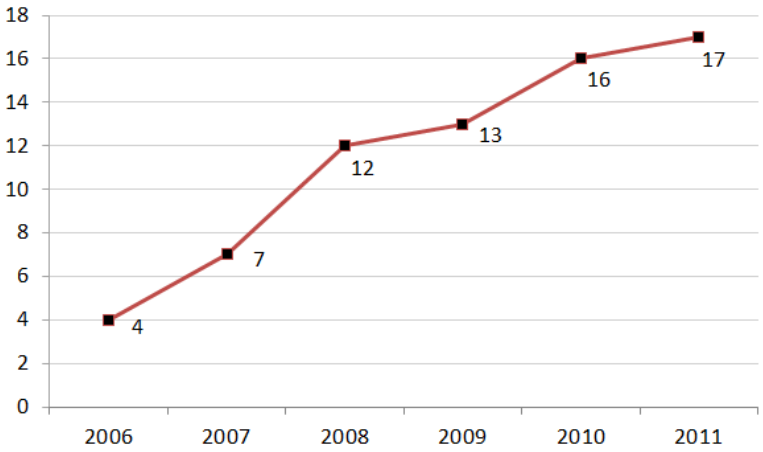
Human Activity Recognition

Human Activity Recognition - **HAR** - has emerged as a key research area in the last years and is gaining increasing attention by the pervasive computing research community (see picture below, that illustrates the increasing number of publications in HAR with wearable accelerometers), especially for the development of context-aware systems. There are many potential applications for HAR, like: elderly monitoring, life log systems for monitoring energy expenditure and for supporting weight-loss programs, and digital assistants for weight lifting exercises.



HAR: IEEE publications (2006-2011) based on wearable accelerometers' data

Systematic-like approach for reviewing literature

In order to enable you to replicate the literature review we made for this research, all publications assessed in this paper are **available here, in RIS format**. In this research, the bibliographic management and publishing solution used was the EndNote X5(tm). The library in EndNote format is also **available for download**.

HAR Dataset for benchmarking

We propose a dataset with 5 classes (sitting-down, standing-up, standing, walking, and sitting) collected on 8 hours of activities of 4 healthy subjects. We also established a baseline performance index. **You can download the dataset here** (please, drop us a line (wugulino *at* inf *dot* puc-rio *dot* br) about your research and how we can contribute to your benchmarking).

Detailed Accuracy

Correctly Classified Instances	164662	99.4144 %
Incorrectly Classified Instances	970	0.5856 %
Root mean squared error	0.0463	
Relative absolute error	0.7938 %	
Relative absolute error	0.7938 %	

Detailed Accuracy by Class

TP Rate	FP Rate	Precision	Recall	F-Measure	ROC Area	Class
0.999	0	1	0.999	0.999	1	Sitting
0.971	0.002	0.969	0.971	0.970	0.999	Sitting down
0.999	0.001	0.998	0.999	0.999	1	Standing
0.962	0.003	0.969	0.962	0.965	0.999	Standing up

0.998	0.001	0.998	0.998	0.998	1	Walking
0.994	0.001	0.994	0.994	0.994	1	**Weighted Avg.**

Please, cite this publication to refer this dataset and literature review

Ugulino, W.; Cardador, D.; Vega, K.; Velloso, E.; Milidiu, R.; Fuks, H. **Wearable Computing: Accelerometers' Data Classification of Body Postures and Movements** . Proceedings of 21st Brazilian Symposium on Artificial Intelligence. Advances in Artificial Intelligence - SBIA 2012. In: Lecture Notes in Computer Science. , pp. 52-61. Curitiba, PR: Springer Berlin / Heidelberg, 2012. ISBN 978-3-642-34458-9. DOI: 10.1007/978-3-642-34459-6_6.
Cited by 2 (Google Scholar)

