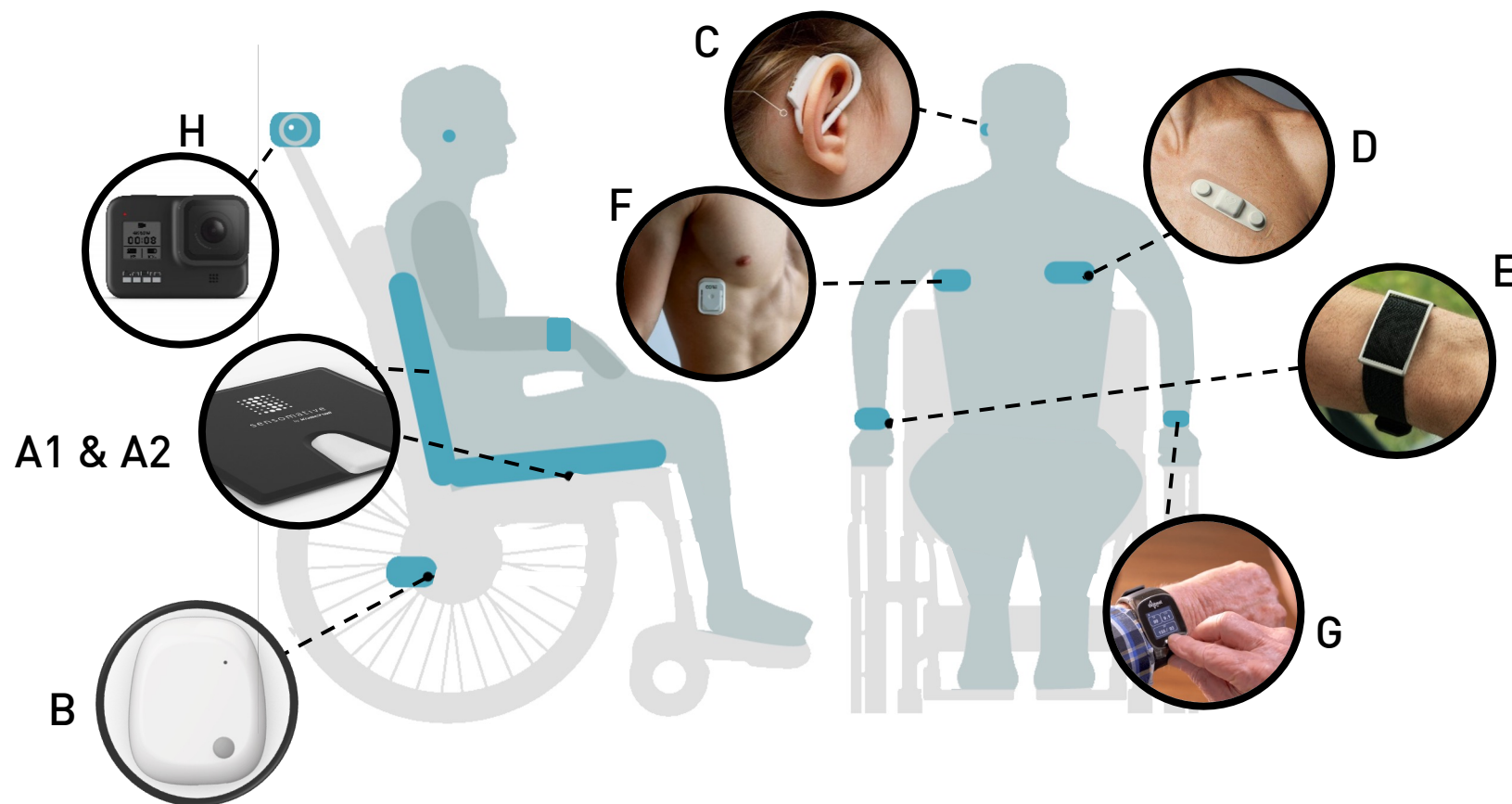
Videos per Class

Self Propulsion	46
Assisted Propulsion	54
Transfer	36
Using Phone	74
Talking	85
Washing Hands	30
Arm Raises	30
Using Computer	45
Eating	38
Resting	34
Changing Clothes	16
Pressure Relief	31



