Negotiation During Intelligent Sales Support with Case-Based Reasoning

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Abstract

This paper motivates the necessity for support for negotiation during Sales Support on the Internet within Case-Based Reasoning solutions. Different negotiation approaches are discussed and a general model of the sales process is presented. Further, the traditional CBR-cycle is modified in such a way that iterative retrieval during a CBR consulting session is covered by the new model. Several general characteristics of negotiation are described and a case study is shown where preliminary approaches are used to negotiate with a customer about his demands and available products in a 'CBR-based' Electronic Commerce solution.

1 Introduction

"Leo Baekeland sold the rights to his invention, Velox photographic printer paper, to Eastman Kodak in 1899. It was the first commercially successful photographic paper and he sold it to Eastman Kodak for $ 1 million. Baekland had planned to ask $ 50.000 and to go down to $ 25.000 if necessary, but fortunately for him, Eastman spoke first." [Asimov, 1982]

Searching for and selecting complex products on the World-Wide-Web is a difficulty task for consumers as well as for business professionals. The main reason for this well-known deficit in electronic commerce is that, unlike in normal business situations, there is no intelligent support or assistance for the user on the Web. This is particularly evident in the selection of products/services or when navigating through the complex space of available product information in an electronic mall. Therefore, there is a need for intelligent advise during the selling of products via the Internet. Like in the real world, an electronic *sales agent* is needed which is able to *negotiate* with the customer about his *demands* and assist him during the search for an appropriate product.

In this paper we give an overview on current negotiation techniques and present different characteristics for architectures of sales agents which are able to negotiate with a customer. We illustrate these characteristics in a realised example system and we close with some discussion and an outlook for further research.

2 Negotiation in Electronic Commerce

Negotiation is an important part of the selling process via the Internet, and in order to support customers in a sufficient way, electronic commerce systems need the ability to negotiate. However, negotiation is a process with relatively little support to date. We define *negotiation* in electronic commerce as *a process were two parties bargain resources for an intended gain, using tools, and techniques of electronic commerce solutions.* The process of negotiation is more complex, the more complex the product or service is to negotiate about. The underlying kinds of problem solving strategies divide different approaches into two classes: a *co-operative approach* and a *competitive approach.* However both approaches present two extremes on a continuum of possible underlying problems. In existing research, negotiation during the search in an electronic catalogue is seen as a competitive approach [Beam and Segev, 1996]. They assume a conflict in the price of a good were all other attributes of the desired product are fixed. Competitive negotiation takes place if there is at least some conflict of interest between the buyer and the seller. Consequently, there will be not more collaboration than necessary between the buyer and the seller to solve the negotiation problem. Co-operative negotiation means that there is as much collaboration as possible between the two negotiation parties.

A second criterion to distinguish between different negotiation approaches is the underlying paradigm: the *human factor approach*, the *economics/game theory approach* and the *computer science* approach. The human factor approach provides not much which is directly applicable to electronic negotiations. However, it defines the general objective of a satisfying solution and should therefore taken into account. The focus is here to manage human factors, like pride, ego, or culture as good as possible which lead to customer satisfaction if such criteria are fulfilled within a negotiation outcome. The fields economics and game theory give some valuable insights into the problem. The approaches in the area of computer science are most applicable to product search and negotiations in electronic commerce. Mainly research in the field of intelligent agents provides different approaches to the topic of electronic negotiations. A survey of these approaches can be found in [Beam and Segev, 1997][1].

We distinguish different approaches also by their underlying technology in the electronic shopping solution. *Catalogue-based* approaches are a replication of their printed counterparts. They support the navigation in the electronic catalogue with an index or an ontology. The index is a hierarchy of describing features of the products in the catalogue and supports the user during the search. There are several examples on the Internet like the Quelle warehouse[2]. The second kind are *requirement based* navigation approaches were a user enters his demands for a product and a database is searched for appropriate products. Such approaches for example selling used cars can be found at Audi[3] or BMW[4].

