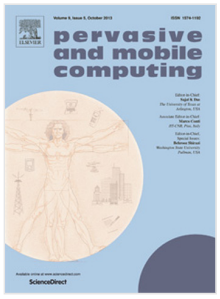
Accepted Manuscript



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PII: S1574-1192(16)30136-5
DOI: http://dx.doi.org/10.1016/j.pmcj.2016.08.010
Reference: PMCJ 744

To appear in: *Pervasive and Mobile Computing*

A Personalized Recommender System for Pervasive Social Networks

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Abstract

The current availability of interconnected portable devices, and the advent of the Web 2.0, raise the problem of supporting anywhere and anytime access to a huge amount of content, generated and shared by mobile users. On the one hand, users tend to be always connected for sharing experiences and conducting their social interactions with friends and acquaintances, through so-called Mobile Social Networks, further improving their social inclusion. On the other hand, the pervasiveness of communication infrastructures spreading data (cellular networks, direct device-to-device contacts, interactions with ambient devices as in the Internet-of-Things) makes compulsory the deployment of solutions able to filter off undesired information and to select what content should be addressed to which users, for both (*i*) better user experience, and (*ii*) resource saving of both devices and network.
In this work, we propose a novel framework for pervasive social networks, called *Pervasive PLIERS (p-PLIERS)*, able to discover and select, in a highly personalized way, contents of interest for single mobile users. p-PLIERS exploits the recently proposed PLIERS tag-based recommender system [2] as context a reasoning tool able to adapt recommendations to heterogeneous interest profiles of different users. p-PLIERS effectively operates also when limited knowledge about the network is maintained. It is implemented in a completely decentralized environment, in which new contents are continuously generated and diffused through the network, and it relies only on the exchange of single nodes' knowledge during proximity contacts and through device-to-device communications. We evaluated p-PLIERS by simulating its behavior in three different scenarios: a big event (Expo 2015), a conference venue (ACM KDD'15), and a working day in the city of Helsinki. For each scenario, we used real or synthetic mobility traces and we extracted real datasets from Twitter interactions to characterize the generation and sharing of user contents.

Keywords: pervasive content sharing, mobile social networks, opportunistic networks, personalized recommender systems

1. Introduction

The amount of data accessible through the Internet has dramatically increased over the last years. This trend has been exacerbated by the advent of online social networks (hereinafter OSNs) and by video-on-demand services like Netflix [3]. It is then expected to boom with the Internet of Things, where potentially every object in the physical world will create and share information over the network. The availability of this data represents an important resource that is revolutionizing our society, but it is also posing some serious technological challenges in terms of maintenance, management, indexing and identification of contents. This affects especially mobile communications, where users want to be always connected and able to share contents anywhere and anytime. To alleviate the burden of data traffic on cellular networks, several solutions based on device-to-device (D2D) wireless communications have been proposed in the literature, such as opportunistic networks [7]. However, most of the classical mechanisms for content identification and recommendation designed for centralized infrastructures cannot be directly applied to these scenarios, and ad-hoc solutions must be adopted. This is the case of Mobile Social Networks (hereinafter MSNs), designed to further improve social interactions and inclusion through experience sharing based on opportunistic communications, and to this aim they need efficient and personalized mechanisms for useful content selection and distribution.
The basic approaches to identify useful contents in opportunistic networks are based on publish/subscribe mechanisms. Users have to explicitly define their interests by subscribing to a fixed set of thematic channels and, when they encounter other mobile users, they can ask them for contents related to the channels they are subscribed to (see for example the PodNet project [19]). Other solutions exploit context information (e.g., the history of physical contacts between nodes, social information about the users or the presence of communities) to improve forward-

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