

A Navigation Strategy for Swarm Robotics Based on Bat Algorithm Optimization Technique

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Abstract

Navigation strategy to control the motion of robots is essential to develop a stable system in swarm robotics. Swarm robotics is a group of homogenous robot working together to achieve a target. This paper aims to adapt Bat Algorithm (BA) optimization techniques to the swarm robotics system. BA as a nature inspired algorithm is used in the system to determine current location and search for future position of each robots inspired by echolocation behavior of microbats. Five robots which represent five particles in this study need to move from designated initial positions to one point of desired position. All the robots need to meet at the point to verify the success of the navigation strategy. Number of iterations and accuracy of localization are presented and compared with navigation strategy based on Particle Swarm Optimization (PSO). The analysis of the performance of proposed algorithm is conducted by considering two different parameters. First is the number of iterations to achieve the desired position. Second is the accuracy which is the difference between the final position of the swarm robot and the desired position. The result shows that the number of iteration for BA technique and PSO technique are 42 and 77 respectively. In term of accuracy, BA has 0.0039% of error while PSO 0.0079% error. It is shown that BA outperformed PSO technique with less number of iterations and higher accuracy.

Keywords: Navigation strategy, swarm robotics, Bat Algorithm.

1. Introduction

Nowadays, swarm robotics or also known as multi-robot system is one of the emerging technologies which go through fast revolution every day. Consists of more than two members of robot will increase the difficulty to manage and control the behavior, navigation and task completion by the system. The future of swarm robotics system can be foreseen to be