

Target Detection Using Algorithmic Matter

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Motivation

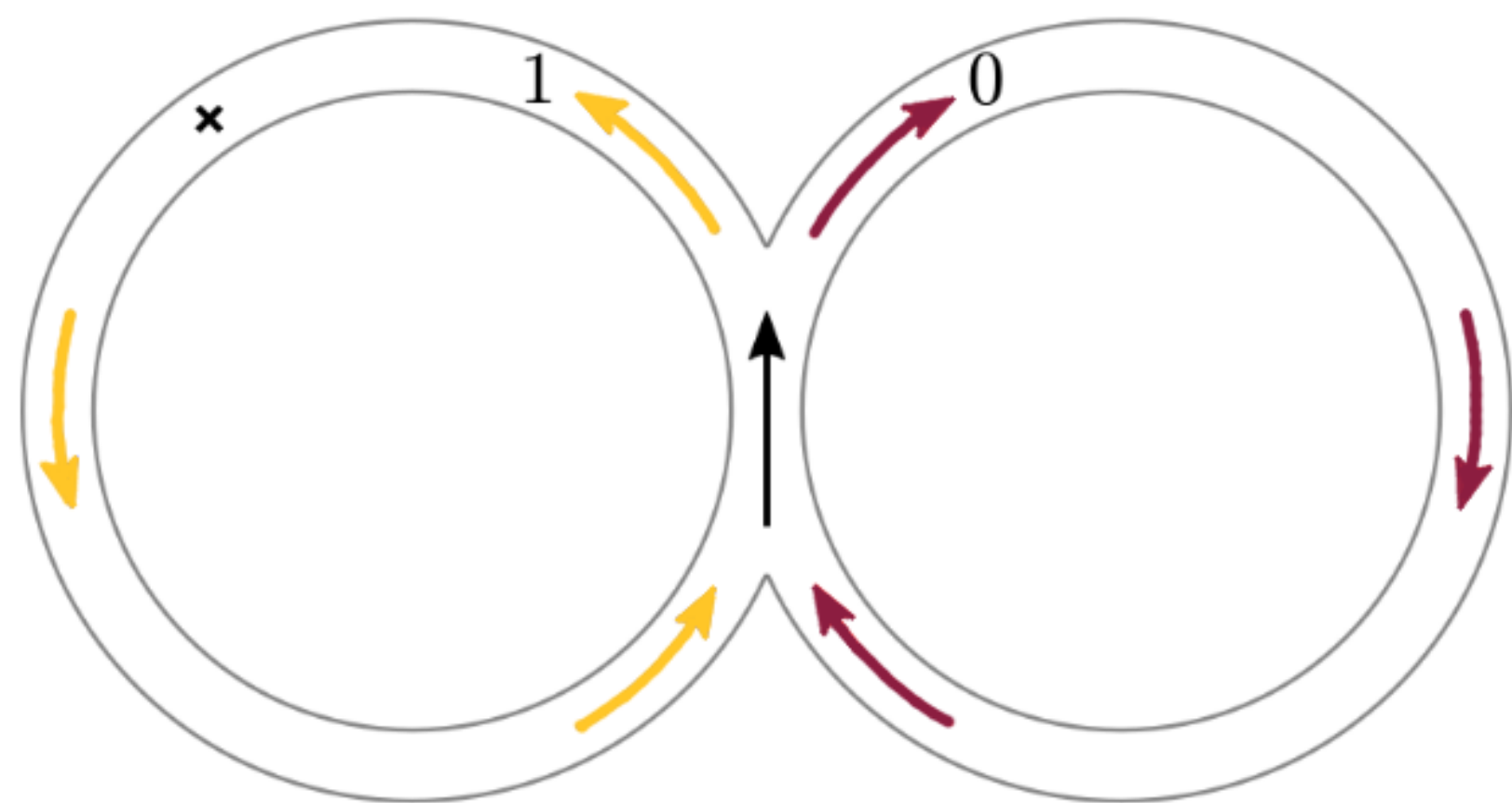
- Invasive surgery has higher risks
- Distributed algorithms allow a system of simple machines to have complex behaviour
- Nanosized particles with constant memory can run distributed algorithms without centralized control

Research question

Is there an efficient distributed algorithm that can make the system of particles detect and converge to a target in the environment?