3 CBR for Electronic Commerce

3.1 The Sales Process

Recently, case-based reasoning (CBR) was used to introduce intelligent support into electronic shopping solutions[5] during the retrieval of appropriate products for the customer [Wilke, 1997]. These applications support the retrieval of products by a similarity based match. However, the whole CBR process can improve more than one step in the selling process via the Internet. We identify the following major steps during the selling process in our scenario (see Figure 1): After the preliminary pre-sales process, the user has to turn his requirements into a description of the desired product during the a "translate user requirements into query phase". Next, the sales assistant retrieves appropriate product offers. During the adaptation of the retrieved products (synonymous to product configuration) the retrieved products are adapted to best fit the user's requirements, if necessary. The results are presented and alternatives are explained to the user. Succeeding refinement of requirements may lead into cycling of the sales process, i.e., the process will take place again. If the user has achieved a satisfactory result, the overall business process can continue to the processing of the order.

[1]http://haas.berkly.edu/~citm/nego-proj.html
[2]http://www.quelle.de
[3]http://www.audi.de
[4]http://www.bmw.de
[5]http://wwwagr.informatik.uni-kl.de/~lsa/CBR/ECommerce/

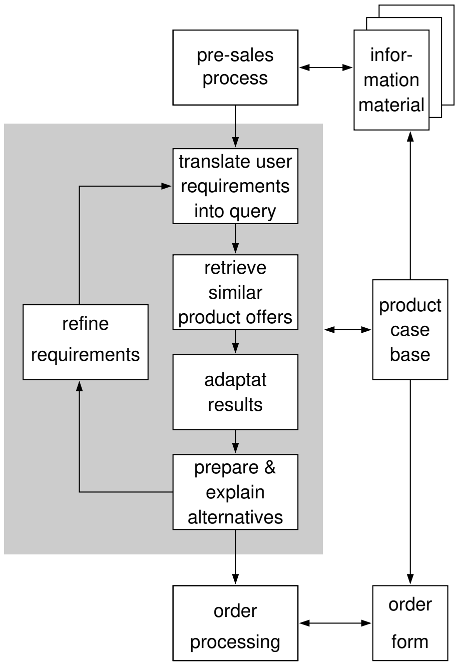

Figure 1: The electronic sales process: Capabilities of existing intelligent CBR sales support applications.

3.2 The CBR Cycle for Electronic Commerce

If we have now the sales process in mind and we take a look at the well established CBR-Cycle [Aamodt and Plaza, 1994], we observe that this cycle is not directly applicable in our situation. Therefore we suggests a modified cycle shown in Figure 2 regarding the different situation in electronic sales support applications. First, the sales process starts with a set of initial demands stated by the user and a *retrieval* for similar products in the product base of all available products is performed. Next, the retrieved products may be *reused* in a product configuration phase. In this phase the products are tailored to the specifc demands of the user. These modified products are offered to the customer. The customer evaluates these offers during the *revise* phase, which results in a set of evaluated products. The customer can state that he accepts certain products or parts of the products or he may state that something is not appropriate. Next, a new step called *refine* is introduced. This step does not occur in the traditional CBR cycle. Here, the current user demands are refined based on the evaluations given by the customer. This is required if the current demands cannot be fulfilled on the bases of the available products. After this refine phase the e-commerce cycle is re-entered. Here, a retain phase does not happen after each iteration of the cycle. Nevertheless, a successful selling of

