

# A Survey on Mobile Data Uses

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## ABSTRACT

Mobile devices leave an unprecedented volume and variety of digital traces of human beings. In this paper, the authors propose an overview of multiple uses of mobile data published in the scientific literature. The organization of the survey follows a typology built on two criteria: interaction level and focus of analysis. Crossing these two dimensions would suggest 8 research areas. Only 4 of them are actually covered by the collected pieces of work. They are discussed in turn showing off the main characteristics of them. Finally, the discussion of the 4 remaining areas highlights new research areas with a special focus on the possibility to use mobile data to influence individual users towards efficient collective behaviors. To conclude, current and future research avenues suggest that mobile devices and their underlying data are likely to be employed in many domains and may be used not only to observe human life but also to influence it.

## KEYWORDS

Big Data, Data Mining, Human Activity, Mobile Data, Mobile Marketing, Mobile Systems, Reality Mining, Recommendation Systems, Survey

## 1. INTRODUCTION

Mobile devices are ubiquitous in the everyday life of people. According to a recent mobility report of Ericsson (Mike, 2014), global mobile penetration was 94% in Q2 2014. Given that some people have more than one mobile device, it represents around 4.6 billion subscribers worldwide. These mobile devices leave an unprecedented volume and variety of digital traces of human beings like the historic of visited locations or the activity on social networks offering promising opportunities to better analyze the human life.

As we will see later in this article, mobile data can be used in a large variety of application domains linked to decision making (Pentland, 2009) from the medical personal watch (Burns et al., 2011) to the economic development of a country (Eagle et al., 2010). Some uses of these data are already well established in the scientific community like the analysis of communities of people based on data provided by a telephone company (Net mob conference, 2015). Other uses are currently only conceptual or experimental due, at least to some extent, to the current lack of relevant available data.

The main goal of this article is to propose an overview of different uses of mobile data within the scientific literature according to a specific structure. Some propositions of future investigations are also drawn. Beside this analysis, this research also constitutes the opportunity to build some bridges between the different uses. Some common issues, synergies or future convergences between the different uses can indeed be identified like between pull and push recommendations to mobile users.

Based on a review of the scientific literature, we propose a typology of the main research areas linked to mobile data. Some research areas less covered are then identified. The structure of the study is the following. The second section presents the framework proposed by Colot et al. (2015), which identifies different kinds of information derived from mobile data. These kinds of information are

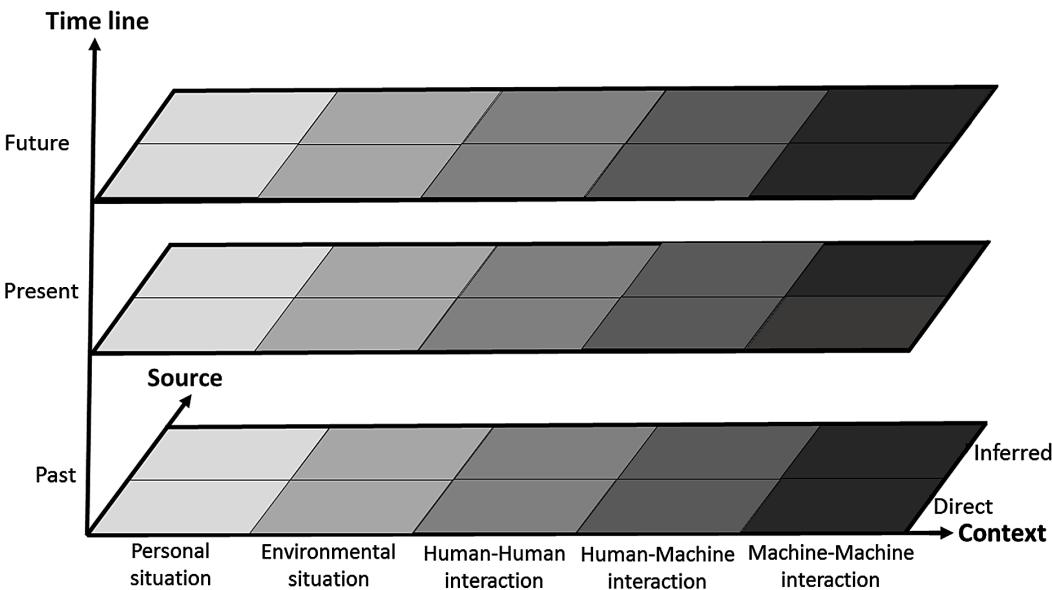
then discussed in our methodology presented in the third section. This third section explains how the review of the scientific literature is performed and how the different research areas are constituted. The fourth section reports the set of studied papers distributed in four identified research areas: (1) **User Activity**, (2) **Human Activity**, (3) **Personal Recommendation System**, and (4) **Personal Promoting System**. Each research area is defined in turn, showing off some of his specificities like data used, main topics of interests, etc. The fifth section suggests some new research perspectives on mobile data. The conclusion points up our results.

## 2. CONTEXT

This study focuses on the use of mobile data and is part of a research project towards a better insight on mobile research. In particular, a previous work (Colot et al., 2015) addresses data point of view of mobile: different kinds of information are identified based on mobile data and are organized in a framework called Mobile 3D (M3D) model. This typology is later referred in this article as support for the investigation of the different research areas. Figure 1 gives an overview of the M3D model. The M3D model classifies mobile information according to three dimensions: context, time and source. Each cell represents a specific set of information classified according to the three axes. On the **context** axis, five categories are considered:

- personal situation of the user: it covers any specific information obtained with mobile data about him from inside: medical parameters (e.g.: blood pressure, body temperature), state of mind, feelings, etc.;
- environmental situation of the user: it includes the localization of the user and some more information derived from his/her localization like the corresponding weather or the kind of land;
- interaction between humans (proximity based or not);
- interaction between human-machine: it refers to interaction of the user with his mobile device);
- interaction between machines: it includes interaction between the mobile device and another device.

Figure 1. Mobile 3D model: the dimensions



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