Method

- A policy is a sequence of decisions that tell the particle which path to take in the graph
- Randomly explore environment until target is encountered; then, update and follow policy as shown in the figure^[1] below, where each possible branch is assigned a number
- Use stored policy to deterministically choose path after target is seen



Simulation

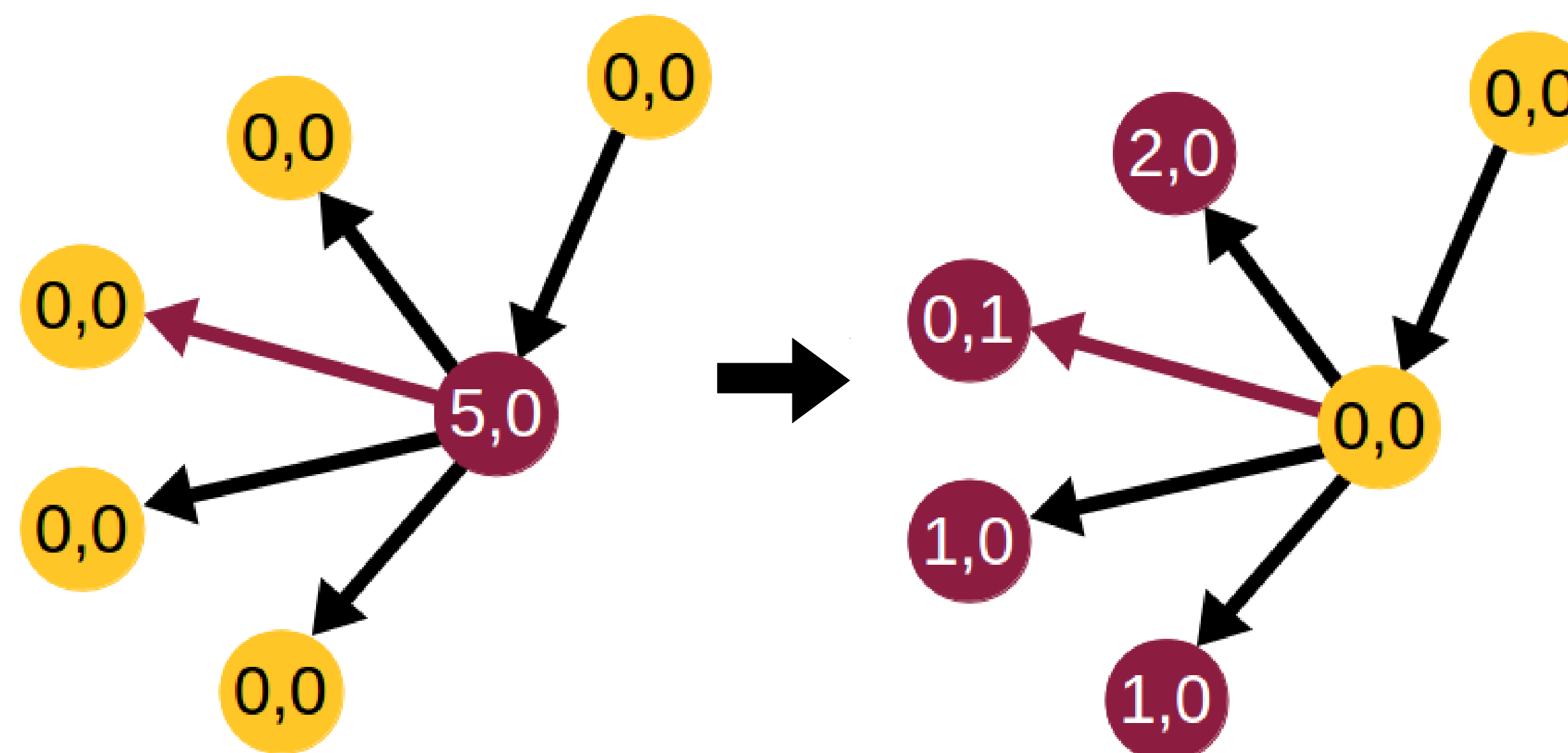


Fig 1: The environment has been modeled as a graph, with the target edge marked in red.

