University of Technology Sydney

Motivated Agents for Informed Bilateral Negotiation

A dissertation submitted for the degree of
Doctor of Philosophy in Computing Sciences

by

Paul Bogg

Sydney, Australia
2008

Abstract

The automation of contract negotiation has the potential to change the way B2C and B2B trade takes place. For all its promise however, contract negotiation between businesses (for instance, e-Procurement) is still not conducted automatically. The automation of contract negotiation for e-commerce trade is complicated by three factors. Firstly, the majority of contract negotiation is multi-issue. Secondly, dynamic and uncertain contextual information is typically crucial for decision making in the negotiation. Finally, business relationships that evolve from negotiation need to be accounted for.

One observation made is that research in automating negotiation has not adequately addressed the role that uncertainty plays in decision making. Further more, understanding the importance of information for reducing this uncertainty is fundamental to designing software that is capable of modeling and valuing relationships that evolve from negotiation.

In light of this, this dissertation proposes an architecture design for an agent that makes negotiation decisions based on the value of information that it gives away and receives, where this value is derived from the amount of uncertainty the information reduces. It is argued that an agent that values information in this way delivers superior performance in B2B-style negotiations than an agent that is not able to do so.

The performance of an agent constructed with this architecture is evaluated with a series of bilateral negotiation simulations. An assessment is made on the behaviour of this agent, and a comparison is made between a strategy where decisions are made

based on information exchange, and a strategy where decisions are made based on a valuation on outcomes.

This architecture design is extended to a particular instance of B2B negotiation — integrative negotiation. In integrative negotiation, goals form part of the negotiation decision making apparatus. For the architecture design extension, this dissertation outlines integrative negotiation norms described by sociological research in real world negotiation. An agent constructed with this architecture is evaluated to assess its behaviour in real world B2B-style negotiations.

The dissertation concludes that, by modeling the uncertainty reduced by the communication of information, an agent is able to value the communicative interactions between itself and another agent. Business relationships are founded upon communication, and when an agent is capable of valuing its communicative interaction, then it is capable of modeling aspects of business relationships that evolve from negotiation.

Acknowledgments

First and foremost, I would like to express my gratitude to Professor John Debenham for his continual advice and patience during my PhD candidature. It is an honour to have been given the opportunity to study under his tutelage. There have been so many lessons learnt over the past years, I am forever indebted. I would also like to thank Professor Simeon Simoff for assisting me in those early research days. His advice and ideas inspired me on many occasions. My thanks to the two of you for supporting me throughout the good, and the bad.

I am also grateful to the support that the University of Technology, Sydney has provided over the past years, not least of which in terms of scholarships. The PhD certainly would not have been possible without their assistance.

I would like to thank the Emarkets team for their support, in particular, Ante, Anton, and Les for their conversations in and around the office. I would also like to extend my thanks to the citizens of RedSquare, for also providing handy tips on all sorts of matters. I would like to give thanks to Dr. Yun Zhang for many words of wisdom and support.

I would like to express my thanks to Professor Graham Low and Dr. Ghassan Beydoun for their support over the last year or so. Working with them has provided a welcome distraction from the rigors of thesis writing.

I would also like to thank Professor Carles Sierra, Debbie Zhang, Ting Yu, Marc Esteva, Helmut Berger, Assoc. Professor Barry Jay, Professor Chengqi Zhang, and Peter Dalmaris, for the support that they have provided. Many thanks also to the

technical support and administrative staff at UTS.

I would like to express my appreciation of the coffee machine in 5.270. Also, to Minghui, for minding the office. Anton and I have been very grateful!

Lastly, I would like to thank my family for their endless support.

This "wu gui" has finally gotten there.

Table of Contents

List of Tables

List of Figures