

ADAPTIVE QUESTION ANSWERING WITH A DIALOGUE INTERFACE

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Key Results: This is a proposal for a question-answering system with a dialogue interface and a user modelling component. The distinguishing feature of the system is that it provides an adaptive output based on a model of the questioner and the type of answer to be returned.

How does the work advance the state-of-the-art?: We expose an approach to the interaction between question-answering systems and dialogue systems, which has been scarcely investigated so far. Moreover, we propose a question-answering system which provides an adaptive output, via the integration of a user modelling component.

Motivation (problems addressed): Two problems are addressed: firstly, the output of current question-answering systems is usually independent of the questioner's characteristics, goals and needs. Secondly, some questions can have multiple answers and/or answers more complex than a single sentence. Such answers should be delivered more effectively than by returning ranked lists of documents (as usually done by question-answering systems).

Introduction

One problem in state-of-the-art question-answering is that it does not generally involve nor evaluate user models. For instance, up to now the TREC question-answering tracks, regarded as the major evaluation campaigns for question-answering system evaluation, have never taken into account the user modelling abilities of systems [1]. Indeed, the output of question-answering systems is usually independent of the questioner's characteristics, goals and needs. We believe that the integration of a user modelling component in a question-answering system would considerably enhance its performances. Moreover, there exist questions having multiple answers (e.g. different points of view) or complex answers (e.g. a theorem proof, a list of side-effects, an articulated explanation). Such answers should be delivered in an effective way, enabling the user to understand and clearly distinguish among the different viewpoints, parts of an explanation, and so on. Therefore, an intelligent presentation strategy which tunes the final answer not only on the characteristics of the questioner but also according to the type of information it contains would be extremely useful.

This document proposes a question-answering system with a dialogue interface. The key feature of such system is that it provides an adaptive output as a function of a model of the questioner and the type of answer to be provided. Thus, it adjusts both contents and presentation of the answer(s). The question-answering module would be based on a search engine and would in turn be the basis for the dialogue system (see Figure 1). The focus of this paper is not on the search engine, as we assume that any engine could be used. We will rather concentrate our attention on the use of retrieved documents and on their presentation. Both the question-answering system and the dialogue system would have access to a user modelling component. The user modelling module would provide

information to the dialogue manager about how to interact and how to present results to the user, and to the question-answering system in order to adapt the query criteria. It would be created using information provided by the user and updated by the dialogue history.

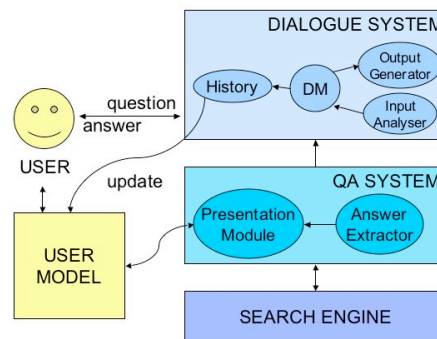


Figure 1 - System Architecture

The Question Answering System

The question-answering system is characterized by the following capabilities: it is able to distinguish among questions with simple answers and questions with more complex answers and/or multiple answers; moreover, for complex answers, it is able to consider that more than one answer can be relevant, correct and acceptable [1] (e.g. the answer to "What are the side effects of Aspirin?"). The engine must also identify and separate the different segments of the final answer(s) and allocate the most suitable media for the final answer (according to both the user model and the characteristics of the answer). The question-answering module is therefore composed of two components, an answer extraction module and a presentation module (see Figure 1).

The Dialogue System

The dialogue system should be able to perform the interactions necessary to construct a model of the user's

interests, goals and level of understanding. The dialogue history, appropriately stored, would help the user modelling module to construct such a model. Moreover, the dialogue system should be able to help the user to refine his question in order to elaborate an appropriate answer; this can be done by starting a clarification sub-dialogue. Finally, the system must cooperate with the question-answering module in the output generation in order to present the information in a natural way.

The User Model

The user modelling module in the current project would provide information to the question-answering system in order to adapt the query criteria, and to the dialogue manager on how to interact and how to present results to the user. The user model would be created using information provided either implicitly or explicitly by the user and updated by the dialogue history, recorded by the dialogue system. It would at least describe the user's *characteristics* (i.e. age, interests, education, etc.): these can be explicitly provided by the user but also inferred from some keywords in his speech, the vocabulary he uses, etc. Furthermore, it should also model the user's *goals*, inferred both from the characteristics of the user (e.g. student in a particular subject) and from the ongoing and past dialogue with the system (e.g. clarification dialogues). The approach to user model construction and evaluation should be developed once the target use of the system has been evaluated: if the question-answering system is targeted to an educational environment, it will be essential to assess the current level of knowledge of the students, while more interest will be given to other sources such as item preferences and browsing styles for an e-commerce application.

Information Presentation

The issue of information presentation is strictly related to both the user model and the type of answer to be provided by the system. In order to approach it, we must consider several related issues: for instance the user's *experience*: e.g. the effects on trust, persuasion, satisfaction as felt by the users. Another issue is the usability of the final system (especially in case of multimodality, where information overload is a risk) and in some cases the knowledge acquired by the user during the interaction. However, the most relevant issue in our case is that of *media allocation*, that is, determining which information to allocate to which medium. In [2], the problem of media allocation is approached by examining and classifying the knowledge underlying multimedia presentations and by determining rules to the production of a multimedia presentation. We could think of a similar approach for our system, where rules would be developed to choose the most suitable media on the basis of the type of answer to be provided to the user but also on the model of the user, for instance whether he prefers visual or textual output. Another interesting idea is to use a multi-

character output strategy. In [3, 4], André et al. investigate a new style for presenting information: presentation teams, which - rather than addressing the user directly - convey information in the style of performances to be observed by the user. The authors argue that using multiple characters can help users to organize the information in their minds and make it easier to remember. Also, a team of presenters can allow to establish relationships among different pieces of information, such as antagonism, temporal sequencing, similarity of view points. In addition, presentation teams can be useful as rhetorical devices allowing the reinforcement of beliefs and in general user persuasion. Even without presentation teams, simply using different text colors or icons would help represent the concepts with more information on the relationships of the content they express. For instance, we could use a similar strategy to that used for TV programs in [5], where a recommending system is realized through a set of icons/friendly characters representing different stereotypes of TV watchers. This strategy, transposed to question-answering, would be useful at a primary stage of the system; an icon associated to each answer would represent the system's evaluation of the type of user most likely to be interested/able to understand the answer.

Conclusion

A question-answering system with a dialogue interface and a user modelling component is proposed. This system would enable the adaptation of the query criteria of the question-answering engine to the characteristics of the user and the efficient presentation of the answer. A possible architecture is described and guidelines for further development are given. The final implementation and evaluation will test the efficiency and usability of the system described.

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