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Demand Forecasting of Supply Chain Based on Support Vector Regression Method

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Abstract

Introducing the basic theory and computing process of time series forecasting based on Support Vector Regression (SVR) in details, optimizing the parameters of SVR by Genetic Algorithm (GA). Applying SVR to forecast the demand of supply chain in real data, and compared to the RBF neural network method. The result shows that SVR is superior to RBF in prediction performance. And SVR is the suitable and effective method for demand forecasting of supply chain.

Keywords: Support vector regression;Supply Chain; Demand Forecasting

1. Introduction

In today's global economy, organizations have to face a very competitive environment and employ a number of strategies to gain competitive advantage. One such strategy is mass customization (MC), which combines mass production and individualized production. The phenomenon of mass customization is observable in a variety of physical and digital goods and services sold over the Web. The ubiquitous Web will serve as a disinter mediator by replacing the links in a traditional supply chain with a direct channel to the consumer in the future. Consequently, producers will get better signals regarding consumer preferences and demand levels, which in turn leads to better inventory management and production planning (Park and Park 2003; Vakharia 2002).

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Mass customization combines the advantages of the following two concepts: efficiency in manufacturing and customer satisfaction because of the precise matching between the goods' characteristics and consumers' requirements (Pine 1993; Piller 2003). Mass customization exists at several levels in practice. It could be as simple as allowing customers to add specific services to a product, i.e., service individualization at the reseller, or as complex as individualized product design and manufacturing, which involves building customer specific products using a small number of standardized parts as well as parts that are individualized to meet specific customer requirements. The former is generally referred to as "Soft Customization" whereas the latter is referred as "Hard Customization" (Coates 1995; Blecker and Graf 2003). Soft customization and personalization can be adequately handled using traditional information systems because of simplicity and straightforward information exchange. In this paper, we focus on hard customization with product individualization within the manufacturing process.

For a successful implementation of mass customization, a number of problems have to be solved. In addition to the need for effective logistics and information management, a big challenge is to manage the coordination between the various actors (nodes) within the supply chain (Reichwald et al. 2000; Dietrich et al. 2003).

Uncertain demand for materials, unique order identification, product specification by configuration, and limited interplant data-transfer are some of the specific issues in mass customization. Coordination of adjacent economic activities and competition pose considerable challenges. Especially if a supply chain is not fully vertically integrated, many complications arise from the need to coordinate nodes that are competing with each other (Schlueter-Langdon and Sikora 2003). Thus, systematic collection of relevant information from the actors within the value chain, propagating it in a timely manner, and using it to orchestrate a production plan, are challenging tasks. This is necessary because enterprises should be able to forward order information to the customers at anytime. In addition, the extended delivery time (cp. production on demand) is inconvenient and hard to schedule. Enterprises must react to this volatile schedule and reduce the time between placing of order and delivery. Existing supply chains cannot support the level of coordination needed between the various actors within the chain in order to cope with the unpredictable "on demand" production schedule. However, intelligent agents have the potential to provide solutions to some of these coordination problems (Baker et al. 1999; Nissen 2001;Swaminathan et al. 1998; Yung et al. 2000; Sikora and Shaw 1998).

Our proposed architecture consists of customer-centric and resource-centric agents. These agents not only collaborate with each other in carrying out the mass customization tasks, but also provide a seamless interface to existing legacy systems. Our agent coordination approach is flexible and supported by partial global plans (Durfee and Lesser 1987). (Durfee and Lesser 1987)。The partial global planning technique for coordinating distributed problem solving supports each node (agent) with a reasoning capability for developing its partial global view by exchanging node models among the involved nodes. The overall goal is to form a consistent partial global plan so that a node can determine when to work and whom to work with; i.e., the partial global plan guides the nodes to achieve the underlying global objective.

The remainder of the paper is organized as follows. Section 2 discusses related work in the field of agent-based and non-agent-based supply chain management. Within that section, the benefits of an agent-based approach for MC are also analyzed. In Section 3 typical actors in mass customization scenarios are illustrated for the shoe industry. Section 4 presents the architecture for a multi-agent system for mass customization and a three-tier model for addressing the coordination problem. This section also contains the formal coordination protocol. Section 5 provides an application of the protocol to the shoe industry and a glimpse of the proof-of-concept prototype that is under development. This prototype implements partially the MAS architecture and our coordination protocol for mass customization. Finally, Section 6 provides the summary and future work.