Collaborative Human Activity Recognition

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# ABSTRACT

Human Activity Recognition (HAR) is a research topic broadly covered in the last decade for its relevance in areas where the users’ context is important to build interactive applications. Smartphone applications have the capability to collect data from the environment and along with algorithms that take advantage of context-aware information becomes a powerful development platform. In this paper, we propose a HAR System denominated HARDroid that is specifically designed to detect common user activities. Furthermore, data collected from users on ground are taken into account to improve the activity recognition classifier. HARDroid is freely available as a library that may be included in Android applications. Finally, an evaluation that comparing the initial classifier with an improved classifier is presented, achieving a recall of 91% and a precision of 92%.

## 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 that covers the design of 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 smartphone are varied and may include a GPS (for location), microphones, cameras, luxometer, thermometer, barometer, compass and accelerometer. There are also other sensors more varied depending on the model, manufacturer or accessories that can be paired with the device. The accelerometer is the most common sensor in these devices and can measure the movement in two or three axes as well as detect the orientation of the device. The main use of provided sensors information is the recognition of human activities.

Along with the above, there has also been a breakthrough in the state of the art for the human activities recognition with sensors. This includes recognition techniques, methods of data capture and signal processing, 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 been developed in the field of human activities recognition, there is still a lack of a software HAR component that can be extensible and be available for free use or for its improvement. That is, without relying on private Application Programming Interfaces (APIs), Software as a Service (SaaS) platforms, or third-party applications of free use but of closed definition, such as Google Play Services and Apple Health Kit, among others.

This proposal contemplates the study of the human activity recognition techniques on smartphones with focus in provide a HAR system in the form of a library that is free to use or to improve. Moreover, interactive user participations are taken into account to do a collaborative improve of the recognition classifier. The generated components are validated through experimental tests and the collected data shows the effectiveness of the resultant library.

# STRUCTURE OF HAR SYSTEMS

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## Data collection

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## Processing

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## Learning and classification

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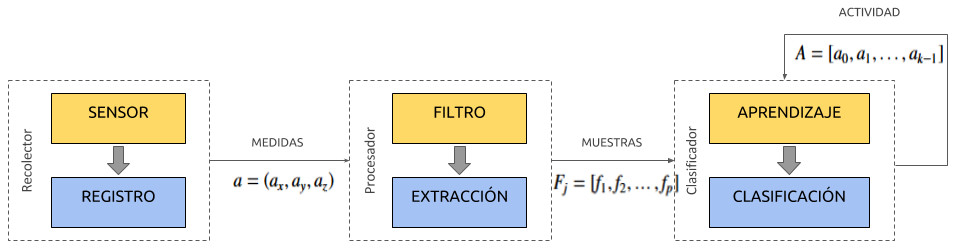


Figure 1. General structure of human activity recognition.

# 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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