Title: Classifying Activities of Daily Living from ambient and wearable sensor triggers using Machine Learning methods

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Description
In the domain of Ambient Intelligence, one of the often-encountered subjects of project and development is that of recognizing activities of daily living (ADL - e.g. sleeping, toileting, preparing food, eating, watching TV). Recognizing these activities is especially useful in applications seeking to provide support for people in need of extended monitoring / care at home, in care facilities or at the workplace (e.g. the elderly, factory workers).

In order to support privacy, activity detection is performed on hand of ambient sensors installed in the user homes (e.g. motion sensors, cupboard/door/window opening sensors, item removal/return sensors), as well as body-worn sensors, primarily accelerometer based (e.g. from a mobile phone, a smart watch or a dedicated bracelet).
Using existing datasets (e.g. CASAS), the aim of this project proposal is to incorporate data-driven (Machine Learning based) inference capabilities into the context inference process. The purpose is to develop online-learning based algorithms that can in time learn the pattern of sensor activations for individual activities and individual users.

Specific research directions will involve:
- Defining and implementing *change-point* detection methods (i.e. identifying when there is a significant statistical change in sensor activations - to signal possible change of activity); this can include both learning-based methods, as well prior-knowledge (human bias) based ones [1]
- Experiment with encoder-decoder and attention-based deep learning models to classify sequences of sensor activations into probable activities [2, 3, 4]
- Extend models for single-user activity detection to multi-user activity detection

This research subject continues existing work.

Keywords: Ambient Intelligence, Activity Recognition, Wearable Sensors, Binary Sensors, Timeseries Analysis, Deep Learning, Knowledge Representation

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