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**Asynchronous Stochastic Approximation Based Learning algorithms for As-You-Go Deployment of Wireless Relay Networks along a Line**

**Abstract:**

We are motivated by the need, in emergency situations, for impromptu (or “as-you-go”) deployment of multihop wireless networks, by human agents or robots (e.g., unmanned aerial vehicles (UAVs)); the agent moves along a line, makes wireless link quality measurements at regular intervals, and makes on-line placement decisions using these measurements. As a first step we have formulated such deployment along a line as a sequential decision problem. In our earlier work, reported, we proposed two possible deployment approaches: (i) the pure as-you-go approach where the deployment agent can only move forward, and (ii) the explore-forward approach where the deployment agent explores a few successive steps and then selects the best relay placement location among them. The latter was shown to provide better performance (in terms of network cost, network performance and power expenditure), but at the expense of more measurements and deployment time, which makes explore-forward impractical for quick deployment by an energy constrained agent such as a UAV. Further, since in emergency situations the terrain would be unknown, the deployment algorithm should not require a-priori knowledge of the parameters of the wireless propagation model. In we, therefore, developed learning algorithms for the explore-forward approach.

**Existing System:**

Motivated by the need for as-you-go deployment of wireless sensor networks (WSNs) over large terrains, such as forest trails, in our earlier work we had considered the problem of multihop wireless network deployment along a line, where a single deployment agent starts from a sink node (e.g., a base-station), places relays as the agent walks along the line, and finally places a source node (e.g., a sensor) where required.

We formulated this problem as a measurement based sequential decision problem with an appropriate additive cost over hops. In order to explore the range of possibilities, we considered two alternatives for measurement and deployment: (i) the explore-forward approach: after placing a node, the deployment agent explores several potential placement locations along the next line segment, and then decides on where to place the next node, and (ii) the pure as-you-go approach: the deployment agent only moves forward, making measurements and committing to deploying nodes as he goes.

**Proposed System:**

We have formulated as-you go deployment as an MDP, found structural results for the optimal policy, and proposed learning algorithms to solve the sequential decision problems without using any prior knowledge of the radio propagation parameters. The use of MDP to formulate as-you-go deployment was first proposed.

This work was later extended by, where the authors have provided an algorithm derived from an MDP formulation, so as to create a multi-hop wireless relay network between a sink and a source located at an unknown location, by placing relay nodes along a random lattice path. However, these papers do not consider spatial variability of wireless link qualities due to shadowing, which allows them to develop deployment algorithms that place the next relay based on the distance from the previously placed relay.