

Sedentary Behaviour Classification in Older Adults: Algorithm Optimisation and Validation for Dementia Research.

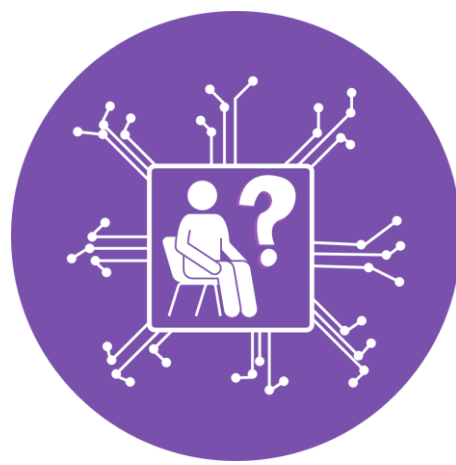
Jenny L Wales, Aoife Hampson, Chloe Hinchliffe, Alison Yarnall, Silvia Del Din, Róna Mc Ardle



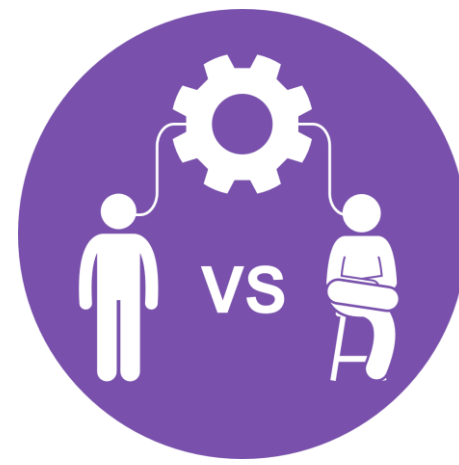
Introduction



Older adults with dementia self-report more sedentary behaviour (SB) than their cognitively intact peers [1].



Findings from wearable devices remain inconsistent, largely due to a lack of algorithm validation in older populations [2].



Current algorithms rely exclusively on accelerometer data and struggle to differentiate sitting from standing [2].



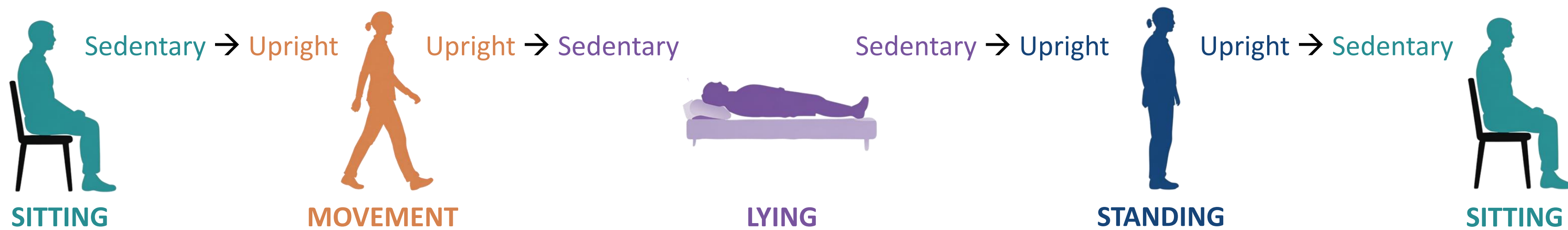
Utilising gyroscope data alongside accelerometry could improve SB classification accuracy by detecting postural transitions [2].

