Adaptive Sensory Configurations in Robot Teams

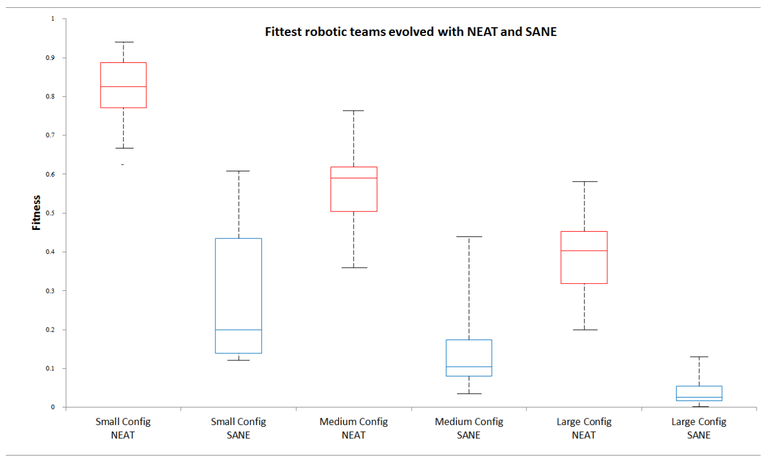
Overview

Evolutionary Robotics combines the fields of Robotics and Evolutionary Computing to provide a robust and efficient robotic design method. In this research, we tested the performances of different evolutionary design approaches that evolved a different component of a robot in a collective gathering task. The task is designed such that the robots require different levels of cooperation to efficiently complete them.

Controller Evolution

Controller of the robot was evolved while having a fixed set of morphology. In particular, we investigated the performance of NEAT and SANE at developing a neural network controller for robot teams. Teams evolved with NEAT showed overall better performance.

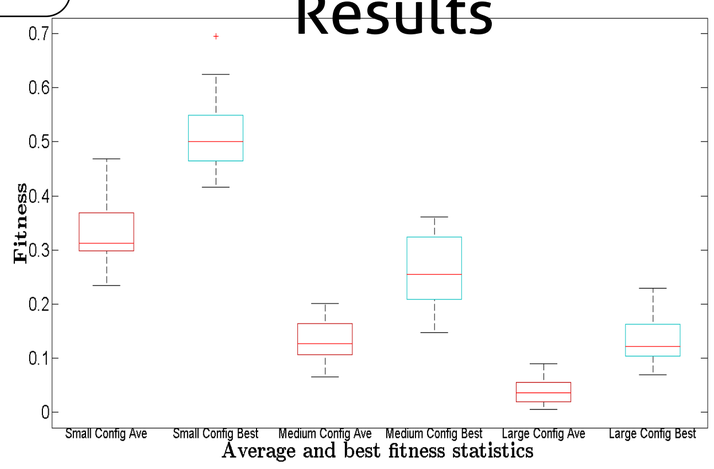
Results



Morphology evolution (ME)

The morphologies of the robots were evolved with a GA - keeping the heuristic controller static. Performed best when task complexity was low. Naturally avoided using the maximum number of sensors available.

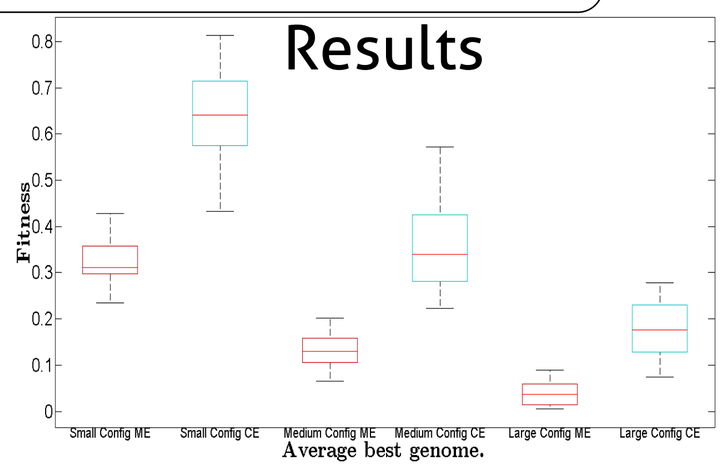
Results



Co-Evolution of Morphology and Controller (CE)

NEAT-M (Neuro Evolution for Augmenting Topologies and Morphology) was used to evolve the controller AND morphology of a Robot. The results were compared to a Morphology-Only Evolution for various levels of cooperation.

Results



Conclusions

The Controller Evolution method showed that NEAT consistently produced better controllers compared to SANE.

The Morphology-only evolution method preformed best when the task required the least amount of cooperation to complete it efficiently.

The Co-Evolution of Controller and Morphology consistently outperformed the Morphology-only evolution for Minimum, Medium and Maximum levels of cooperation.

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