S. Bensland, A. Paul, L. Grossmann, I. Eriks-Hogland, R. Riener, and D. Paez-Granados. "Healthcare Monitoring for SCI individuals: Learning Activities of Daily Living through a SlowFast Network". In: IEEE International Conference on System Integration. Jan. 2023. <https://doi.org/10.1109/SII55687.2023.10039043>

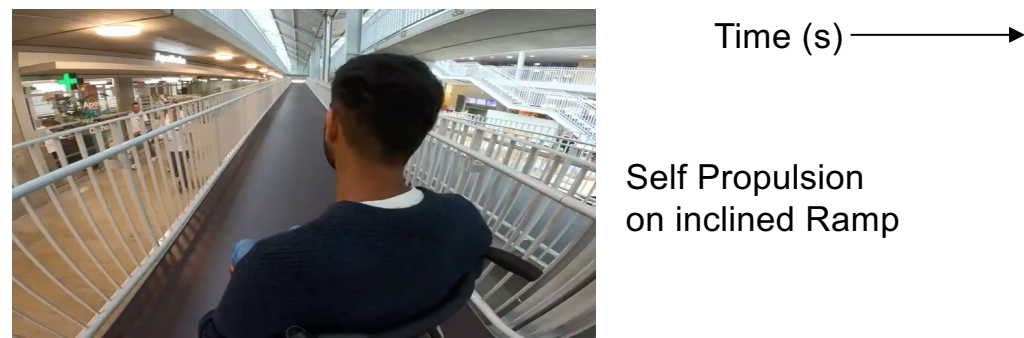
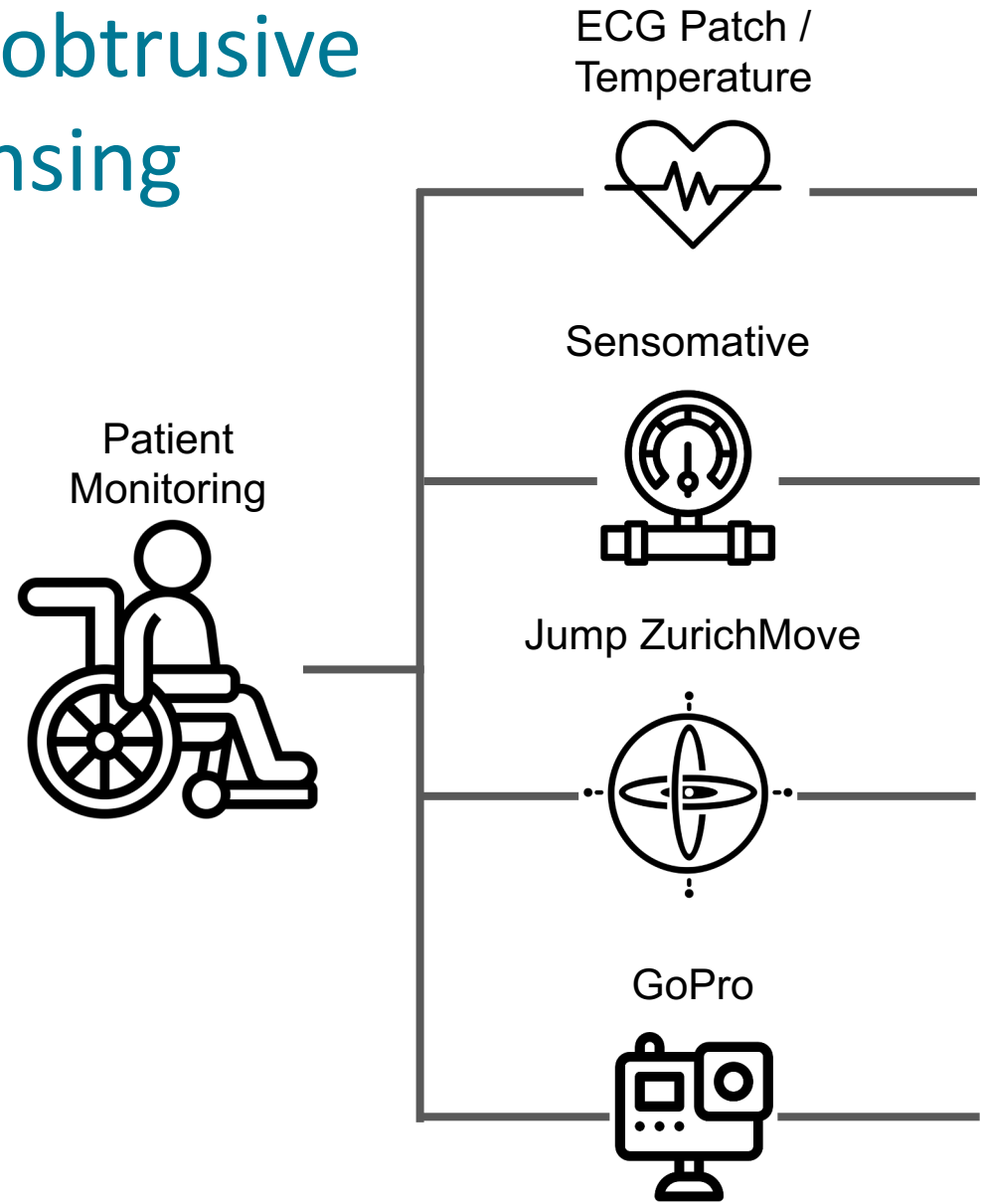
Unobtrusive Sensing for ADLs Monitoring