Aims

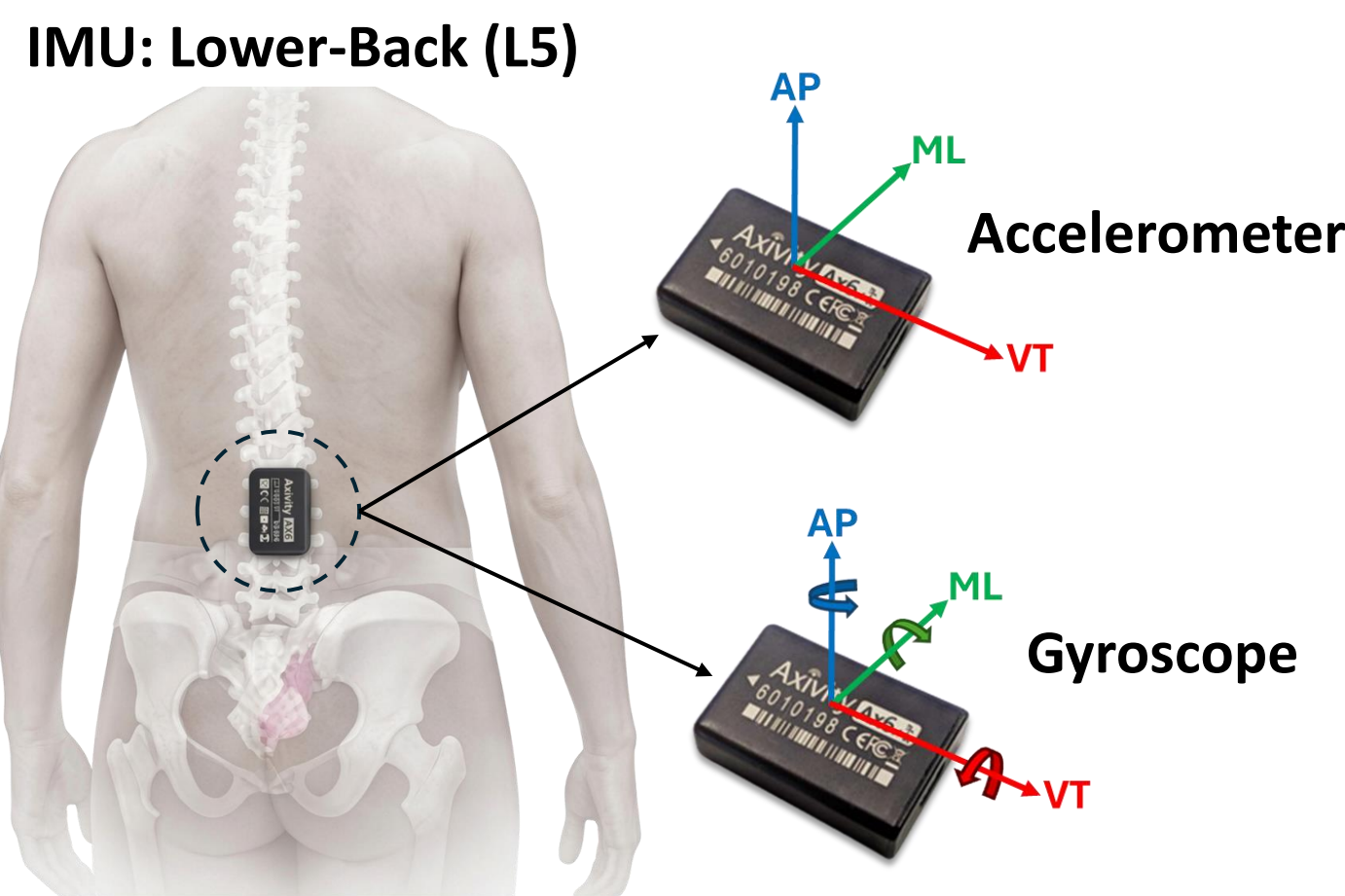
- 1 **Develop** an algorithm **integrating** accelerometer and gyroscope data to detect SB.
- 2 **Assess** agreement between algorithm-derived classifications and video-annotated ground truth.
- 3 **Determine** whether the integrated algorithm improves SB detection.

