Evaluation of a Bayesian Network with Multi-State Nodes for Shill Verification in Online Auctions

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Abstract

Agent based systems have made remarkable progress over the past few decades. One of the challenging problems in developing intelligent agents is to define effective mechanisms for an agent to handle information that is incomplete in nature. A classic example is an online auction system that uses agents to monitor auction activities, and detect and verify shill bidders with available but incomplete information. In order to efficiently detect shill bidders, a monitoring agent uses real-time auction data to search for a shill suspect based on patterns of shilling behaviors. When a shill suspect is detected, a security agent can use available user information and historical auction data to verify whether the shill suspect is an actual shill.

This project focuses on developing an effective verification engine for shill bidders in agent based online auction systems. We propose to use a multi-state Bayesian network as the core of the verification engine that verifies the decision made by a monitoring agent. The Bayesian network allows us to encode dependencies among various factors involved in identifying a shill bidder with some certainty. We collected auction data and information about users from e-Bay as the sample space for development of the Bayesian network with multi-state nodes. Then based on the Bayesian network, we developed a toolkit with a GUI and an API that support automatic calculation of certain probabilities for a particular shill suspect, such as the probability of being an actual shill and the probability of being a normal user. We performed experiments and show that a multi-state Bayesian network is effective for shill verification in online auctions, and can support agent decision making with more certainty than a bi-state Bayesian network.