ETSMC019- 2017 Distributed Algorithms to Compute Walrasian Equilibrium in Mobile Crowdsensing

Abstract

In this paper, we consider joint pricing and task allocation in a unified mobile crowdsensing system, where all task initiators and mobile users are viewed as peers. From an exchange market point of view, the pricing and task allocation in such a unified system depend only on the supply and demand since no one can dominate the process, with the optimal solution being characterized by the Walrasian equilibrium. This is quite different from existing approaches, where each task initiator builds a specific mobile crowdsensing system and provides an incentive mechanism to maximize his/her own utility. We design distributed algorithms to compute the Walrasian equilibrium under the scenario where one cloud platform is available in the system. We propose to maximize social welfare of the whole system, and dual decomposition is then employed to divide the social welfare maximization problem into a set of subproblems that can be solved by task initiators and mobile users. We prove that the proposed algorithm converges to the optimal solution of social welfare maximization problem. Further, we show that the prices and task allocation obtained by the algorithm also yields a Walrasian equilibrium. Also, the proposed algorithm does not need the cloud to collect private information such as utility functions of task initiators and cost functions of mobile users. Extensive simulations demonstrate the effectiveness of the proposed algorithms.