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Human Activity Recognition with Wireless Sensor Networks using Machine Learning

Abstract  
Recognizing human behavior in an automated manner is essential in many ambient intelligence applications such as smart homes, health monitoring applications and emergency services. In order to make such long term health monitoring systems sustainable, we need smart environments in which the human activities are recognized automatically. In order to infer the human behavior, we can use machine learning methods on the data collected from the smart environments but those methods require annotated datasets to be trained on. Recording and annotating such datasets are costly since they require time and human effort. Moreover, the complex nature of human activities makes it difficult to accurately model them. While hierarchical models can be a remedy for more accurate representation, finding suitable complexity levels is not a trivial task. Finally, when we deploy automatic human behavior monitoring systems on a world-wide scale, we need to tune the model behavior for each new house to accurately reflect the residents' behavior for that specific house. Rather than annotating a dataset consisting of several weeks of data, an algorithm can be used to decide for which point in time it would be most informative to obtain annotation in order to minimize the need for annotation and maximize the usefulness of annotation. This thesis addresses the above mentioned issues by (i) collecting publicly available benchmark datasets, (ii) proposing a methodology for incorporating a hierarchy into the model that is tailored for various activities individually, (iii) improving the ways of evaluating different approaches and models considering the domain specific needs, (iv) handling multi-resident environments in an unobtrusive manner and, (v) using active and semi-supervised learning techniques in order to reduce the annotation effort in large scale deployments.

PUBLICATIONS

Journals

Conferences and Workshops


8. H. Alemdar, T.L.M van Kasteren, C. Ersoy, “Using Active Learning to Allow Activity Recognition on a Large Scale”, in International Joint Conference on Ambient Intelligence, Amsterdam, Netherlands, November 2011.


International Workshop on Sensing for App Phones (PhoneSense'10), Zurich, Switzerland, November 2010.


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Defense Date: 13.2.2015