M. Ejtehad, S. Amrein, I. Eriks-Hogland, R. Riener, and D. Paez-Granados. "Learning Activities of Daily Living from Unobtrusive Multi-modal Wearable Sensors: Towards Monitoring Outpatient Rehabilitation". In: IEEE International Conference on Robotics and Rehabilitation. Sept. 2023. <https://doi.org/10.1109/ICORR58425.2023.10304743>

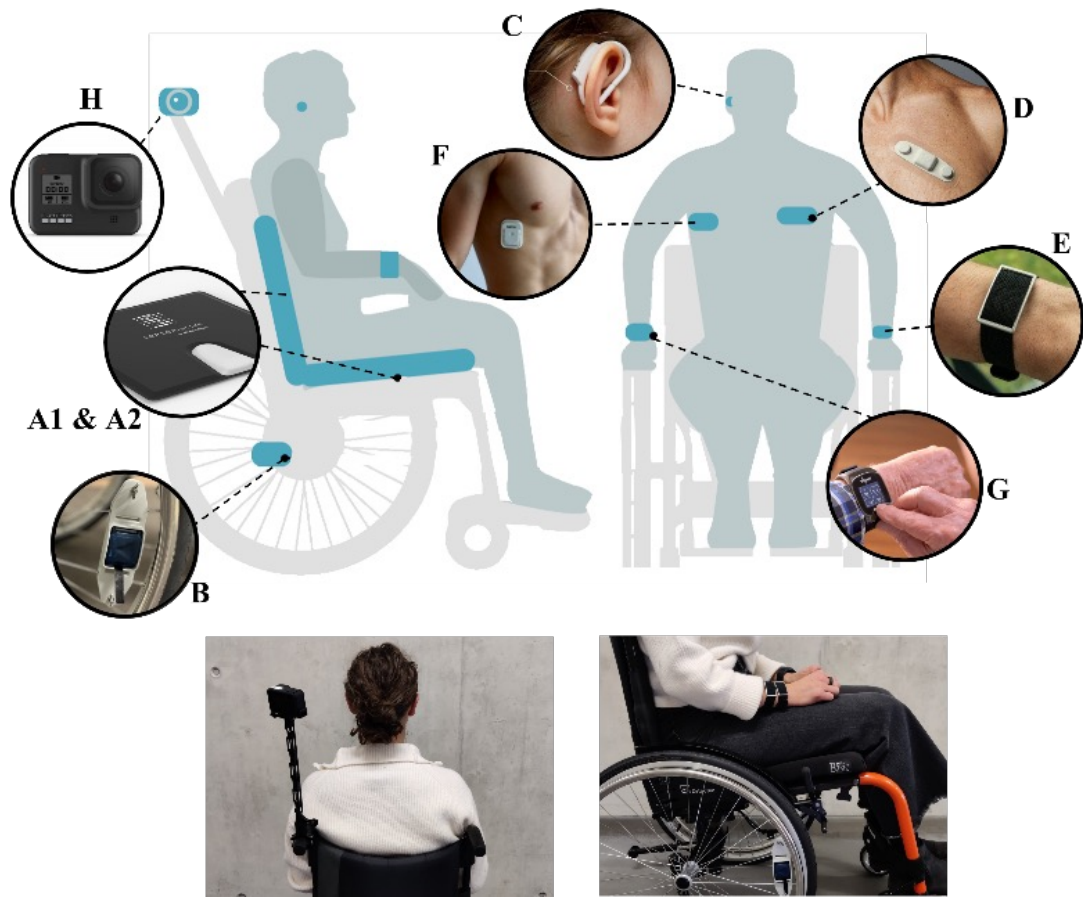


Unobtrusive Sensing



Tutorial: Coding Tasks

Sensors & Classes



- What devices are useful to each class?
- What is the expected frequency of each activity?

Label	Device Name
A1	sensomative_bottom
A2	sensomative_back
B	zurichmove_wheel
C	cosinuss_ear
D	vivalink_patch
E	corsano_wrist
F	NOT USED
G	NOT USED

Arm Raises