Assessment Protocol

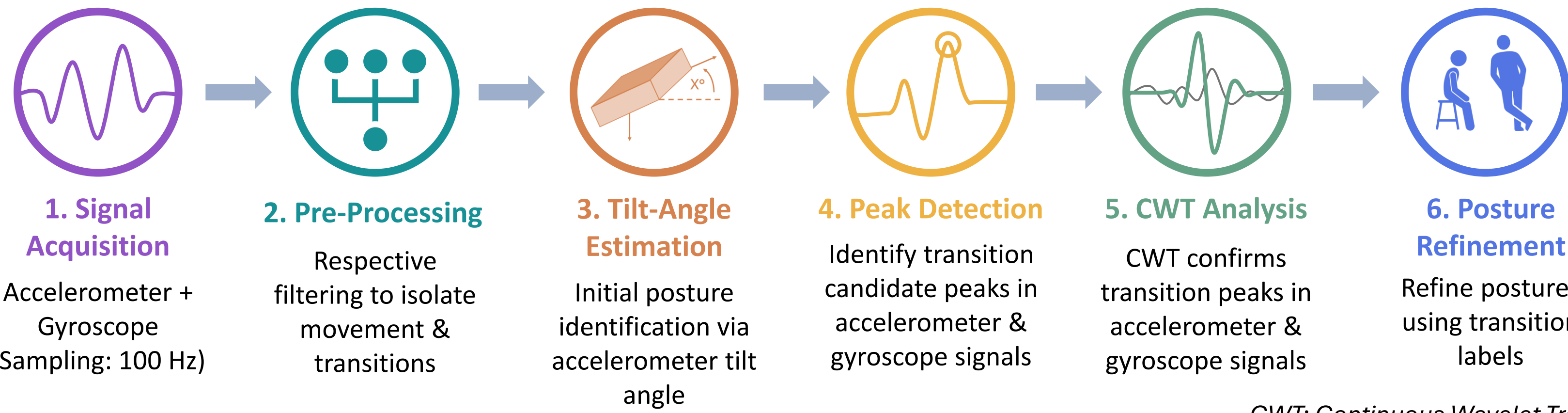
Twenty-one older adults wore a lower-back mounted inertial measurement unit (IMU) during scripted activities, **video-recorded for ground truth:**



Sensor Placement



Algorithm Pipeline



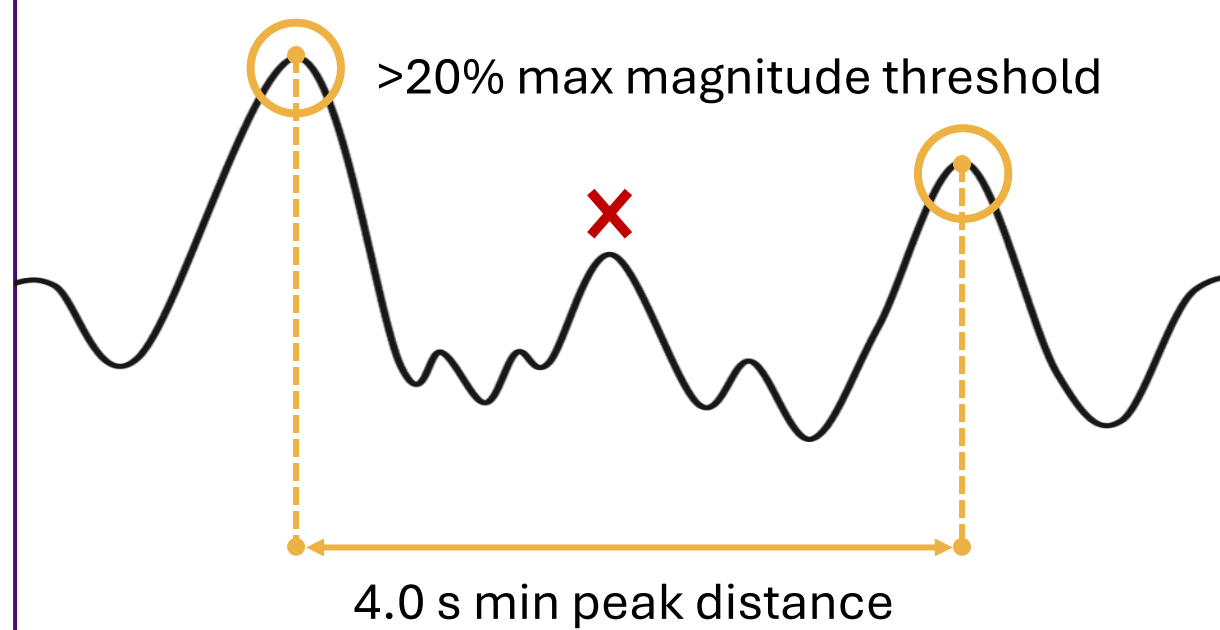
Tilt-Angle Estimation [2]