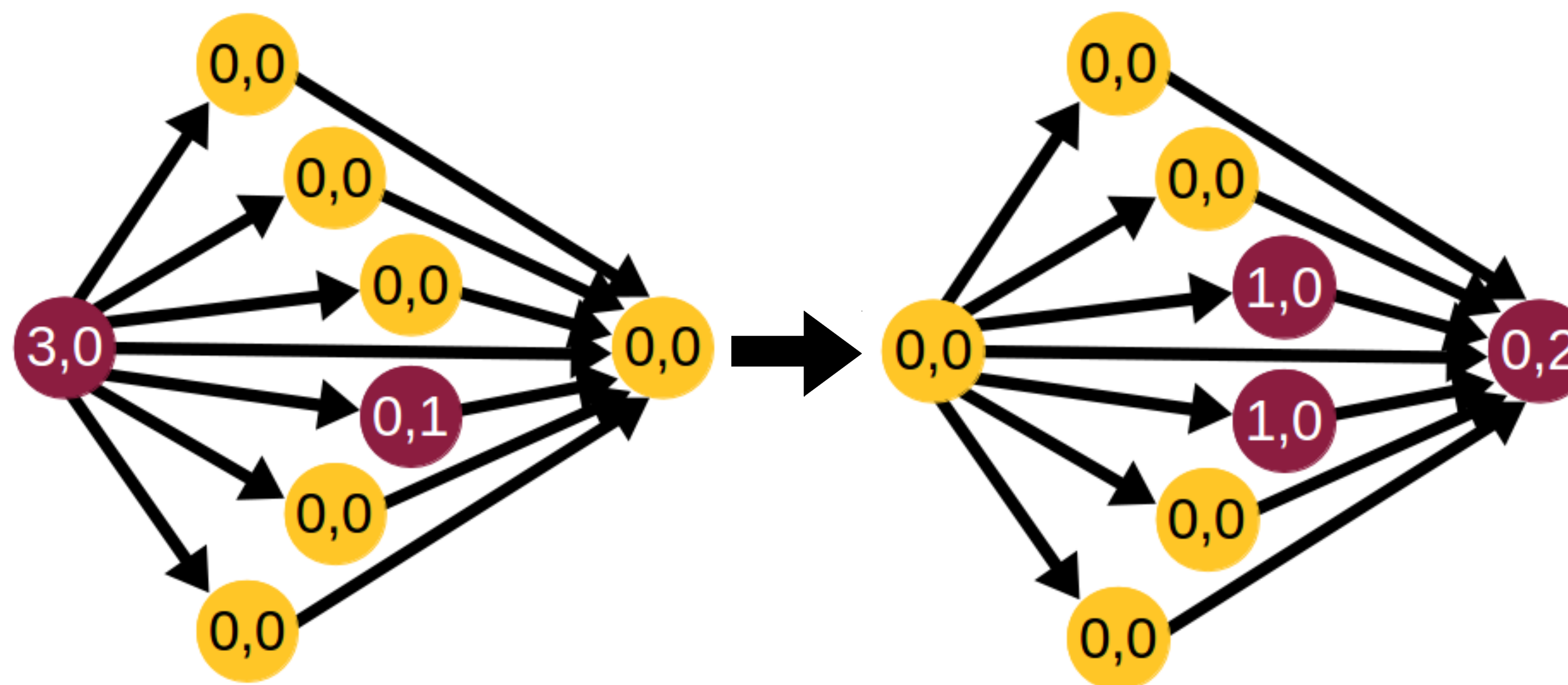
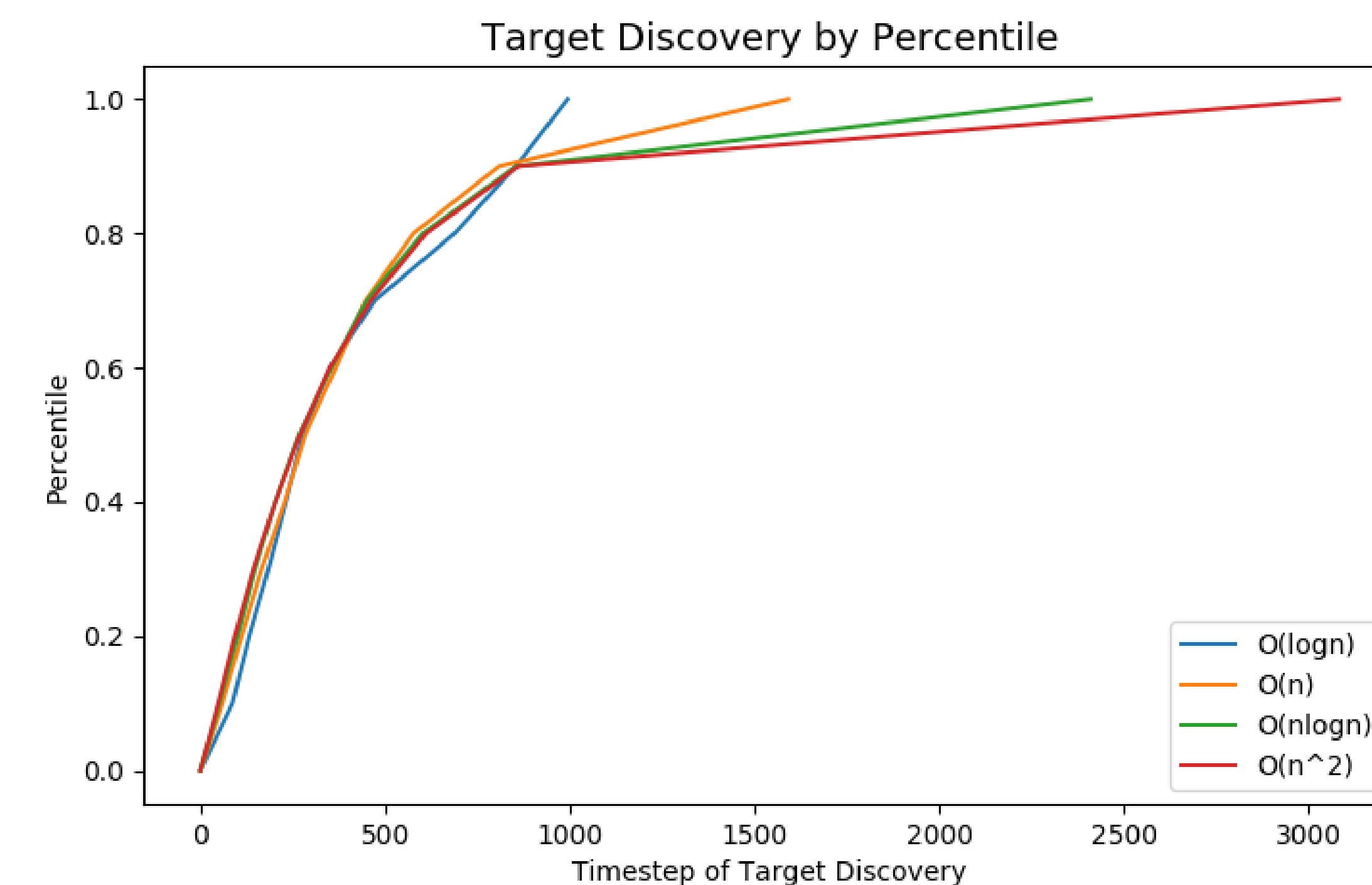


Fig 2: The communication policy allows particles who have not found the target to copy the policies of those who have.

Results



Conclusion & Future Work

- Combination of random exploration and individual policies will cause all particles to converge to target
- Next, improve runtime; this method is exponential on the number of paths

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References

[1] Berrueta, Thomas A., Ana Pervan, and Todd D. Murphey. "Towards Robust Motion Planning for Synthetic Cells in a Circulatory System."