

**CHENNAI – PONDICHERRY**

**Multi-objective Optimization based Allocation of Heterogeneous Spatial Crowdsourcing Tasks**

**Abstract:**

With the rapid development of mobile networks and the proliferation of mobile devices, spatial crowdsourcing, which refers to recruiting mobile workers to perform location-based tasks, has gained emerging interest from both research communities and industries. In this paper, we consider a spatial crowdsourcing scenario: in addition to specific spatial constraints, each task has a valid duration, operation complexity, budget limitation and the number of required workers. Each volunteer worker completes assigned tasks while conducting his/her routine tasks. The system has a desired task probability coverage and budget constraint. Under this scenario, we investigate an important problem, namely heterogeneous spatial crowdsourcing task allocation (HSC-TA), which strives to search a set of representative Pareto-optimal allocation solutions for the multi-objective optimization problem, such that the assigned task coverage is maximized and incentive cost is minimized simultaneously. To accommodate the multi-constraints in heterogeneous spatial crowdsourcing, we build a worker mobility behavior prediction model to align with allocation process. We prove that the HSC-TA problem is NP-hard. We propose effective heuristic methods, including multi-round linear weight optimization and enhanced multi-objective particle swarm optimization algorithms to achieve adequate Pareto-optimal allocation. Comprehensive experiments on both real-world and synthetic data sets clearly validate the effectiveness and efficiency of our proposed approaches.

**Existing System:**

SC applications need to select the best subset of available workers by matching task requirements with worker profiles. Recent studies have established that spatial locations have a significant impact on the quality of final results for spatial crowdsourcing. By aligning spatial tasks with workers’ daily routines, the disturbance to workers’ main business in completing spatial tasks can be lowered, and the incentive cost incurred by longer detours can be decreased. Moreover, the chances of cheating results (i.e., generate false responses without actually visiting the specified task location) will be decreased.

However, to accommodate the *Multiple Constraints* in heterogeneous spatial crowdsourcing (i.e., spatial location, valid duration, processing time and number of required workers) is a challenge, as we need to consider not only crowd workers’ potential moving trajectory, but also their stay duration. In the paper, we mathematically formulate the heterogeneous SC task allocation problem (*HSCTA Problem*), which aims to efficiently assign all existing heterogeneous tasks to the right workers, with objectives of *maximizing crowdsourcing quality (i.e., the possibility with which selected workers will perform assigned task is maximized) and minimizing incentive budget (i.e., the total incentive budget paid to all selected workers is minimized) simultaneously*.

**Proposed System:**

We formally define the heterogeneous spatial crowdsourcing task allocation problem, under the multiple constraints, with multi-objectives optimization of task coverage and incentive budget simultaneously. To the best of our knowledge, this is the first framework solving heterogeneous spatial task allocation issue, leveraging the participant users’ comprehensive mobility perdition in Section 4 to achieve Pareto-optimal solutions.

*\_* In order to solve the multi-objective optimization problem and obtain adequate Pareto-optimal solutions, we propose efficient heuristic approaches, namely multi-round linear weight optimization (MRLWO) algorithm, and enhanced multi-objective particle swarm optimization (EMOPSO) algorithm to tackle the HSC-TA problem.

*\_* We conduct extensive experiments using real and synthetic data sets to evaluate our proposed allocation algorithms on small and large-scale environment. The results show the effectiveness and efficiency of our proposed HSC-TA solving approaches**.**