

Analysis of a Swarm Approach to Building Voronoi Diagrams

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Abstract

Big Data is challenging traditional methods of engineering. The dramatic increases in information volume, velocity, and variety are rendering centralized approaches less practical. Swarm intelligence describes multi-agent systems that utilize emergent behavior to solve complex problems. Such systems exhibit desirable traits like scalability and robustness, but are not yet well understood. To begin formulating universal properties of swarms and to identify design methodologies, we can solve traditionally centralized problems using swarms to draw comparisons and filter distinctions.

In this paper, we engineer a biologically-inspired swarm system that solves two spatial problems. First, we introduce a novel ant colony system adapted for clustering based on k-means. Second, we demonstrate how a simple modification to ant foraging behavior can yield the Voronoi Diagram for the chosen clusters. The system is modeled with an agent-based simulation. Analysis of swarm runtimes will be discussed. Through these two examples of swarm problem solving, we aim to further distinguish general swarm properties and swarm engineering design methods.