Computer And Information Systems

Artificial Intelligence
Swarm Intelligence And Robotics
- An Evaluation

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ABSTRACT
SWARMS have fascinating properties. Their individual members follow simple rules – yet the swarm accomplishes complex tasks. No single member controls the swarm, making it extremely robust. This simplicity and robustness make them an interesting model for solving problems in computer science. In this paper the term swarm intelligence is explained and the motivation behind the approach is discussed. Properties of swarms and social insects are described and the process of building a metaheuristic after an example in nature is looked at. Different uses of swarm intelligence and swarm robotics are introduced and the usefulness of the field is evaluated.

General Terms:
robust, metaheuristic

Explanation in brief the general terms:
Robust : A system, organism or design may be said to be "robust" if it is capable of coping well with variations (sometimes unpredictable variations) in its operating environment with minimal damage, alteration or loss of functionality.

Metaheuristics : Metaheuristics are generally applied to problems for which there is no satisfactory problem-specific algorithm or when it is not practical to implement such a method.

Keywords:
Image processing techniques, mini robot model, application robots, Neural Network Algorithm.

Description:
The complexity of an ant colony or the beautiful sight of a large swarm of birds surprise with the simplicity of the underlying rules. With ant colony optimization and particle swarm optimization two algorithms have been created which can solve difficult computational problems efficiently, while still being easy to understand. As there is a wide variety of swarm behaviors in nature, there is a great chance we will see more algorithms and systems modeled after social insects and other social animals. The challenge in designing such systems will be to define the correct rules for the interaction of the individuals, as it is not immediately evident which rules lead to the desired behavior of the swarm. Swarm intelligence is a very active and exciting research field. As our technical systems become increasingly complex, swarm intelligence algorithms – which consist of many simple parts – become more and more useful as a solution to difficult computational problems. As the algorithms are parallel in nature, they are well adapted for the use on parallel hardware. On coming processor generations – which will feature a growing number of parallel processing units – this may lead to very efficient implementations of these algorithms. Apart from algorithms and swarm robotics the knowledge about the underlying rules of swarm behavior is used to write computer simulations of swarms. Applications are simulations of realistic animal swarms or even human crowd behavior. An example is the evaluation of the impact of hydraulic structures on fish populations where fish swarming behavior has to be taken into account. In computer graphics swarm simulations have also become widely used. For the Lord of the Rings trilogy Massive has been developed, a software which animated thousands of agents for the giant battle scenes. Each agent has an artificial intelligence brain that can select from a collection of possible movements depending on external stimuli. Massive has since then been used for a lot of projects including motion pictures and commercials. Apart from these realistic simulations, art projects like SwarmArt use swarm simulations just because of their beauty.