

MobGap-Plus

A pipeline from raw sensor data to mobility outcomes

Artem Vakhutinskiy

The University of Sheffield

avakhutinskiy1@sheffield.ac.uk



Measuring mobility

- NHS patients with limiting mobility conditions
- One week at home, sensor on the lower back
- Axivity AX6, 100 Hz, about 1 GB per patient



Axivity AX6



Worn at the lower back

IMU inertial measurement unit

Three axes of acceleration, three of rotation

DMO digital mobility outcome

Walking bouts, stride length, cadence, speed

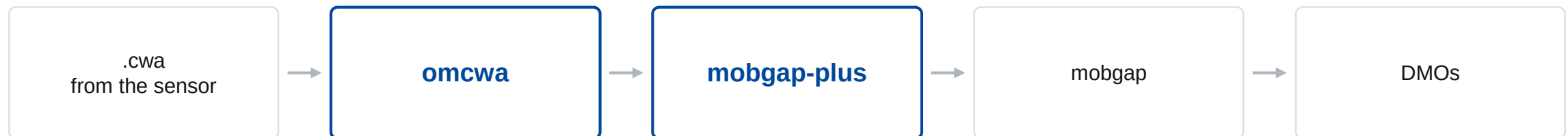
The data collection bottleneck, and the fix

BEFORE



Hours per recording, and roughly 8 GB on disk before any analysis starts.

AFTER



One function call. Nothing written to disk.

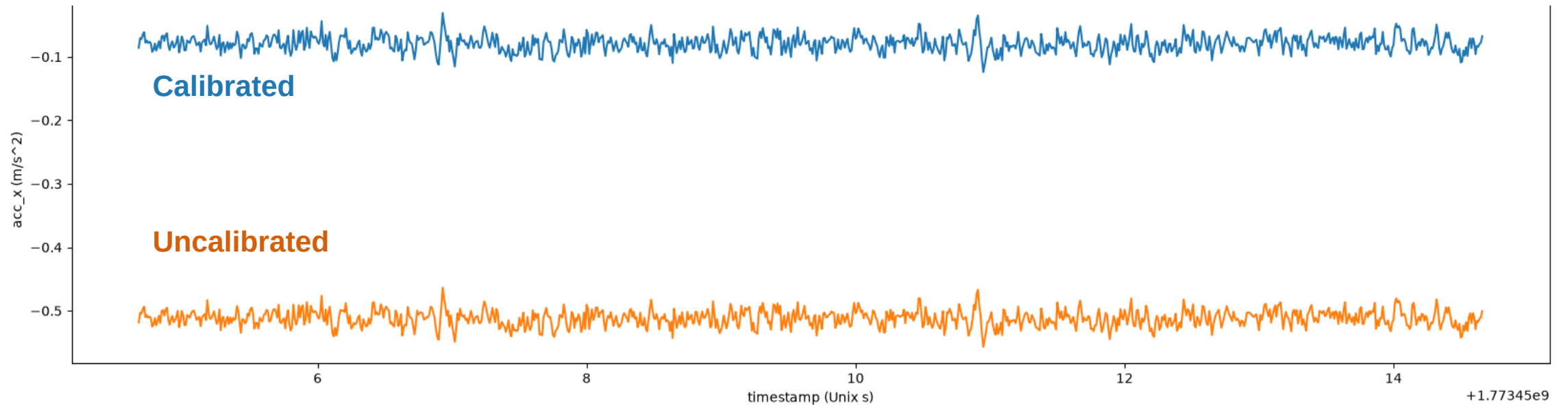
Obstacles and pitfalls

Documentation

Silent calibration failure

Performance

Ingestion into mobgap



The same recording, calibrated and uncalibrated.

What was built

omcwa

- .cwa straight into NumPy arrays
- Vendors OpenMovement's own C
- AX6 calibration fixed, failures loud
- Fast enough for a week of data

mobgap-plus

- Plug-and-play mobgap extension
- Ingests .cwa through omcwa
- No .mat export, nothing on disk
- Per-hour and per-day aggregation

BEFORE

- Hours per recording, by hand
- About 8 GB on disk
- One recording at a time
- Failures nobody could see

AFTER

- One function call
- Nothing on disk
- About 100 s of CPU per GB
- Calibration failures stop the run

Open source at github.com/uos-mobgap

One recording in, a week of walking out

The report

9 days recorded, 660 walks found, 13,844 strides measured.

6032681_0000000000.cwa, 14 Mar 2026, 00:00 to 22 Mar 2026, 17:30

Number of walks

660

Time spent walking

196.6 min

Average length of a walk

10.9 s

Cadence, across every walk

84.3 steps/min

Walking speed, walks of 10 to 30 seconds

0.67 m/s

Walking speed, walks of 30 seconds and over

0.71 m/s

Stride length, walks of 30 seconds and over

1.01 m

Each day

Each hour

Time spent walking

min

Worn

Walks

Time walking

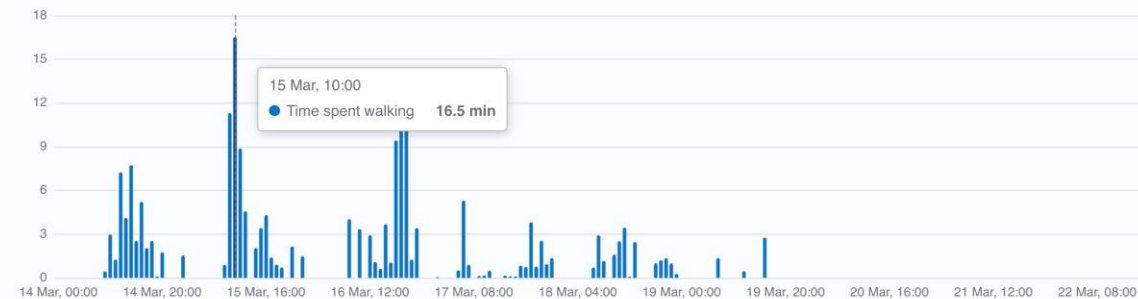
Average walk

Cadence

Speed, short walks

Speed, long walks

Stride length



Each hour

Show every column

MVP WEB APP, WORK IN PROGRESS

- 1 Drop in a .cwa recording
- 2 omcwa and mobgap-plus run the pipeline
- 3 Outcomes back by day and by hour

Where this is going

- Running during the appointment, not weeks later in the office
- Clinic scale is the next engineering problem

Where this leaves us

The question

- From a week-long recording to DMOs you can trust, unattended

Where it stands

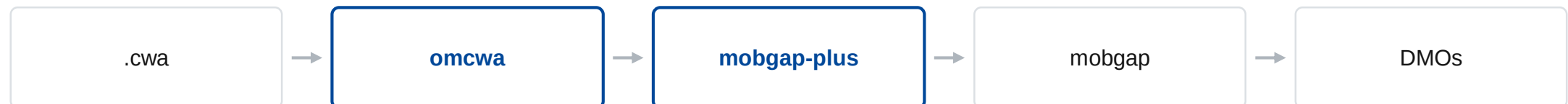
- .cwa to DMOs in one call
- Calibration failures stop the run
- Documented, tested, released

Still open

- Only the first session is calibrated
- A week still has to fit in memory

Next

- omcwa to PyPI, mobgap-plus upstream
- MVP into something a clinic can use



Thank you

Professor Vitaveska Lanfranchi
Dr Robert Chisholm
my supervisors

John Mitchell
who mentored me through all of it

Staff at both N8 CIR and UoS
for this opportunity

