Intelligent User Preference Detection for Product Brokering

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INTRODUCTION

A good business-to-consumer environment can be developed through the creation of intelligent software agents (Maes, 1994; Nwana & Ndumu, 1996, 1997; Bailey & Bakos, 1997; Soltysiak & Crabtree, 1998) to fulfill the needs of consumers patronizing online e-commerce stores. This includes intelligent filtering services (Chanan, 2000) and product brokering services to understand users' needs before alerting users of suitable products according to their needs and preferences.

We present a generic approach to capture individual user responding towards product attributes including non-quantifiable ones. The proposed solution does not generalize or stereotype user preference, but captures the user's unique taste and recommends a list of products to the user. Under the proposed generic approach, the system is able to handle the inclusion of any unaccounted attribute that is not predefined in the system, without re-programming the system. The system is able to cater for any unaccounted attribute through a general description field found in most product databases. This is extremely useful as hundreds of new attributes of products emerge each day, making any complex analysis impossible. In addition, the system is self-adjusting in nature and can adapt to changes in a user's preference.

BACKGROUND

Although there is a tremendous increase in e-commerce activities, technology in enhancing consumers' shopping experience remains primitive. Unlike real-life department stores, there are no sales assistants to aid consumers in selecting the most appropriate product for users. Consumers are further confused by the large options and varieties of goods available. Thus there is a need to provide, in addition to the provided filtering and search services (Bierwirth, 2000), an effective piece of software in the form of a product brokering agent to understand their needs and assist them in selecting suitable products.

Definitions

A user's choice in selecting a preferred product is often influenced by the product attributes that range from price to brand name. This research shall classify attributes as accounted, unaccounted, and detected. The same attributes may also be classified as quantifiable or non-quantifiable attributes.

Accounted attributes are predefined attributes that the system is specially catered to handle. A system may be designed to capture the user's choice in terms of price and brand name, making them accounted attributes. *Unaccounted attributes* have the opposite definition, and such attributes are not predefined in the ontology of the system. The system does not understand whether an unaccounted attribute represents a model or a brand name. Such attributes merely appear in the product description field of the database. The system will attempt to detect the unaccounted attributes that affect the user's preference and consider them as *detected attributes*. Thus detected attributes are unaccounted attributes that are detected to be vital in affecting the user's preference.

Quantifiable attributes contain specific numeric values (e.g., hard disk size), and thus their values are well defined. Non-quantifiable attributes on the other hand do not have any logical numeric values, and their valuation may differ from user to user (e.g., brand name).

The proposed system shall define price and quality of a product in the ontology and consider it to be quantifiable, accounted attributes. All other attributes defined in the system and considered as unaccounted attributes will be detected by the system.

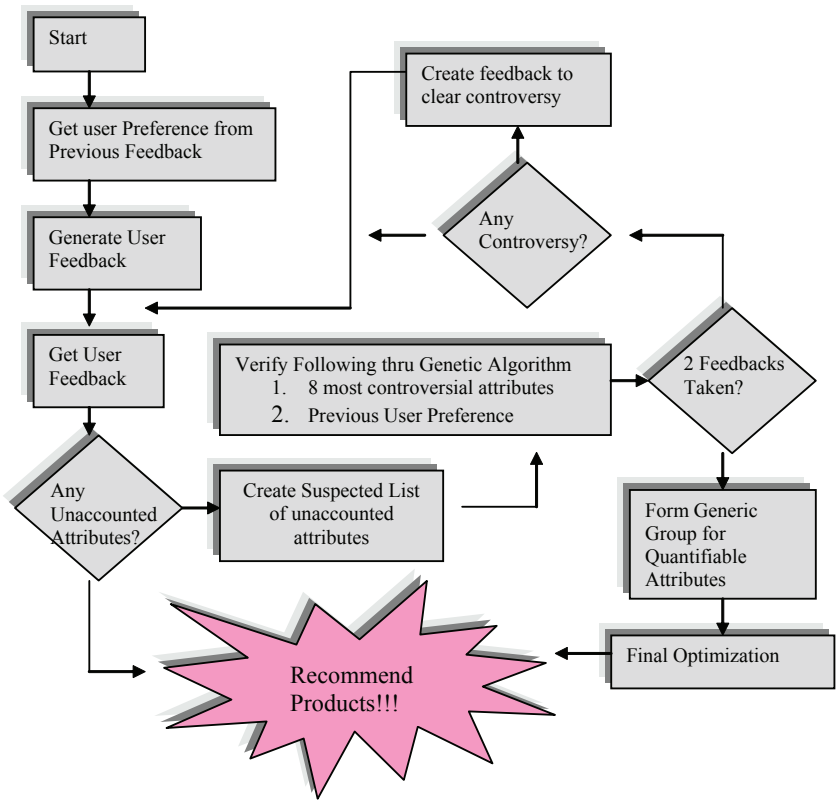
Related Work

A lot of research and work has been done to aid transactions in electronic commerce. One of the research aims found is to understand a user's needs before recommending products through the use of product brokering services. Due to the difference in complexity, different approaches are proposed to handle quantifiable and non-quantifiable attributes.

One of the main approaches to handle quantifiable attributes is to compile these attributes and assign weights representing their relative importance to the user (Guan, Ngoo, & Zhu, 2002; Zhu & Guan, 2001; Sheth & Maes, 1993). The weights are adjusted to reflect the user's preference.

Much research is aimed at creating an interface to understand user preference in terms of non-quantifiable attributes. This represents a more complex problem as attributes are highly subjective with no discrete quantity to measure their

Figure 1. System flow diagram



values. Different users will give different values to a particular attribute. MARI (multi-attribute resource intermediary) proposed a "word-of-mouth approach" to solve this problem. The project split up users into general groups and estimated their preference to a specific set of attributes through the group the user belongs to.

Another approach in the handling of non-quantifiable attributes involves specifically requesting the user for the preferred attributes. Shearin and Liberman (2001) provided a learning tool for the user to explore his or her preference before requesting him or her to suggest desirable attributes.

Some of the main problems in related work lie in the handling of non-quantifiable attributes, as the approaches are too general. Most work so far only attempts to understand user preference through generalization and stereotyping instead of understanding specific user needs. Another main problem is that most works are only able to handle a specific set of attributes. The attributes that they are able to handle are hard-coded into the design of the system, and the consequence is that they are not able to handle attributes that are unaccounted and beyond the pre-defined list. However, the list of product attributes is often large, possibly infinite. The approach used in related research may not be able to cover all the attributes, as they need to classify them into the ontology.

DESCRIPTION OF INTELLIGENT USER PREFERENCE DETECTION

The proposed approach attempts to capture user preference on the basis of two quantifiable accounted attributes, price and quality. It incrementally learns and detects any unaccounted attribute that affects the user's preference. If any unaccounted attribute is suspected, the system attempts to come up with a list of highly suspicious attributes and verify their importance through a genetic algorithm (Haupt & Haupt, 1998). Thus vital attributes that are unaccounted for previously will be considered. The unaccounted attributes are derived from the general description field of a product. The approach is therefore generic in nature, as the system is not restricted by the attributes it is designed to cater to.

Overall Procedure

The overall procedure is as shown in Figure 1. As the system is able to incrementally detect the attributes that affect user preference, it first retrieves any information captured regarding the user from some previous feedback and generates feedback in the form of a list of products for the user to rank, and attempts to investigate the presence of any unaccounted attribute affecting the user's preference. The system shall