

Tool for analysis of genetic algorithms applied to obstacle avoidance and exploitation

Breno Cunha Queiroz e Eduardo do Valle Simões

Universidade de São Paulo

brenocqueiroz@usp.br, simoes@icmc.usp.br

Objective

This work aims to develop a tool to analyze the impact of different techniques on the evolution of a robot population for exploration with obstacle avoidance. The program was developed in MATLAB (Figure 1), while the robots were simulated in Gazebo. The ROS (Robotics Operating System) was used to establish communication [1].

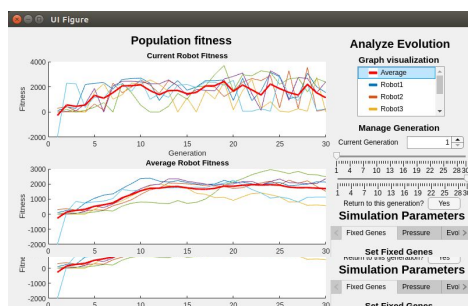


Figure 1: Fitness analysis interface.

Materials and Methods

In the simulation each robot has in its chromosome genes to define linear and angular velocities, rotation time, sensor activation distance, and angle between sensors. Fitness is calculated by the distance traveled by each robot, which is equivalent to the terrain explored. User-changeable evolutionary operators include: selection [2], time per generation, mutation rate, predation [3], neutrality [3], back-mutation prevention [3], and inheritance of average fitness [3]. It is also possible to select the genes to be mutated. After starting the simulation with the chosen parameters, charts presenting fitness and genes for each robot are displayed in real time.

Results

The information presented about each robot during the evolution of the system can be analysed to achieve better evolutionary performance. The simulation can be saved and re-loaded to test different evolutionary parameter settings acting in the same scenario. It was even possible to pause and save the data of a simulation to resume it in the future.

Conclusions

Choosing the best alternative for a given application is a task that requires programmer experience. In this work it was possible to create an expandable tool to visualize the impact of each chosen technique on the evolution of a virtual robot population, which could be applied to physical robots [1]. The software and test results are available at: <https://github.com/Brenocq/EvolutiveSystemAnalyzer-ObstacleAvoidance>

References

- [1] TAKAYA, Kenta; et al. Simulation environment for mobile robots testing using ROS and Gazebo. 2016
- [2] ZITZLER, Eckart; THIELE, Lothar; DEB, Kalyanmoy. Comparison of Multiobjective Evolutionary Algorithms: Empirical Results. 2000
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