Collaborative Human Activity Recognition

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# ABSTRACT

Human activity recognition is a research topic broadly covered in the last decade for its relevance in areas where the use of context is important to build interactive applications. Smartphone applications have the capability to sense data from the environment and reason along with algorithms that provides context-aware information. In this paper, we propose a human activity recognition system specifically designed to detect basic activities from trained data collected in a collaborative effort. We take into account feedbacks recorded from users on ground to improve the recognition precision, with the help of a survey application we test and evaluate the activity recognition component, which uses accelerometer data and implements a decision tree classifier. HARDroid is freely available as a library that may be included in any Android application. Finally, we present an evaluation comparing the initial classifier with an improved classifier achieving 91% recall and 92% precision.

## Author Keywords

## Location-Aware/Contextual Computing; Collaboration; Mobile Devices: Phones/Tablets; Quantitative Methods; Prototyping/Implementation; Machine Learning; Sensors Wearable Computers; Contextual Inquiry; Survey; Artifact or System Dataset.

## ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous; See<http://acm.org/about/class/1998>for the full list of ACM classifiers. This section is required.

# INTRODUCTION

Human Activity Recognition (HAR) is a research topic in constant development for more than a decade and seeks to design algorithms that collect data from people interacting with their environment to provide contextual information [1]. The common example of using these algorithms is to recognize basic ambulatory activities, which are, when an individual is walking, running, standing or sitting, all through some type of sensor or camera available for that purpose.  
As smart mobile phones began to become more widespread, HAR-based applications have been propitious to be developed in order to determine user interactivity and interact with them. This allows the use of contextual information available for various purposes such as: data mining and predicting activities for various types of intelligent applications in different fields, for example in medicine, security, entertainment or military use, etc. [2].  
The usual sensors in a smart mobile phone are varied and include: a GPS (for location), microphones, cameras, lux meter, thermometer, barometer, compass (address) and accelerometer. There are also other sensors more varied depending on the model, manufacturer or accessories attached to the device. The acceleration sensor is the most common in these devices and can measure movement in two or three axes as well as detect the orientation of the device and mainly provide information crucial to the recognition of human activities.  
Along with the above, there has also been a breakthrough in the state of the art for the recognition of human activities with sensors. These include recognition techniques, methods of data capture and signal processing of sensors and the application of artificial intelligence techniques such as Machine Learning [3], [4].  
On the other hand, despite the large amount of software and applications that have also been defined in the field of recognition of human activities, there is still a lack of a component for the development of HAR software for smartphones that is extensible and available for free use according to the guidelines of free software. That is to say, without relying on Application Programming Interfaces (APIs), SaaS Internet services (Software as a Service) or third-party applications of free use but closed definition such as Google Play Services and Apple Health Kit, among others.  
This proposal contemplates the study of the human activity recognition techniques that use sensors in smart mobile phones with a view to providing a software component in the form of a free use library for the development of applications for these devices. Thus, it is intended to generate open source components that can be validated through experimental tests and data collection and to allow the development of mobile applications that take advantage of the context information determined by the library.

# STRUCTURE OF HAR SYSTEMS

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## Data collection

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## Learning and classification

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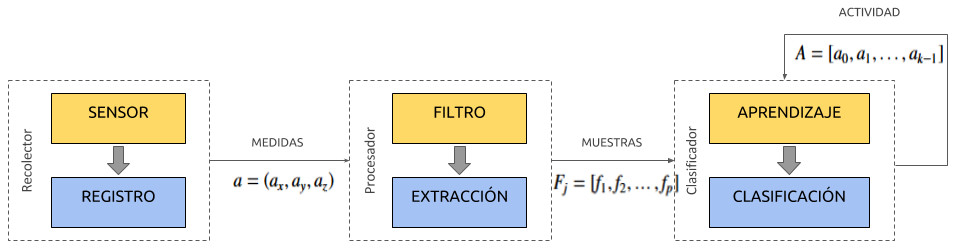


Figure . General structure of human activity recognition.

# HARDROID

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# EVALUATION OF HAR SYSTEMS

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# Conclusion

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Sample text: We thank all the volunteers, and all publications support and staff, who wrote and provided helpful comments on previous versions of this document. Authors 1, 2,and 3 gratefully acknowledge the grant from NSF (#1234-2012-ABC). This is just an example.

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