Bachelor/Master Thesis

Group Biomedical Devices and Systems from OFFIS R&D division Health has an announcement for an immediate bachelor/master thesis.

Analysis of Low-Level Features for Non-Intrusive Load Monitoring

Load Monitoring, Signal Processing, Machine Learning

BACKGROUND:

Non-Intrusive Load Monitoring (NILM) consists in labeling the use of appliances in a household by analyzing its electricity consumption. The output of this analysis can be used for many applications, such as support in reducing energy consumption or as part of early alarm system to protect people with disabilities. Thanks to the ever-growing presence of smart meters, such NILM based applications can be offered to a large number of users without the need for costly hardware or cumbersome installation procedure. However, the reliability of the end application is of course strongly dependent on the accuracy of the used NILM algorithm. This accuracy can severely degrade when applied to noisy signals, which are typically encountered in realistic scenarios. Consequently, constant efforts are made to develop more robust NILM algorithms [1, 2].

A recently proposed algorithm relies on the use of the, so-called, Hotelling's T2 to analyze multiple low-level features and detect the time at which appliances in a household are switched on and off. Initial evaluation suggests that this method is promising, particularly in the case of small appliances [3]. Consequently, this is a promising NILM approach for home activity monitoring. However, the accuracy of the detection still has to be improved before using it in an activity monitoring application. Performance improvement might come from further analysis of the used features or the by using features designed specifically for this task.

[1] G. W. Hart, Nonintrusive appliance load monitoring, Proc. of the IEEE, vol. 80, no. 12, pp. 1870-1891, 1992.

[2] N. Batra, J. Kelly, O. Parson, H. Dutta, W. Knottenbelt, A. Rogers, A. Singh and M. Srivastava, NILMTK: An Open Source Toolkit for Non-intrusive Load Monitoring, Int. Conf. on Future Energy Systems (ACM e-Energy), Cambridge, UK, 2014.

[3] A. Gerka, B. Cauchi and A. Hein, Multivariate Event Detection for Non-intrusive Load Monitoring, Int. Conf. on Ambient Computing, Applications, Services and Technologies (AMBIENT), Porto, Portugal, 2019.

OBJECTIVE:

The aim of this work is to improve the performance of the considered NILM approach by analyzing the used features and combining them with others more appropriate to the task. After becoming familiar with the current literature and comparing the considered approach with the state-of-the-art, the work will focus on improving this approach. This improvement would come first, from analyzing the used features, second, from using additional features more appropriate for to the task. The necessary programming work will be done in either Python or Matlab.

YOUR PROFILE:

- You are currently studying in a University or other institution for higher education
- You have basic knowledge of signal processing and/or machine learning
- You have experience programming in Python or in Matlab

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