Chapter 21
Knowledge Acquisition in a Cooperative and Competitive Framework

Alberto de la Encina
Universidad Complutense de Madrid, Spain

Mercedes Hidalgo-Herrero
Universidad Complutense de Madrid, Spain

Natalia López
Universidad Complutense de Madrid, Spain

ABSTRACT

In this chapter, we modelize an interchange commerce system based on the economic concept of utility function. A cognitive agent controls the interchanges of the clients in her market. When interchanges are not possible any more, the agent becomes a client of a higher market, giving place to a hierarchical market system. Now, she behaves according to what she has learned from her clients. Apart from physical resources, intangible goods such as knowledge are also interchanged. This cooperative and competitive structure is formalized via process algebra.

KNOWLEDGE ACQUISITION IN A COOPERATIVE AND COMPETITIVE FRAMEWORK

There are several literature references which deal with interchange of tangible goods (see e.g. López, Núñez, Rodríguez, & Rubio, 2002). However, when the nature of interchangeable goods is more complex, such as knowledge, some considerations must be taken into account. In case of information “interchange”, it is compulsory to consider that to supply it does not imply that the initial owner loses it. This is radically different from the treatment of physical resources, since when, for instance, a person exchanges a horse for a car, she has not got the horse any more. This difference, which seems simple at first sight, entails great and radical changes when dealing with interchange systems where the changeable goods may include knowledge.

When tackling interchange systems, a crucial point is the process that leads users to make their
decisions, that is, it is important to know why they exchange a good for another one. As defined in (Wang, & Ruhe, 2007), “decision making is a process that chooses a preferred option or a course of actions from among a set of alternatives on the basis of given criteria or strategies”. Obviously, decision making is also a complex issue itself, requiring different types of techniques for the different aspects it requires. In this paper we will concentrate on developing a formal framework to describe the exchange of goods (either material or intangibles) among entities, assuming that each entity can describe its own preferences.

In particular, our approach will be based on using an agent-based system. The reason is that these systems have already proved their usefulness to deal with cognitive environments (see e.g. (Yang, Lin, & Lin, 2006; Vinh, 2009; Uchiya, Maemura, Hara, Sugawara, & Kinoshita, 2009)).

In our work, the concept of utility function is very useful. A utility function returns a real number for each possible basket of goods: The bigger this number is, the happier the owner is with this basket. Intuitively, agents should act by considering the corresponding utility function (see e.g. (Rasmusson & Janson, 1999; Eymann, 2001; Dastani, Jacobs, Jonker, & Treur, 2001; Lang, Torre, & Weydert, 2002; McGeachie & Doyle, 2002; Keppens & Shen, 2002; López, Núñez, Rodríguez, & Rubio, 2002)). Besides, a formal definition of the preferences provides the entity with some negotiation capacity when interacting with other entities (Kraus, 1997; Sandholm, 1998; Lomuscio, Wooldridge, & Jennings, 2001). Let us remark that, in most cases, utility functions take a very simple form. For instance, they may indicate that an entity E is willing to exchange the item a by the items b and c. Our framework consists of a set of agents performing exchanges of goods. Let us remark that it is not necessary to reduce all the transactions to money. In fact, most cognitive transactions are not based on money. Thus, an exchange is made if the involved parties are happy with their new goods, where the goods can be either tangibles or intangibles.

Note that, as transactions do not require money, the framework allows a richer structure of exchanges. First, money could be considered as another good, so we do not lose anything. Second, suppose a very simple circular situation where for each 1 ≤ i ≤ r, agent A_i owns the good a_i and desires the good a_{(i mod r)+1} (see Figure 1). This multi-agent transaction can be easily performed.

Figure 1. Exchange of items in the presence of circular dependencies