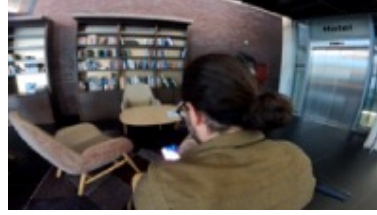
Pressure Relief



Exercise

Using Phone

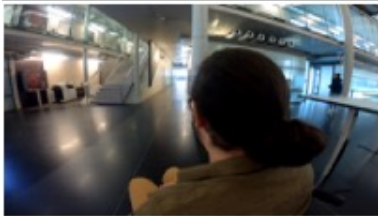
Using Computer



Leisure

Assisted
Propulsion

Self
Propulsion



Mobility

Washing
Hands

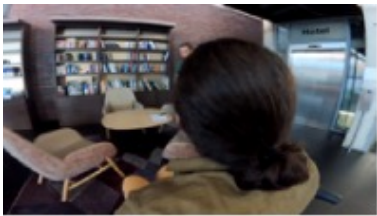
Changing
Clothes



Self Care

Talking

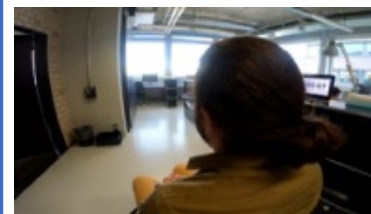
Eating



Social

Transfer

Resting



Transfer

- What activities can you classify?
- What level of confidence can you achieve?
- What is the expected frequency of each activity?

Number	Class Name
0	calmness
1	selfpropulsion
2	armraises
3	transfer
4	usingphone
5	talking
6	Washinghands
7	eating
8	assistedprop
9	usingcomputer
10	changingclothes
11	pressurerelief