Modeling Socio-Technical Processes in e-Commerce Scenarios

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Abstract: We consider socio-technical processes, i.e. processes where machines as well as humans participate. Typical examples occur in sales processes in e-commerce. Three modeling tasks are selected: Modeling user preferences and utilities, modeling evaluations and modeling influence factors. A central concept representing knowledge is the notion of similarity. The major technique discussed is machine learning. Two application scenarios and simulation results are presented: Learning utility functions and performing dialogs with customers.

1 Motivation

Socio-technical processes are processes where humans and machines interact in various ways. We restrict ourselves to situations where the machines are represented by software agents. A typical example is buying a (complex) product from an e-commerce shop which provides an intelligent software agent to support the sales process.

To design, plan and execute such processes a careful division of labor is necessary. There are different kinds of modeling tasks involved here. The two major types are:

1. Modeling the domain of interest (e.g. the products sold in the shop).
2. Modeling, testing and improving the support.

We are mainly interested in the second point. We start with a quotation which is of particular interest for socio-technical processes [Sh02]:

- The old computing was about what computers could do, the new computing is about what users can do.

- Users of old computing proudly talked about their gigabytes and megahertz, but users of new computing brag about how much e-mail they sent, how many bids they made in online auctions, and how many discussion groups they posted to.

This indicates a shift in the focus of interest from purely technological aspects to human users oriented views and has a major influence on different modeling aspects. Among the many questions that arise here we isolated three major ones which seem to be most important:

1. *Modeling utility*: How can one precisely define the context what is of interest for the user?
2. *Modeling evaluation*: Given a computational device, how can one perform measurements in order to predict whether the focus of interest of the device is met?
3. *Modeling influence and sensitivity*: If the focus is not met sufficiently well, what are the reasons and how to make improvements?

These three tasks are not independent but rather of increasing difficulty. A major source of the modeling problems arise from the fact that automated technical agents and human agents cooperate, usually in a complex way. They have different strengths and weaknesses: Machines are good for formally understood processes that are time and space consuming, humans can use their creativity and their experience. In addition, they understand informal concepts better. The latter point causes a principal problem for the communication between the agents. Human and software agents prefer different kinds of expressions and even different representation languages. Humans have problems to understand machines and to formulate their results in such a way that machines can understand them. Machines do not easily understand, e.g. expressions in everyday language. As a consequence, the access to human concepts can in many cases not be obtained by defining relevant concepts, principles or methods. For that reason we will demonstrate the use of (machine) learning methods. One of the major advantages of pure computer technology was that it allowed exact measurements and evaluations that could be described objectively and could be repeated at any time. For that reason often complex real experiments are employed. They cause, however, several problems and for that reason we study simulations. These are in turn related to machine learning methods. The main objective of this paper is to illustrate that modeling in complex situations is a difficult task, in particular if human beings are involved. The modeling procedure requires an iterative feedback of the users and the learning procedures have to reflect this.

After introducing general utility concepts and principal methods for modeling utility in Section 2, in Section 3 we discuss problems that arise when measuring utility. In Section 4 we then show how learning may simplify the modelling of utility aspects. Finally, the principal ideas will be illustrated by experiences obtained in practical projects.