Natural Language Sales Assistant

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Abstract

Successful information access on e-commerce websites should accommodate both customer needs and business requirements. Menu-driven navigation and key word search provided by most commercial sites have rigid control. The former is likely to make users overwhelmed and frustrated by lengthy interaction; the latter does not allow users to describe their intentions precisely. We offer a natural language navigation tool that provides convenient, personalized access to e-commerce sites by leveraging technologies in natural language processing and human computer interaction and thus creating a faster and more intuitive way of interacting with websites. The demonstration is a dialog system that supports web interaction with modalities such as text, forms, and standard user interface components. The system directs customers to the relevant product pages through natural language dialog. User studies show significantly reduced length of interactions in terms of time and number of clicks in finding products. The core dialog engine is easily adaptable to other domains.

Introduction

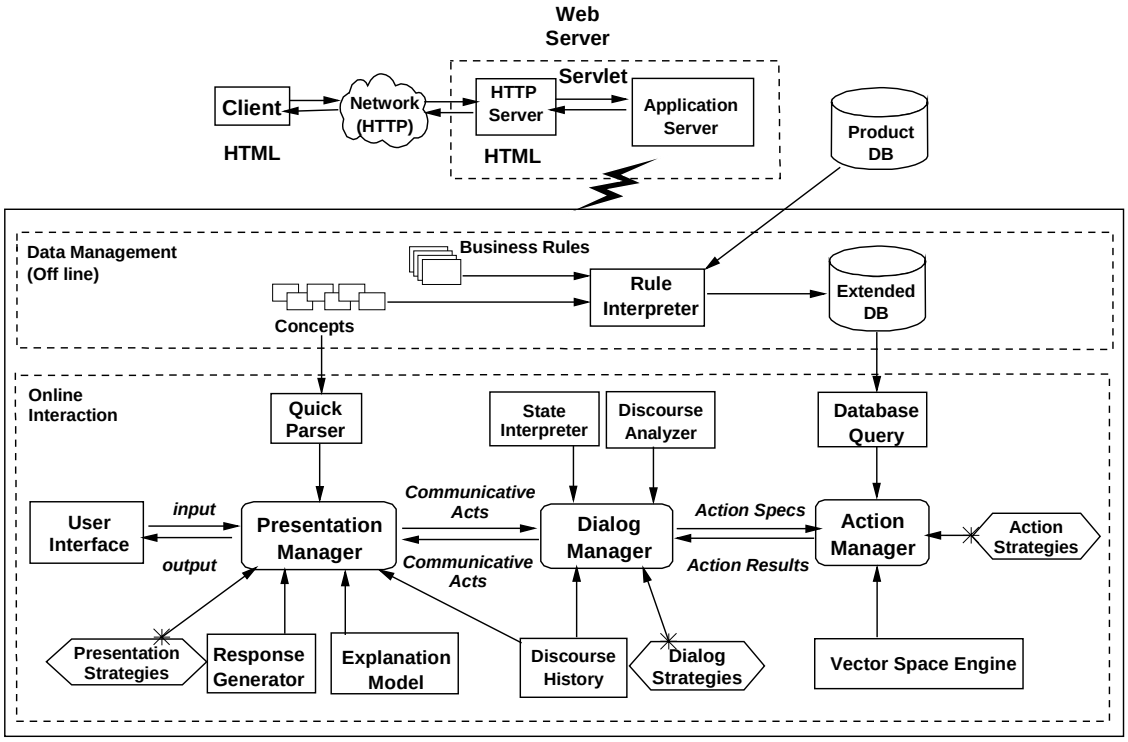
Natural language dialog has been used in many areas, such as for call-center/routing application (Carpenter & Chu-Carroll 1998), email routing (Walker, Fromer & Narayanan 1998), information retrieval and database access (Androutsopoulos & Ritchie 1995), and for telephony banking (Zadrozny et al. 1998). We, on the other hand, integrate dialog with an e-commerce environment. When searching e-commerce sites, users often do not know where to find information, or how to specify a request although they have targets in mind. Sometimes they only have a vague idea what it is they want (Saito & Ohmura 1998). Thus, users need to re-formulate and revise their requests based on additional information, which can be provided naturally in a dialog setting. Our user studies show natural language dialog to be a very effective means for negotiating user's requests and intentions in the context of recommendation systems that provide help and guidance to the user.

1 System architecture

The architecture of the system supports multimodal dialog. Our architecture is designed to support input and output from various channels and modalities including keyboard input, text output, speech input and output over a telephone/microphone, mouse input, pointing device input, dataglove, etc. The system is implemented for textual input, with the option of browsing non-textual information. The system consists of an Online Interaction Subsystem and a Data Management Subsystem addressing tools and processes for maintaining domain knowledge and business specifications (see the figure on the next page).

The **Online Interaction Subsystem** consists of three major modules: (1) Presentation Manager, (2) Dialog Manager, and (3) Action Manager. The Presentation Manager separates content from the presentation in both analysis and generation modes. It employs a (shallow) parser to transform the user's NL query into a logical form. The presentation manager sends the logical form in the form of a communicative act to the dialog manager. It is also responsible for obtaining the system's response from the dialog manager and presenting it to the user (using template-based generation). The Dialog Manager formulates action plans in the form of Action Specs (currently SQL queries) for the Action Manager to perform back-end business oriented tasks such as database access, business transactions, etc. The Dialog Manager applies information state-based dialog strategies to formulate responses depending on the current state, discourse history and Action Results from the Action Manager.

The **Data Management Subsystem** maintains a concept repository with common sense concepts and a phrasal lexicon that lists possible ways for referring to the concepts. Business Rules map concepts to business specifications by defining concepts using a propositional logic formula of constraints over product specifications. Thus, the Business Rules reflect business goals and decisions. The



Extended Database combines product specifications (from the Product DB) and precompiled evaluations of the concept definitions for each product to provide a representation that guides the natural language dialog. We are investigating automated tools for helping developers and maintainers extract relevant concepts and terms on the basis of user descriptions and queries about products.

2 Evaluation

Several user studies were conducted to evaluate objectively the usability of the NLSA and understand better the needs of users and the system's limitations (Chai et al. 2000). The results of a comparative study comparing NLSA with a fully developed menu-driven system show that users (seventeen test subjects) prefer the natural language dialog enabled navigation two to one over the menu-driven navigation. The study confirmed the efficiency of using natural language dialog in terms of the number of clicks and the amount of time required to obtain the relevant information: the average number of clicks used in the natural language dialog system was reduced by 63.2% and the average time was reduced by 33.3%. We found sophisticated dialog manage-ment to be more important than the ability to handle complex natural language sentences. Analysis of the user queries (average length = 5.31 words long; standard deviation = 2.62; 85% of inputs are noun phrases) reveals the brevity and relative linguistic simplicity of their input; hence, simple parsing techniques seem adequate to extract the necessary meaning from user input. We have also learned that in order to improve the functionality of an e-business site, the natural language dialog navigation and the menu-driven navigation should be combined to meet users' needs. While the menu-driven approach can provide choices for the user to browse around or learn some additional information, the natural language dialog provides the efficiency, flexibility and natural touch to the users' online experience.

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