Abstract

This thesis examines behaviour of adaptive agents in Hotelling's location model. We conduct an agent-based simulation in Hotelling's setting with two agents, where the agents use Nash-Q learning mechanism for adaptation. Traditional game-theoretic models often stand on strong assumptions imposed on players such as rationality and perfect information. We explore what alternations or refinements of results this technique brings in comparison to the original analytical solution of the theoretical Hotelling's location model.

We discover that under Nash-Q learning and quadratic consumer cost function, agents with high enough valuation of future profits learn behaviour similar to aggressive market strategy, where both agents make similar products and lead a price war in order to eliminate their opponent from the market. This behaviour closely resembles the Minimum differentiation principle from the original Hotelling's paper with linear consumer costs. This result is surprising because in our simulation, quadratic consumer cost functions are used, which should result in maximum differentiation of the products. Our results suggest that the Principle of minimum differentiation could be justified based on repeated interaction of the agents and long-run optimization.

Additionally, suitability of Reinforcement learning methods for use in agent-based simulations with economic context is evaluated and advantages and disadvantages of Nash-Q learning are discussed.

Keywords

Hotelling's location model, Agent-based simulation, Reinforcement learning, Nash-Q learning