Comparing activity trackers to investigate health behaviour: balancing quality, costs, and usability

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Research objective

Develop a sensor system, in combination with a data processing / machine learning method, alternative for the SQUASH module in Health Surveys that:

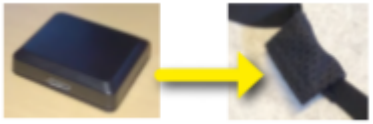
- is more accurate than the SQUASH module
- is modestly prized
- respondents are willing to use or wear one week
- generates consistent, reliable, repeatable and valid measurements
- can be distributed to respondents without advanced expert assistance
- allows easy data extraction.

Lab test

- 40 tests in movement technology laboratory of The Hague University of Applied Sciences.
- Convenience sample of 10 physically active men, 10 active women, 10 non-active men and 10 non-active women.
- Participants did a series of prescribed activities, hooked up to 5 activity sensors and a respiratory gas device and filled in the SQUASH.
- Respondents went home and wore 2 devices for 7 days. They also filled in an activity diary for each day.
- Respondents received €50

Sensors used

UKK RM42



IMU wrist &
IMU tibia

ActivePal

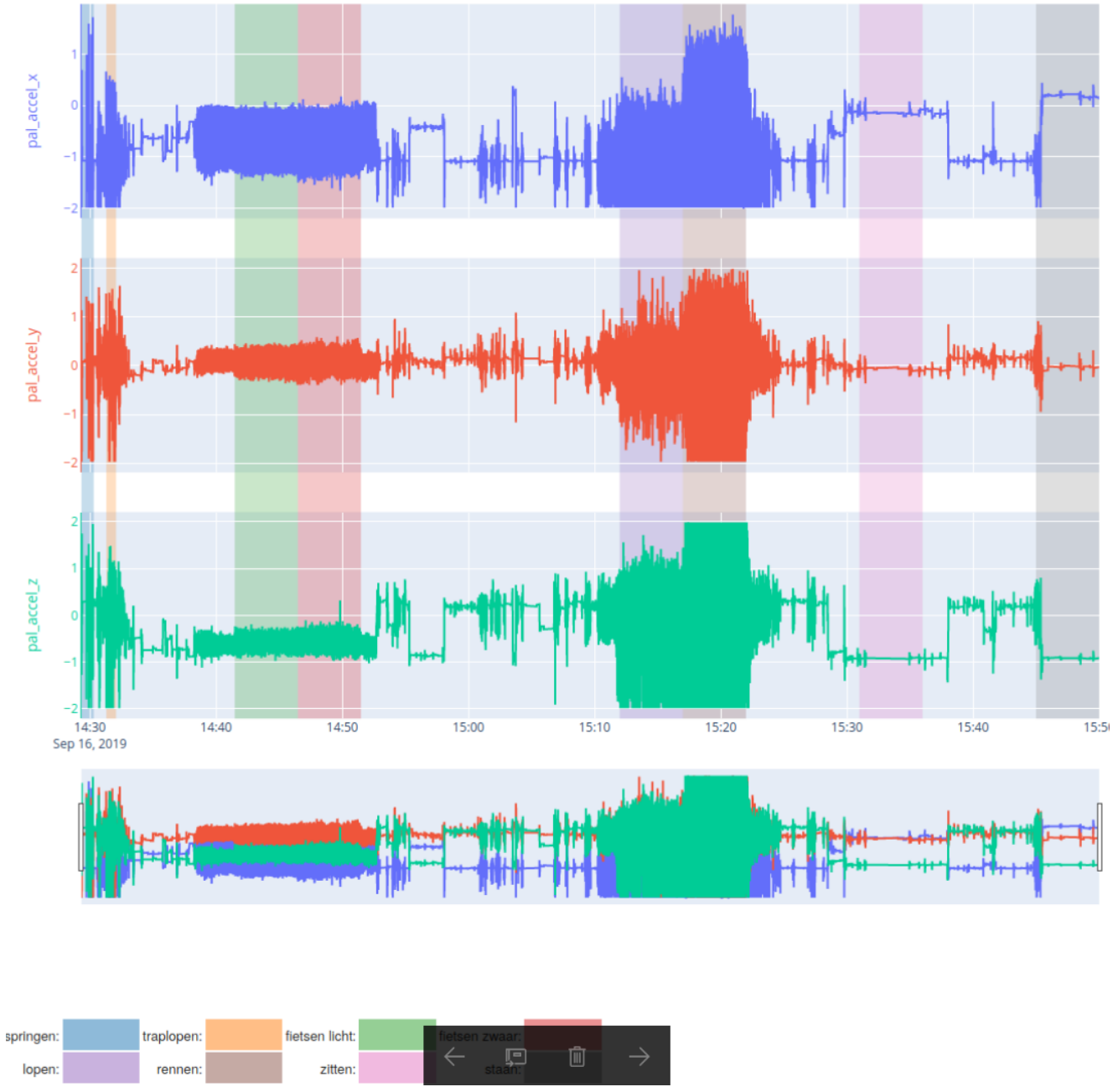
Hexoskin

Vyntus

Variables to be determined:

- Adherence to physical activity norm WHO:
  - Adults (18+):
    - 150 minutes at least moderate intensive PA per week
    - Distribution over days
    - 2x 30 minutes muscle and bone strengthening activities per week
- Intensity determined by MET* values
  - But may be sub optimal measure

*Metabolic Equivalent of Task = oxygen use per Kg weight per minute; 1 MET = EE while sitting.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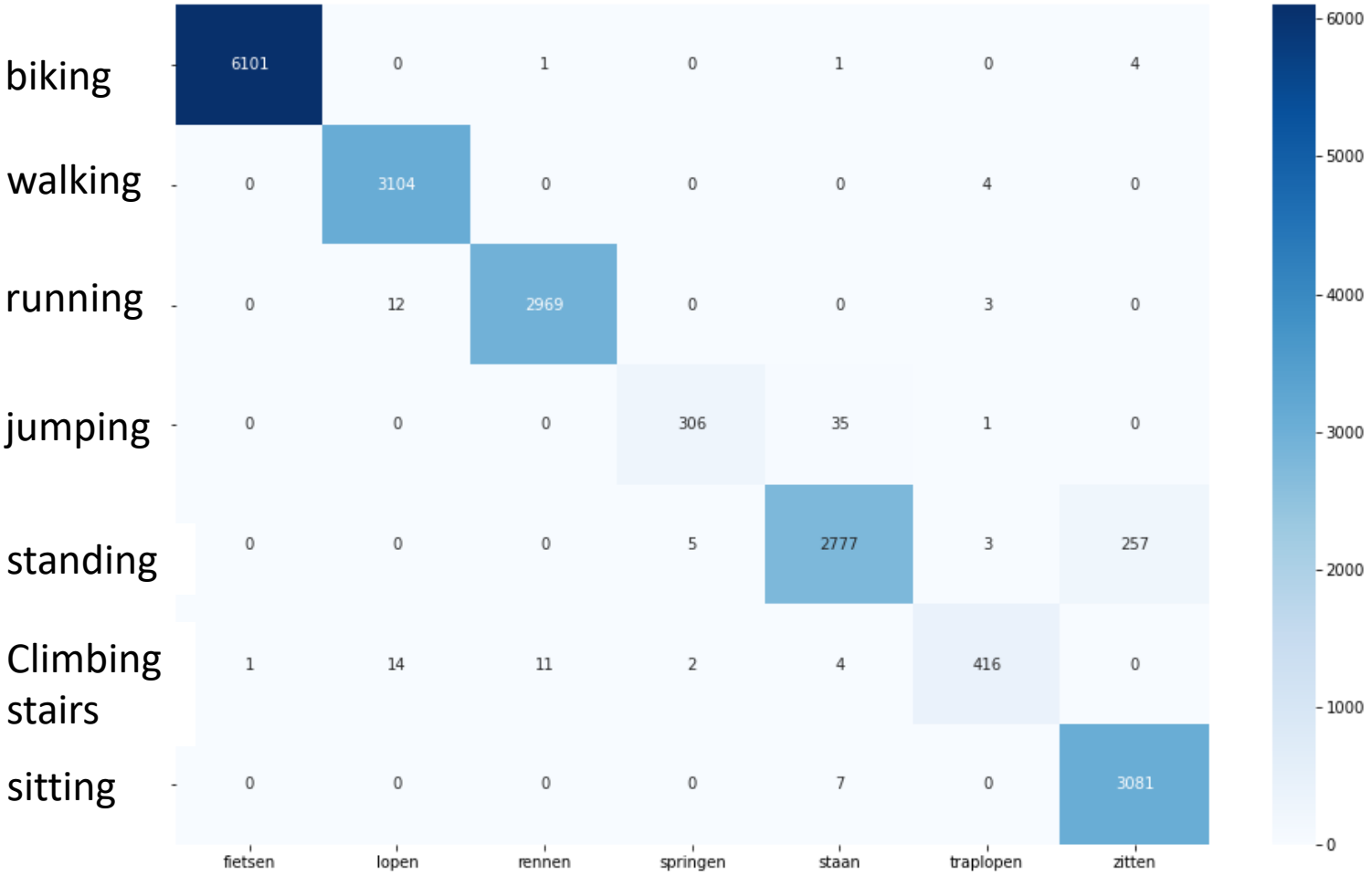
Develop machine learning algorithms and create confusion matrix for activities per sensor



Conclusion as to sensors

- ActivPal adequately distinguishes lab activities,
- Additional heart rate measurement would be beneficial, but not feasible in study of population
- UKK (hip) does not distinguish biking sufficiently

Lessons learnt

- Difficult to find respondents who were not physically active
- Privacy issues
- Logistic and postal constraints
- Respondents forget to reapply the hip worn sensor (UKK) after taking it off (for showers, swimming).
- Hip worn sensor turns on hip (reverses vectors).
- At least 5 respondents complained about skin irritation and itches as a result of activPal adhesive on leg.
- Not all respondents start on the designated time; loss of data.

Additional research

- Investigate use of simple accelerometers that pre-classify activity (e.g., fitbit)
  - Who owns accelerometers
  - Who is willing to share data
    - By copying measurements in questionnaire
    - By uploading data
- How to increase uptake and decrease bias
  - Presently experimenting in large scale fieldtest
- Results: for next years' workshop!