SwarmArchitect: A Swarm Framework for Collaborative Construction

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ABSTRACT

Computer game development has become increasingly popular in the field of autonomous systems. One of the main topics studies the building of various architectures in computer games. A realistic human-like architecture is expected in a thematic computer game, since it strongly motivates the game players in an intuitive way. However, the task of building a human-like architecture is non-trivial since the construction is a real time process without human supervision. In this paper, we present a collective building algorithm inspired by social insects for intelligent construction based on multiple agents. A swarm of virtual agents indirectly design edifications, which resemble basic features in human-like architecture by using a stigmergic mechanism along with branching rules. The main idea of the algorithm is to map sensory information to appropriate building actions.

Categories and Subject Descriptors

I.2.11 [**Artificial Intelligence**]: Distributed Artificial Intelligence

General Terms

Algorithms, Design, Experimentation

Keywords

Swarm Intelligence

1. INTRODUCTION

Computer game development is an attractive area of research due to its wide applications, and various research topics on artificial intelligence, especially the use of agents that are involved in the game design. The generation of constructions that resemble the architectonical style employed by humans (called human-like architecture in this paper) is one of several main tasks in game development. Furthermore, the online generation of human-like architecture is expected to have a low demand of computational resources such as CPU usage. Hence, a reliable and efficient method for constructing geometric figures in real time is needed.

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We present a swarm-based construction algorithm, called the SwarmArchitect algorithm (SA), which is based on our current work [1]. The SA is capable of building a 3D human-like architecture based upon the principles of swarm intelligence. We developed an interactive 3D visualization environment to perceive the behaviors of the agents. Furthermore, we showed the importance of the pheromone system in the SA.

2. EXPERIMENTAL RESULTS

We tested the pheromone system in order to examine its effect upon the performance of the SA. Agents were tasked with building a large construction. The simple rule used in this experiment was hand crafted to ensure that the there was no variation in the finished construction from one simulation run to the next. We ran the simulation several times, with and without pheromone deposits, recording the number of iterations needed to complete the construction. The simulation was tested 10 times both with and without pheromone. Figure 1 shows the number of iterations needed to finish construction in each simulation run. The results demonstrate a significant increase in performance when pheromone is enabled.

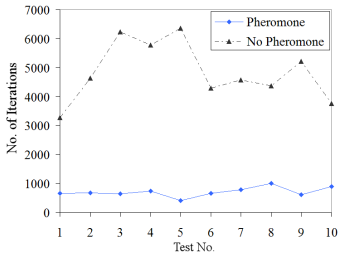

Figure 1: The pheromone strategy implemented in the SA has a large impact on the effectiveness of the agents.

3. REFERENCES

[1] Y. Zeng, D. P. Buus, and J. C. H. Multiagent based construction for human-like architecture. In *In Proceedings of the Sixth International Joint Conference on Autonomous Agents and Multi-Agent Systems(AAMAS'07).*