EngOpt2018 - 6th International Conference on Engineering Optimization
Instituto Superior Técnico, Lisbon Portugal • 17-19 September, 2018
Editors: H.C. Rodrigues, J. Herskovits, C.M. Mota Soares, et al.

Abstract ID 1096

OPTIMAL SEARCH STRATEGIES FOR RESCUE DRONES BASED ON SWARM BEHAVIOUR WITH DIFFERENT ETHICS

Alexander Struck, Ronny Hartanto, Florian Roesner, Clein Sarmiento Castrillón

Rhein-Waal University of Applied Sciences, Germany
alexander.struck@hsrw.eu, ronny.hartanto@hsrw.eu, florian.roesner@hsrw.org, cleinsarmiento@hotmail.com

Keywords: swarm optimisation,autonomous agents,multi-objective optimisation,cultural algorithms,evolutionary computation

Abstract: Search and rescue of people in need after catastrophic events like earth quake areas, large scale wildfires, hurricane zones or flood districts is dangerous and challenging for the rescue personnel. Limited resources and reduced accessibility to danger zones even prevent rescue attempts in total. New technologies to assist and keep safe the search and rescue teams while maintaining maximal success rate are therefore desired. Autonomous drones and robots can provide helpful assistance in locating and supporting injured persons. A particularly powerful aid can be expected if the rescue drones act as a swarm of autonomous agents. Each agent follows a certain search protocol and decides based on sensor input and information exchange with other agents and central command which action it will take, for instance delivering first aid kits and utilities for victims still capable to help themselves, requiring a rescue team for persons in severe danger or reporting casualties. In this context, a rescue scenario based on simulated swarms of agents which can exchange data and energy via charge transfer between their drive battery is discussed, including recharge and information transfer at a base camp/central command. Agents in the swarm follow a certain ethical protocol. For instance, they can act fully altruistically and give up all of their remaining charge when convinced that a victim can be saved by their self-abandonment. The other extreme is maximal selfishness, the agent only communicating the location of victims while preserving always enough energy to recharge at the operation center or through altruistic robots. The protocol furthermore includes inter-agent interactions and communications which will influence the individual agent decisions. We discuss the optimal swarm ethics and its efficiency compared to standard rescue protocols. We also examine limits and benefits in real world technical applications.