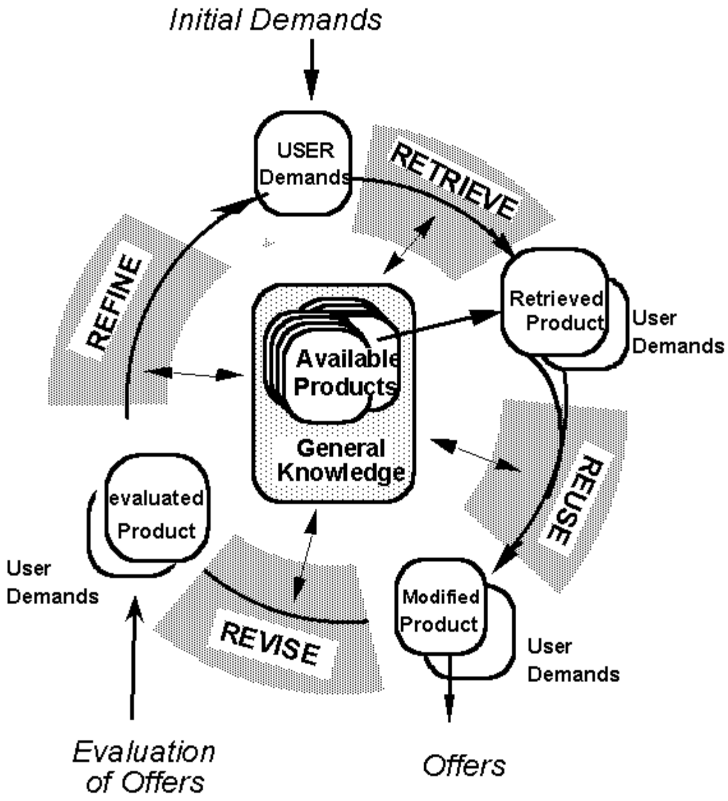

Figure 2: The CBR-cycle for electronic sales support applications

a product lead to a retain phase, where probably a new mapping of customer requirements and a product is formed. This mapping can be added to the original case base or may have further effects. This allows the product to be more rapidly located for similar requirements in the future. The user demands accompany the products from the product base during all phases. This cycle must possibly be re-entered several times until a sufficient negotiation result (meeting of demands and offered product) is achieved. In general this cycle is applicable in all situations where an iterative retrieval in a decision support situation takes place. Unlike in traditionally CBR, not only the case (product) is adapted, but also the query (demands).

4 The Sales Agent

In this section we have a closer look on the task of the sales agent supporting the negotiations in an electronic commerce solution. Further, we have some insights what happens during the CBR process if the sales agent fulfils his task.

4.1 The Task of the Sales Agent

In electronic commerce solutions based on CBR a case consists of a *problem description* which describes the demands of a customer in a specific situation together with a *product description* which satisfies these demands as a solution to the customer's problem. Modifying both descriptions is part of the negotiation between the customer and the electronic sales agent in the electronic shop as shown in Figure 2. One step forward is the use of adaptation techniques during the product configuration phase [Schumacher et al., 1998] were the product is modified to satisfy the customer's needs. Product specific suggestions to the customer to modify his problem description in a predefined way can lead to satisfying product search.

During the sales process, the customer is navigating through the available products and searches for a product which meets his demands. Some demands are *known* in advance and additional ones may be *discovered* during the navigation in the product space. Some demands are *fixed* and must be fulfilled by the product and other demands are more or less *weak* and the sales agent can negotiate about them. The goal of the sales agent is to identify these demands in co-operation with the customer and to find a product which fulfils them. During negotiation in the selling situation the agent might add some new demands or modify some weak demands for the purpose to find an appropriate product. For configurable products, it is also possible for the sales agent to modify existing products during adaptation to meet the customer's demands.

So the task for the sales agent during the negotiation process is: *the iterative adaptation of user demands by adding or changing them and the iterative adaptation of products by product configuration with the goal to find an agreeing point in the multidimensional demand/product space, in which product and demands agree.*

4.2 Negotiation and the CBR Process

In general, the customer's satisfaction is maximal if the modification of his weak and hard demands is minimal and he finds his product as quickly as possible. There are several characteristics which describe a negotiation processes to meet the customer's demands.

Active or Passive Sales Agent. The Sales Agent is *active* if he explicitly suggests modifications of particular demands to the customer. This can be the suggestion of changing one (or more) already specified demand(s) in a way or to specify new demands. The sales agent suggests the refinements of the customer demands and after one or more iterations, the customer finally finds a satisfying product. *Passive* sales agents support the modification only by offering several techniques which may help the user to find out what demands he might have or which he is able to change. The decision what to do is left to the customer. The customer demands are refined by the customer himself during several iterations and he finds a product with or without adaptation after several iterations.

