Evolutionary Computation for Energy Conservation Within a Distributed System

Jose Guadalupe Hernandez, Alexander Lalejini, Dr. Charles Ofria
Michigan State University, East Lansing, Michigan

Motivation

Distributed systems provide ability to break down and cooperatively solve complex problems that could be difficult for a single agent. Obstacles that make objectives difficult for distributed systems is the lack of global problem state information and communication. These problems may interfere with the coordination of the distributed system.

Research Question

Can digital organisms evolve a distributed algorithm to contend with energy conservation and coordination within a distributed system that is in a resource varying environment?

Objectives

- Develop an environment where resources are available either in abundance or scarcity.
- Develop a distributed system model with homogeneous nodes.
- Evolve and analyze the distributed algorithms produced.

Environment

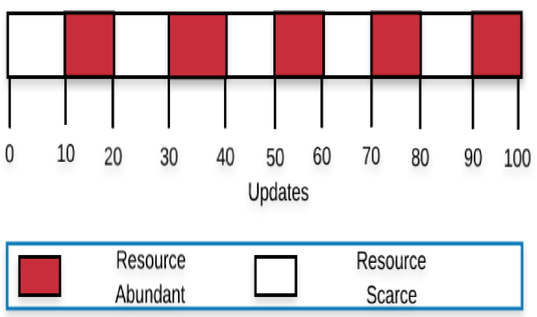


FIGURE 1. Resources will appear in abundance or scarce.

Methodology

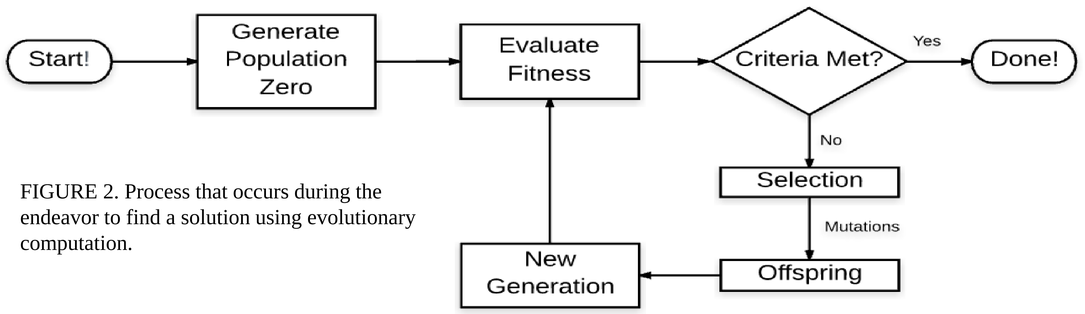


FIGURE 2. Process that occurs during the endeavor to find a solution using evolutionary computation.

