

Chapter 30

On the Use of Fuzzy Logic in Electronic Marketplaces

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ABSTRACT

Today, there is a large number of product providers in the Web. Electronic Marketplaces (EMs) enable entities to negotiate and trade products. Usually, intelligent agents assume the responsibility of representing buyers or sellers in EMs. However, uncertainty about the characteristics and intentions of the negotiating entities is present in these scenarios. Fuzzy Logic (FL) theory presents a lot of advantages when used in environments where entities have limited or no knowledge about their peers. Hence, entities can rely on a FL knowledge base that determines the appropriate action on every possible state. FL can be used in offers, trust, or time constraints definition or when an agent should decide during the negotiation process. The autonomic nature of agents in combination with FL leads to more efficient systems. In this chapter, the authors provide a critical review on the adoption of FL in marketplace systems and present their proposal for the buyer side. Moreover, the authors describe techniques for building FL systems focusing on clustering techniques. The aim is to show the importance of FL adoption in such settings.

INTRODUCTION

Nowadays, it is known that users acting in the Web are in front of a huge amount of resources. Users are able to search, find and utilize a large amount of pieces of information and other products. However, searching for products among of millions of pages is a very tedious, non-scalable task for

human capabilities. An automated approach for product-finding in the Web is a sound strategy. Intelligent autonomous software components, such as agents, appear to be the appropriate solution to this problem. An Intelligent Agent (IA) is a software or hardware component capable of acting in order to accomplish the tasks delegated by its user (Nwana, 1996). Intelligent agents integrate Artificial Intelligence (AI), which means that they are capable of learning the preferences and the

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characteristics of their owners, thus, increasing their efficiency. Agents can learn the behavior of their owners as well as their environment in order to choose their course of action. They can undertake the responsibility of finding products in the Web with the minimum intervention from their users.

These software components can act in Electronic Markets (EMs) where entities, not known in advance, can negotiate on the trade of products. Web marketing models typically involve payment for the acquisition of products. Providers require specific returns in exchange for goods. Usually, there are groups of market members such as: the consumers or buyers or customers, the providers or sellers and members that are in the middle between buyers and sellers helping them in their tasks. Buyers aim to buy products while sellers offer a number of specific products. Middle entities deal with administration or mediation tasks. The combination of the discussed technologies yields a lot of advantages to the product acquisition and delivery processes.

However, limited information is present concerning the characteristics of entities participating in EMs. A buyer or a seller agent cannot be sure for the intentions as well as the characteristics of their trading peers. In such settings, we need a technique that efficiently treats the incomplete information. Fuzzy Logic (FL) theory can provide significant advantages for the definition of the knowledge base (KB) of these autonomous components when acting in EMs. FL is a precise system of reasoning, deduction and computation in which the objects of discourse and analysis are associated with information which is, or is allowed to be, imprecise, uncertain, incomplete, unreliable, partially true or partially possible (Zadeh, 1965). FL deals with incomplete information and helps at representing the knowledge of the agents involved in an EM in order to automatically take decisions during a certain interaction. Such knowledge base is an efficient mechanism that determines the buyer

or seller decision at every step of the negotiation process or the definition of critical parameters.

In this chapter, we provide a critical review on the use of the FL in every part of the interaction process between buyers and sellers or other intermediate entities. Mainly, the FL is used in:

- the proposal definition at the buyer or at the seller side. In such cases, there are a number of offers that are issued during the negotiation process. Usually, a Bargaining Game (BG) (Fudenberg & Tirole, 1991) is used to model such interaction. The BG involves a set of alternating offers and the two entities have to agree upon the price of a product.
- The trust level calculation or other security issues. FL can prove very advantageous in cases where autonomous entities need an efficient trust mechanism. Specific fuzzy models have been created for the calculation of the trust level of each entity with increased efficiency.
- the interaction deadline calculation. To the best of our knowledge, in the majority of the models found in the literature, there is no model or mechanism for the negotiation deadline calculation. A reasoning mechanism that is based on the FL adapted to the entities or products characteristics can be very advantageous. This way, each entity can dynamically calculate the deadline for which it will participate in the negotiation process.
- the decision process of each entity. This is the most important aspect of FL use in this setting. Entities can have a FL KB that will determine the action taken on every state of the world. This knowledge base is used at every step of the interaction process and it will be fed by crisp values representing each state of world, resulting the appropriate action. For example, in a BG, at every round, there is uncertainty about

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