Towards Quantum Computing in Agent-Based Simulation

A Practical Approach

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Agent-Based Simulation (ABS) is a methodology in which a system is simulated in a bottom-up approach by modelling the micro interactions of its constituting parts, called agents, out of which the global macro system behaviour emerges.

Additional Key Words and Phrases: Agent-Based Simulation, Quantum Computing, Functional Programming

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1 INTRODUCTION

TODO: in recent years quantum computing has found its way from the science labs to home computers of scientists. Altenkirch et al have developed a Quantum monad, which allows simulating of quantum computing on a classical machine. Microsoft recently released Q# which also allows to write programs for quantum computing and IBM released their cloud-based quantum computing framework, which can be also run on their quantum computer.

TODO: The aim of this paper is to investigate if and how agent-based simulation can be mapped to quantum computing and what the benefits and drawbacks are.

TODO: The contributions of this paper are:

- It describes for the first time how agents in agent-based simulation can be mapped to quantum computing, what the benefits are
- As computing language it uses Q#

TODO: structure of the paper (describe what each section does)

2 RELATED WORK

Want more efficient simulators? Store time in a quantum superposition https://www.sciencedaily.com/releases/2018/03/180302101755.htm

QMAEA: A quantum multi-agent evolutionary algorithm for multi-objective combinatorial optimization: http://journals.sagepub.com/doi/abs/10.1177/0037549713485894

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A quantum approach to multi-agent systems (MAS), organizations, and control: https://pdfs.semanticscholar.org/ecab/cb0b6a36b2fbaf9f01eb535f562d9b38c520.pdf

Using Quantum Agent-Based Simulation to Model Social Networks: An innovative interdisciplinary approach: https://www.igi-global.com/chapter/using-quantum-agent-based-simulation/52865

A quantum multi-agent based neural network model for failure prediction: https://link.springer.com/article/10.1007/s11518-016-5308-2

TODO: IBM cloud computing, Q#, Altenkirchs Quantum Monad

3 BACKGROUND

TODO: provide background in quantum computing

4 A QUANTUM COMPUTING APPROACH TO ABS

5 CONCLUSIONS

6 FURTHER RESEARCH

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