Building a User Profile from Automatic Human Activity Recognition in Lifelogging, for a Personal Recommender System

Stefan Terziyski, Rami Albatal, Cathal Gurrin
Dublin City University
{stefan.terziyski, rami.albatal, cathal.gurrin}@insight-centre.org

Abstract

Our research focuses on Human Activity Recognition (HAR) in Lifelogging. The aim is to develop an automatic classification model for human activities, from multi-modal lifelog data – images, accelerometer and GPS data. The availability of one's lifelog provides ground for building a rich user profile and hence basis for an advanced personal recommender system.

1. Motivation

Recent technological development in personal and ubiquitous computing has provided the conditions for end-user lifelogging. Recommendation systems rely on user profiles in order to make recommendations to end-users, but constructing a user profile remains a challenge. Lifelogs gathered through personal computing can be a solution to this problem, as they are a valuable source of information for building detailed and rich user profiles.

2. Problem Statement

The main challenge is Human Activity Recognition (HAR). Whereas this is a well-formulated problem in surveillance and monitoring, it is not well defined for visual signals that originate from the users' point of view, i.e. the view that user sees. This can be also interpreted as visual context. So instead of looking at what a person does and try to identify the activity, the goal is to recognize the activity of that person given his/her surrounding environment. Due to unavailability of video streams in lifelogging, spatio-temporal information is lost. However, a user may be performing an activity, while having the same view as when performing another.

3. Research Questions

The research questions are: How can similar views or sceneries be detected? How can the different sensors be fused together to provide a reliable activity classification?

4. Related Work

Several works in the state-of-the-art use personal sensing data to recognize activities. Among them, in [1] the authors have used a combination of global image descriptors (color histogram and edge orientation histogram) with FFT accelerometer features, 2D GPS data and subset of MPEG-7 audio descriptors; and good results are obtained from the user of an SVM-HMM classifier. Another successful approach presented in [2] relies solely on visual information. However, this framework may not be applicable in practice, since pre-trained SVM object classifiers are used and due to the nature of lifelog data, it is unknown what objects have to be detected per user. A solution for that is providing classifier training on the fly, but this cannot be done automatically.

5. Hypothesis

For HAR, visual data, accelerometer data and geo-location data, should be sufficient to determine the activity, which the user is performing at the given sensory readings. Once a classification model is established, it can provide automatic annotation of the user's data and hence provide a user profile with the user's activity per day with start and end time per activity window. That in itself constitutes a good platform for recommendations.

6. Proposed Solution

Global Image descriptors, e.g. Color Histograms can be analysed with Discriminative models, such as Support Vector Machines to filter out the images and provide the most appropriate candidate activities. Then the second stage is to extract local image descriptors e.g. Histogram of Oriented Gradients and employ them with Generative models, such as Hidden Markov Model, to produce the final activity classification.

The second stage is where other sensory data may be fused, particularly accelerometer data.

7. Discussion

Our approach is to have an extensive multi-modal data collection across 5 users for at least a month each. Then the idea is to provide a user independent classification model, which should be verified over the collected data.

Acknowledgements

This publication has emanated from research conducted with the financial support of Science Foundation Ireland (SFI) under grant number SFI/12/RC/2289.

8. References

[1] J. Hamm, B. Stone, M. Belkin, S. Dennis "Automatic Annotation of Daily Activity from Smartphone-based Multisensory Streams" *Fourth International Conference on Mobile Computing, Applications and Services*, 2012

[2] P. Wang, A.F. Smeaton, "Using Visual Lifelogs to automatically characterize everyday activities" *Information Sciences* , Elsevier, 10 Jan 2013.