Vertical accelerometer derived tilt angles enabled preliminary identification of sedentary postures:



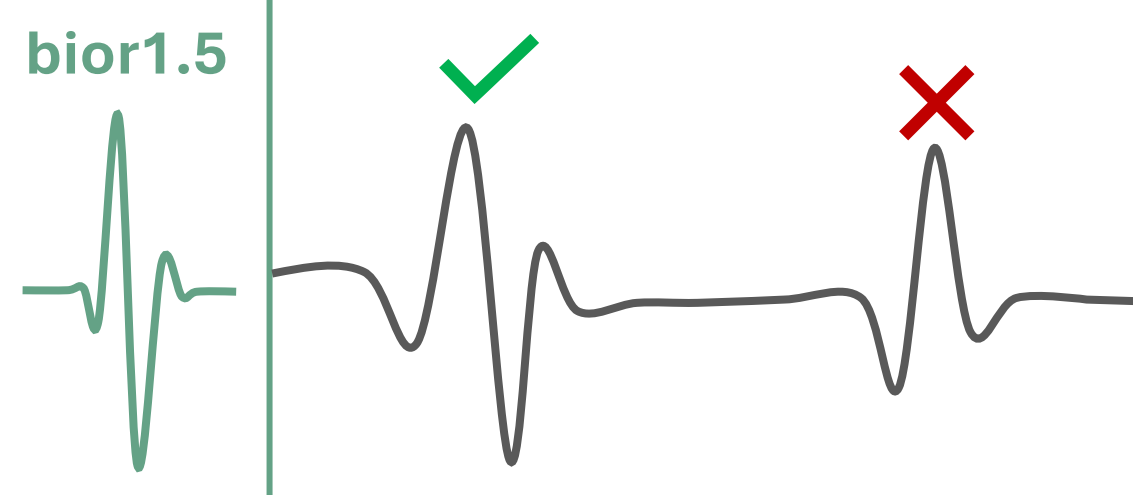
Peak Detection

Transition peaks were detected in accelerometer and gyroscope signals:



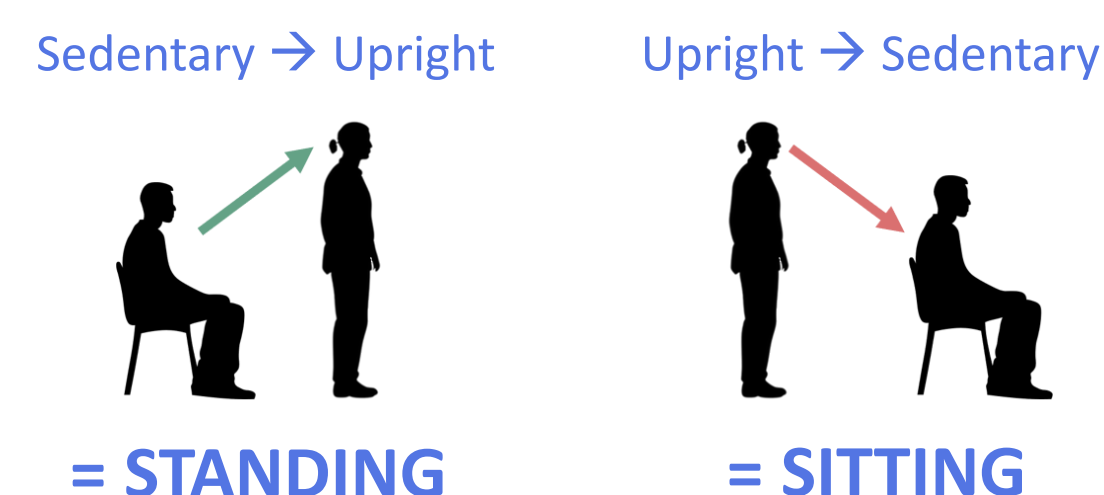
CWT Analysis

Using bior1.5 wavelet; coefficients from the 0.75-4.0 s (0.25-1.3 Hz) scales used for transition detection:



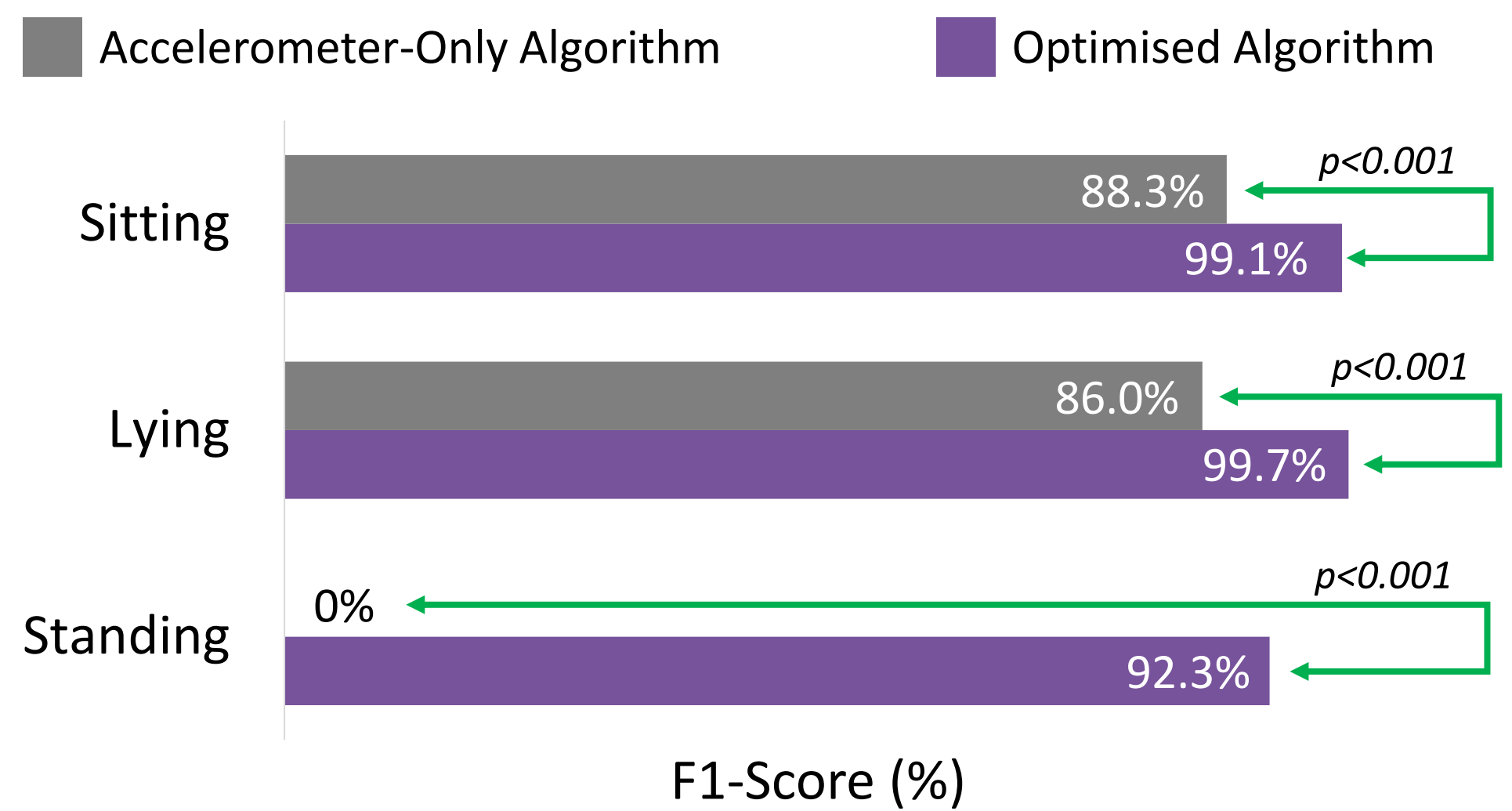
Posture Refinement

Identified transitions were used to refine initial tilt-angle estimation and infer SB postures:

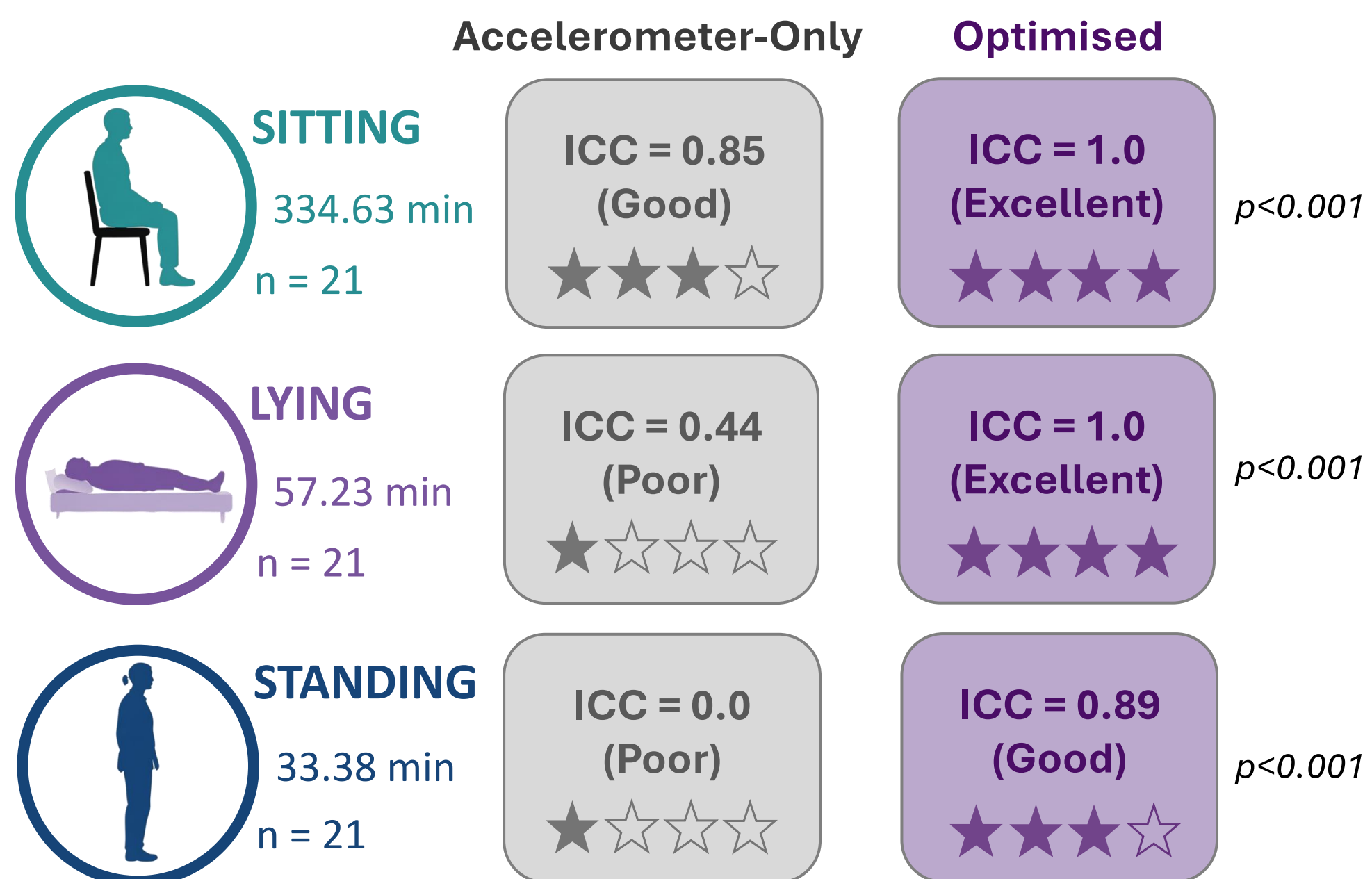


Results

The optimised algorithm demonstrated superior SB classification compared to the accelerometer-only approach:



The optimised algorithm demonstrated stronger agreement with video observations across all postures:



ICC: Intra-Class Correlation

Algorithm Comparison

Accelerometer-Only Algorithm (Jabbar, 2023 [2])



VS.

Optimised Algorithm (Accelerometer + Gyroscope)



Conclusions

- The optimised algorithm outperformed accelerometer-only classification across all postures.
- Gyroscope- and accelerometer-informed postural transitions improved SB detection.
- This validated methodology supports future objective assessment of SB in dementia research.

