

The information gradient-based routing and navigation protocols have been proved to be effective when collecting data from the distributed wireless sensor networks, because the data collector can achieve the global objective through local greedy decision based on the information gradient. An efficient method to establish this information gradient is to solve a discrete approximation to the harmonic function which is called Information Potential Field (IPF). However, the energy-efficient and quick convergence methods to construct the IPF should be fully investigated to trade off the energy efficiency and the quality of the IPF, especially in the large-scale networks with high dynamics. In this paper, two algorithms are proposed to efficiently construct the IPF, including Hierarchical Skeleton-based Construction Algorithm (HSCA) and Value Estimating Substitution Algorithm (VESA). Both algorithms obey the typical hypotheses on WSN settings and are the gossip-styled propagation principle. In addition, we propose advanced approaches of construct the IPF to tackle the challenge of its practical application, such as obstacles, task priorities and sensor energy budget. Comprehensive simulation results show the feasibility of the proposed algorithms, which can reduce the number of iterations to reach a convergence status by 80% so as to conserve energy, and they perform well considering the requirements of real applications.