Population

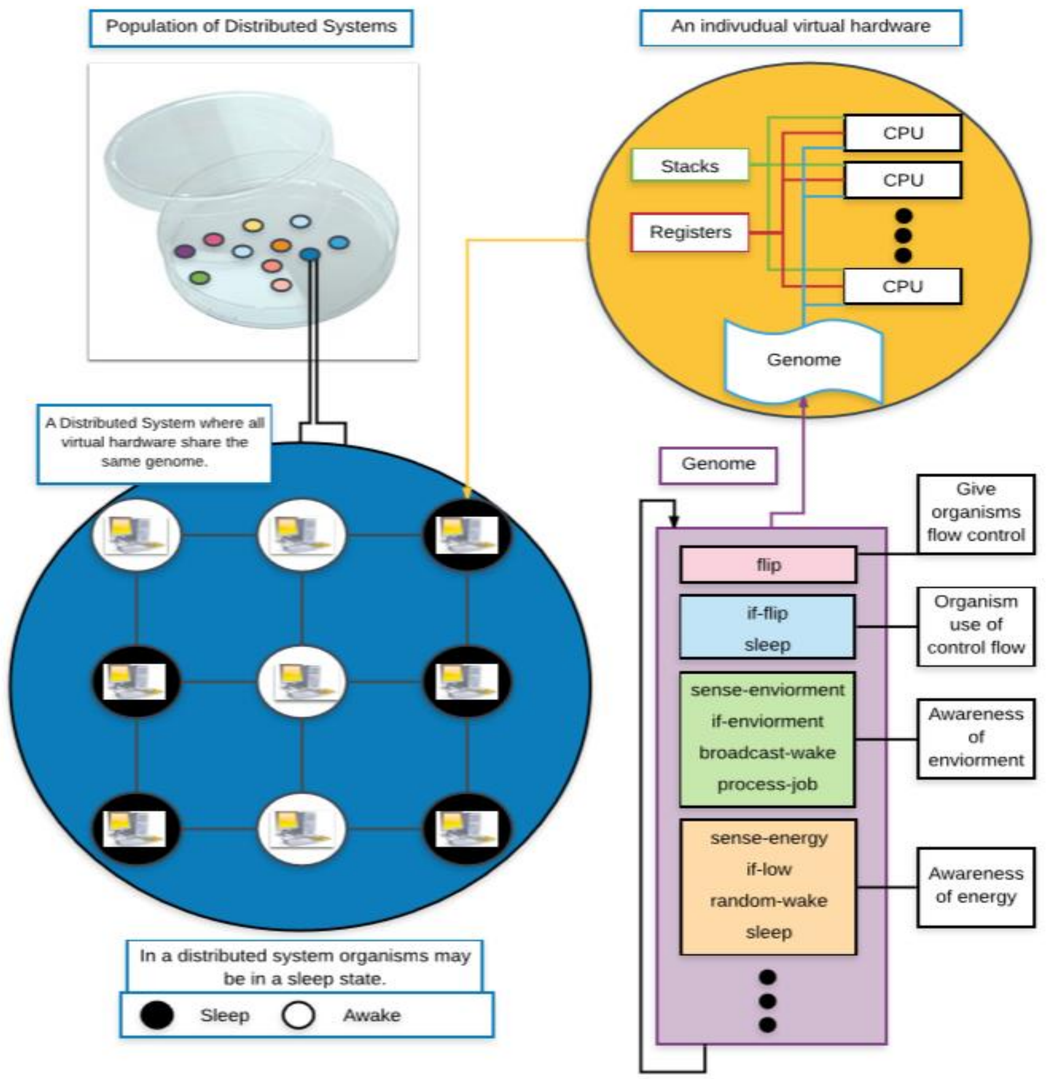
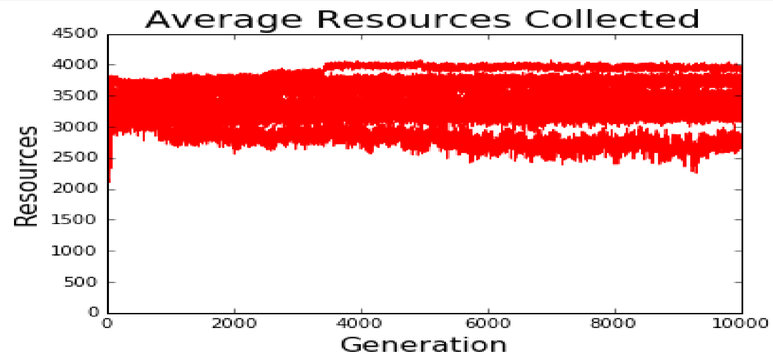
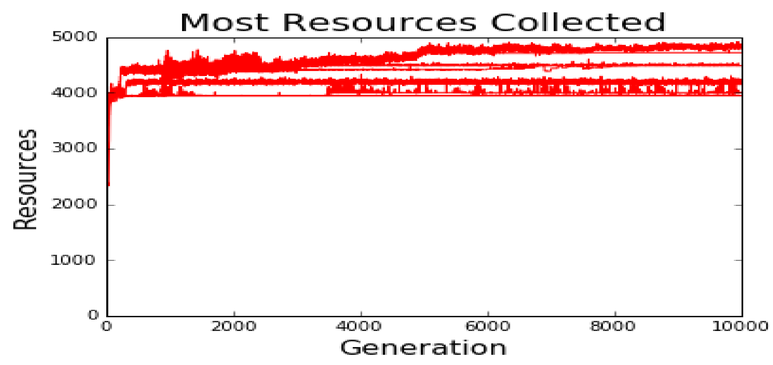
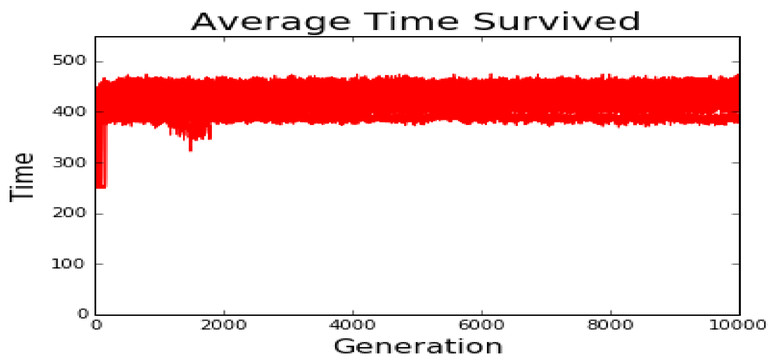


FIGURE 3. Example of population and its internal architecture.

Results







Conclusion

- Resources being collected increasing.
- Some form of communication arising.
- Algorithm:
  - Ability to process resource.
  - Ability to communicate.
- Incorporate these algorithms in real world systems.

Acknowledgements

Dr. Charles Ofria • Alex Lalejini • Dr. Eric Torng • Summer Research Opportunities Program (SROP) • College Assistant Migrant Program (CAMP) • TRIO • BEACONs

References:
1. Heather J. Goldsby et al. “Task-switching costs promote the evolution of division of labor and shifts in individuality”. In: Proceedings of the National Academy of Sciences 109.34 (2012), pp. 13686–13691. DOI: 10.1073/pnas.1202233109. eprint: http://www.pnas.org/content/109 / 34 / 13686 . full . pdf. URL: http : / / www . pnas . org /content/109/34/13686.abstract.
2. Benjamin E Beckmann, Philip K McKinley, and Charles Ofria. “Evolution of an adaptive sleep response in digital organisms”. In: European Conference on Artificial Life . Springer. 2007, pp. 233–242.
3. Richard E. Lenski et al. “The evolutionary origin of complex features”. English. In: Nature 423.6936 (May 2003). Copyright - Copyright Macmillan Journals Ltd. May 8, 2003; Last updated - 2013-02-06; CODEN -NATUAS, pp. 139– 4. URL : https : / / search . proquest .com/docview/204540332?accountid=12598.