Documento Apresentação

Other HAR Related Publications

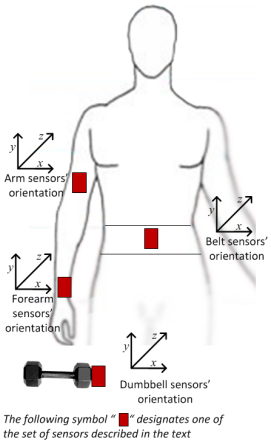
Velloso, E.; Bulling, A.; Gellersen, H.; Ugulino, W.; Fuks, H. **Qualitative Activity Recognition of Weight Lifting Exercises** . Proceedings of 4th International Conference in Cooperation with SIGCHI (Augmented Human '13) . Stuttgart, Germany: ACM SIGCHI, 2013.

Documento

Ugulino, W.; Ferreira, M.; Velloso, E.; Fuks, H. **Virtual Caregiver: Colaboração de Parentes no Acompanhamento de Idosos** . Anais do SBSC 2012, IX Simpósio Brasileiro de Sistemas Colaborativos , pp. 43-48. São Paulo, SP: IEEE, 2012. ISBN 978-0-7695-4890-6.

Documento

Weight Lifting Exercises Dataset



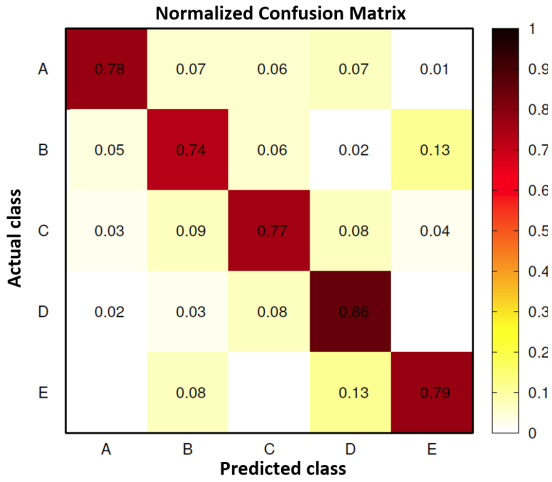
This human activity recognition research has traditionally focused on discriminating between different activities, i.e. to predict "which" activity was performed at a specific point in time (like with the Daily Living Activities dataset above). The approach we propose for the Weight Lifting Exercises dataset is to investigate "how (well)" an activity was performed by the wearer. The "how (well)" investigation has only received little attention so far, even though it potentially provides useful information for a large variety of applications,such as sports training.

In this work (see the paper) we first define quality of execution and investigate three aspects that pertain to qualitative activity recognition: the problem of specifying correct execution, the automatic and robust detection of execution mistakes, and how to provide feedback on the quality of execution to the user. We tried out an on-body sensing approach (dataset here), but also an "ambient sensing approach" (by using Microsoft Kinect - dataset still unavailable)

Six young health participants were asked to perform one set of 10 repetitions of the Unilateral Dumbbell Biceps Curl in five different fashions: exactly according to the specification (Class A), throwing the elbows to the front (Class B), lifting the dumbbell only halfway (Class C), lowering the dumbbell only halfway (Class D) and throwing the hips to the front (Class E).

Class A corresponds to the specified execution of the exercise, while the other 4 classes correspond to common mistakes. Participants were supervised by an experienced weight lifter to make sure the execution complied to the manner they were supposed to simulate. The exercises were performed by six male participants aged between 20-28 years, with little weight lifting experience. We made sure that all participants could easily simulate the mistakes in a safe and controlled manner by using a relatively light dumbbell (1.25kg).

Download the WLE dataset here



Please, cite this paper to refer the WLE dataset

Velloso, E.; Bulling, A.; Gellersen, H.; Ugulino, W.; Fuks, H. **Qualitative Activity Recognition of Weight Lifting Exercises** . Proceedings of 4th International Conference in Cooperation with SIGCHI (Augmented Human '13) . Stuttgart, Germany: ACM SIGCHI, 2013.

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