UNIVERSITY OF TECHNOLOGY SYDNEY

An Argumentation System that Builds Trusted Trading Partnerships

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Doctor of Philosophy in Computing Sciences

by

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CERTIFICATE OF AUTHORSHIP/ORIGINALITY

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

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Abstract

In e-Commerce, a buying process typically begins with browsing the available products or services, and then selecting the ones that satisfy a given need. The next phase is negotiation to reach an agreement. If an agreement is signed between two parties, they enter into the enactment phase including payment and delivery. After that, they evaluate how well the products or services satisfy their needs. One of the reasons for dissatisfaction is that a trading agent does not know its opponent agent's needs, contract acceptance criteria, or behaviour during their interactions. This dissertation is concerned with the problems and challenges of repeatedly conducted trading activities in e-Commerce applications.

Argumentation is a mode of interaction between agents that enables them to exchange information within messages in the form of arguments to explain their current position and future plans with the intention of increasing the chance of success in the negotiation. How an agent conducts all phases of a buying process through argumentation is an important research query. It becomes difficult to solve this query if an agent has to repeatedly conduct trading activities with its opponent agents. This work describes a novel solution to how an agent builds trusted trading partnerships with its opponent agents.

The requirements of all phases of a buying process are specified by five models: the needs model, the opponent agent selection model, the communication model, the agreement model, and the relationship model. The relationship aware argumentation framework is then proposed. It integrates how the trading agents analyze their interaction history, exchanged information, and any promises made. An agent architecture

is then developed that extends the idea of information based agency. It measures the strength of business relationships and predicts behavioural parameters from the history of interactions.

This dissertation establishes the thesis statement, "*Modelling the strength of relationships between agents and predicting the behaviour of trading partner agents in a multi agent argumentation system enables agents to build trusted trading partnerships*". A prototype simulation environment has been developed to conduct the experiments and to validate the thesis statement. The simulated arrival rate obtained by the proposed model is lower than that of an existing model, e.g., the Trust and Honour model. The prototype argumentation system demonstrated a proof of concept. The prototype will be further developed before applying the proposed argumentation system in commercial applications.