

myHealthAssistant: A Phone-based Body Sensor Network that Captures the Wearer's Physical Activity throughout the Day



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DVS

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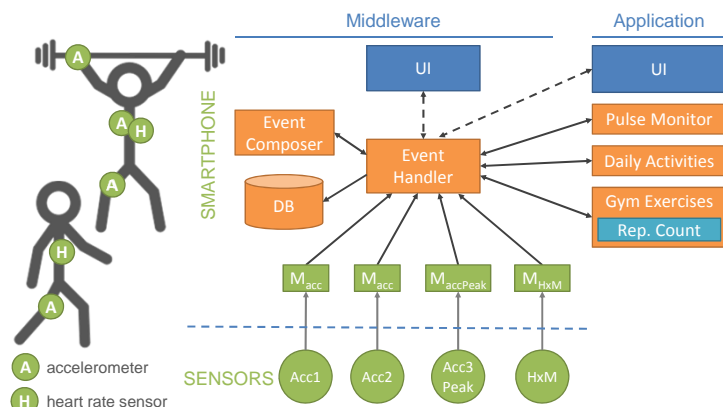
Motivation, State of the Art, Main Objectives

Activity Recognition for Special Purposes

- Detection of daily activities [Kwapisz et al., Human Factors 2010]
 - Detection of gym exercises [Chang et al., UbiComp 2007]
- How to combine both?

Middleware and Activity Recognition

- Activity recognition with regard to given sensor constellation (e.g., daily vs. gym activities)
- Middleware handles constellation changes and triggers the corresponding activity recognition



Daily & Gym Activities

- 5 fitness-relevant daily activities
- 16 gym activities
 - 5 cardio
 - 11 weightlifting incl. counting
- Activity recognition based on
 - Multivariate Gaussian model
 - Maximum likelihood method



Embedded Inertial Sensors

- Embedded in fitness accessories
- Custom prototype node with accelerometer
- 100Hz data pre-processed on sensor
- 1 second window, per axis: mean, variance, peaks

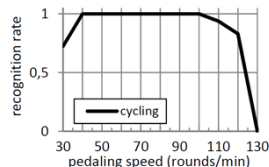
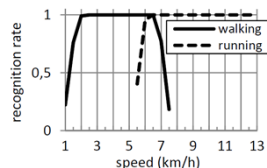


Results, Ongoing Work

Daily Activity Recognition

	Walking	Running	Cycling	Standing	Sitting
Walking	3208	1	1	0	0
Running	0	3094	12	0	0
Cycling	0	0	2938	0	0
Standing	0	0	0	3120	0
Sitting	0	0	1	0	3290
Accuracy	100%	99.9%	99.5%	100%	100%

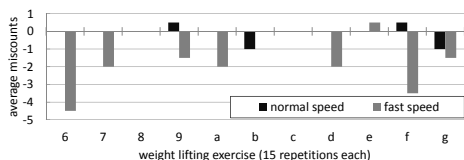
Confusion matrix and accuracies for cross-user test with 6 participants (15 seconds cut-off at borders)



Gym Activity Recognition

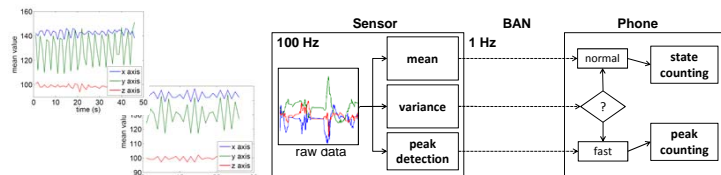
- Overall precision: ~92%
- Overall recall: ~95%
- Counting of weightlifting exercises
 - Normal workout speed: ~2.4% miscounts
 - Fast workout speed: ~12.1% miscounts

6. Wide grip lat pulldown
7. Barbell rear delt row
8. Hyperextensions
9. Barbell bench press
- a. Butterfly
- b. Front barbell raise
- c. Dumbbell lateral raise
- d. Barbell curl
- e. Cable triceps extensions
- f. Barbell squat
- g. Table top crunch



Adaptive Workout Counting (Ongoing)

- Wrist's mean values are sufficient for normal speed
- On-sensor peak detection for fast workout speed
- Chosen based on history of recent variances



The Whole System

- Low impact on the phone, lasts for >12 hours
- Works reliably, handles sensing artifacts

An Event-based BSN Middleware that supports Seamless Switching between Sensor Configurations.
Christian Seeger, Alejandro Buchmann, Kristof Van Laerhoven (IHI 2012)
Wireless Sensor Networks in the Wild: Three Practical Issues after a Middleware Deployment.
Christian Seeger, Alejandro Buchmann, Kristof Van Laerhoven (MidSens'11)



GRK 1362: Cooperative, Adaptive and Responsive Monitoring in Mixed-Mode Environments

