

Mobile Crowd-sensing Applications: Data Redundancies, Challenges, and Solutions

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Conventional data collection methods that use Wireless Sensor Networks (WSNs) suffer from disadvantages such as deployment location limitation, geographical distance, as well as high construction and deployment costs of WSNs. Recently, various efforts have been promoting mobile crowd-sensing (such as a community with people using mobile devices) as a way to collect data based on existing resources. A Mobile Crowd-Sensing System can be considered as a Cyber-Physical System (CPS), because it allows people with mobile devices to collect and supply data to CPSs' centers. In practical mobile crowd-sensing applications, due to limited budgets for the different expenditure categories in the system, it is necessary to minimize the collection of redundant information to save more resources for the investor. We study the problem of selecting participants in Mobile Crowd-Sensing Systems without redundant information such that the number of users is minimized and the number of records (events) reported by users is maximized, also known as the Participant-Report-Incident Redundant Avoidance (PRIRA) problem. We propose a new approximation algorithm, called the Maximum-Participant-Report Algorithm (MPRA) to solve the PRIRA problem. Through rigorous theoretical analysis and experimentation, we demonstrate that our proposed method performs well within reasonable bounds of computational complexity.

CCS Concepts: • **Networks** → **Network control algorithms; Network design and planning algorithms; Cloud computing;**

Additional Key Words and Phrases: Data redundancy, mobile crowd-sensing, optimization, participatory sensing

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1 INTRODUCTION

In contrast to **Wireless Sensor Networks (WSNs)** [18, 27, 36, 37, 39, 43] that rely on the data supplied by stationary sensors to monitor areas, **Participatory Sensing (PS)** or *Mobile Crowd-Sensing* [32] is a new technique that collects data from the environment and society based on a large group of individuals equipped with mobile devices to collect and analyze data. Essentially, mobile crowd-sensing refers to a collaborative sensing model wherein individuals equipped with

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