Modifications of Demands or Demands and the Product. During negotiation the customer or the sales agent are allowed to modify the *customer* demands only. Comparing the situation with other CBR tasks, this is the normal situation were only the query might be modified. If products in the product base are configurable it might also be possible to modify the *products themselves and the demands* during negotiation. Here we mean not to configure products by adaptation. As in reality it could be possible to define the product during negotiation with a special "add-on". For example, a car dealer could offer a sliding roof for free during the negotiation or the price is simply modified. The kind of allowed modifications must be described as a part of the general knowledge in the product base. One negotiation approach from the intelligent agents area is KASBAH[6] [Chavez and Maes, 1996], where such modifications are described for every attribute in a function that determines the kind of allowed modification for every negotiation step (here, every iteration of the sales process).

Modification in Single or Multiple Dimensions. During one iteration in our electronic commerce cycle, it may be only possible to modify a *single* demand or a single attribute of the product. This means that in the multidimensional demand/product space during one iteration a movement in one dimension is allowed. This leads to a slower movement in the space but single actions are easy to survey. In opposite, the customer or the sales agent are allowed to modify *multiple dimensions* during one iteration. This lead to a easier movement for the customer in the demand/product space.

Over- or Underspecification of the Customer Demands. Depending on the current situation, the customer may have *overspecified* his demands.

[6] http://www.jeevies.media.mit.edu

Figure 3: The electronic sales agent during the refinement of the requirements.

This leads to the situation where it is not possible to find an appropriate product in the product base. Therefore, the sales agent or the customer has to relax the demands to find an appropriate product. In the opposite situation *underspecific* demands lead to too much possible products for the customer. As a result he may get lost in the amount of offered products. Therefore, the current demands have to be further specified to come to an appropriate product.

5 An Example System: Used Cars

We will now illustrate the use of a sales agent in an example system which sells used cars in an electronic commerce solution. Figure 3 shows the system in an example session[7]. In our example, we are searching for a *BMW, Coupe* and the price should be about 35.000 German Marks. After the retrieval, the sales agent suggests a *BMW-318i* with *115 hp*, *1796 ccm cubic capacity* as the most similar car. The customer has now two different possibilities of negotiating.

[7]http://minsk.informatik.uni-kl.de:8009/launch/PKWSalesAgent

Modification of Demands by Derived Attributes At the bottom of the window, the sales agent offers several abstract aspects which modify the demands of the user. These are: *cheaper, more sportive, larger, more compact, newer, more comfortable.* Here, the sales agent modifies the query for the customer in such a direction that these aspects are fulfilled. This is realised by a modification of several demands in a way which move the query in the specified direction. Starting from our query's last result, we are searching for a more sportive car. Therefore, the value of the demand *horsepower* is raised and additionally the requirements for *cubic capacity* and a power assisted steering are added. As a result, a more sportive car, a *BMW-320* is offered which is more similar to the modified demands from the sales agent.

This approach is a passive approach because the customer has to choose the aspect on his own. Only multiple demands are modified. This technique is normally used in a situation of overspecification where the customer is not satisfied with the current retrieval result.

Case Focusing with Entropy A second active approach for negotiation is realised in the car application. The customer gets suggestions for demands from the sales agent which he should specify. This approach is normally used in a situations where the actual demands are underspecified and the user gets too much product suggestions. Here, the goal is to focus faster on the relevant products. An entropy-based selection strategy is used to suggest a demand which is most informative and which should therefore be specified by the customer. The selection strategy also incorporates the similarity measure. A determination of single or multiple attributes is possible during one iteration of the sales cycle.

6 Discussion and Outlook

CBR technology introduces intelligent sales support to electronic commerce applications. The deficits of standard database techniques are overcome by implementing expert knowledge into the retrieval system. CBR gets rid of the problem of near misses, the need of expert knowledge on the customer's side and resulting frustration. New solutions can be created by adapting old solutions. Finally, the vendor benefits from the ability to offer nearly perfect solutions and from satisfied customers that do not search for other vendors. Future improvements to intelligent sales support systems are current research topics. The new technology can be expected to offer sophisticated adaptation and interactive configuration of complex products, interactive refinement of the customers requirements and explanation of results.

Negotiation supports or even enables the customer to find an appropriate product depending on his demands. However, these are first ideas and only some of them are realised in a prototype for a sales agent. In upcoming research and development projects, these techniques will be enhanced, refined and further developed.

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