Cobot: Real Time Multi User Conversational Search and Recommendations

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ABSTRACT

Cobot is a new intelligent agent platform that connects users through real-time and off-line conversations about their health and medical issues. Intelligent web based information agents (conversational/community bots) participate in each conversation providing highly-relevant real-time informational recommendations and connecting people with relevant conversations and other community members. Cobot provides an innovative approach to facilitate easier information access allowing users to exchange information through a natural language conversational approach. Conversational Search(CS) is an interactive and collaborative information finding interaction. The participants in this interaction engage in social conversations aided with an intelligent information agent (Cobot) that provides contextually relevant factual, web search and social search recommendations. Cobot aims to help users make faster and more informed search and discovery. It also helps the agent learn about conversations with interactions and social feedback to make better recommendations. Cobot leverages the social discovery process by integrating web information retrieval along with the social interactions and recommendations.

Categories and Subject Descriptors

H.5.0 [**Information Systems Applications**]: General; H.3.3 [**Information Storage and Retrieval**]: Information Search and Retrieval; I.2.7 [**Artificial Intelligence**]: Natural Language Processing

General Terms

Design, Human Factors, Algorithms

Keywords

Real time Collaborative Information Access, Social Search, Contextual Collaborative Filtering, Conversational Search

1. INTRODUCTION

This paper introduces a novel Conversational Search and Recommendation system that involves finding relevant information based on social interactions and feedback along with augmented agent based recommendations. People in social groups can provide solutions (answers to questions)[3], pointers to databases or other people (meta-knowledge)[3][6], validation and legitimation of ideas[3][4], can serve as memory aids[7] and help with problem reformulation[3]. "Guided participation"[11] is a process in which people co-construct knowledge in concert with peers in their community[12]. Information seeking is mostly a solitary activity on the web today. Some recent work on collaborative search reports several interesting findings and the potential of this technology for better information access.[5][2][1][9]

We are building a system called Cobot[1] to address some of these challenges. Cobot introduces a conversational environment that provides social search through conversations integrated with intelligent semantic meta-search from the web. Users want to simplify their experience when performing an information finding task. Conversational Search is about letting users collaboratively search and find in natural language, leaving the task of user intent comprehension on the system. The participating agent interacts with users proving recommendations that the users can accept, reject, like, dislike or suggest.

2. SYSTEM DESCRIPTION

Cobot is an intelligent agent platform that connects users through real-time and offline conversations. Cobot lives in a community, has a limited understanding of domains through ontologies and brings relevant information to the users by participating in the conversations. Cobot's 'conversation engine' monitors user conversations with other users in the community and provides/receives recommendations (links and snippets) based on the conversation to the participants. Cobot's 'community engine' models conversations to capture user-user and user-information interactions.

Design Goals

1. Near real time conversational agent
2. Personalized as well as generic recommendations
3. Agent learns with interaction
4. Uses a structured internal organization of content

[1]We use the term Cobot for Cobot system as well as Cobot agent interchangeably

5. Dynamically connects conversations to the right set of people for participation

6. Helps the user talk about health issues. (Real time conversations)

7. In the real time conversational process, provides recommendations. ('who to talk to', 'what to look at')

In the following sections, we briefly describe the features of the Cobot system.

2.1 Real time Conversational Search

Cobot provides a conversational interface that combines semantic language understanding and real time collaborative environment for information retrieval with contextually relevant recommendations. Cobot helps people find information faster with the aim for finding useful responses for completing the search intent. The conversational interface allows for much more interactivity than one-shot search style interfaces, which aids usability and improves intent understanding. For example, Cobot recommends links and snippets from relevant articles on the internet. It also makes social recommendations to connect contextually relevant users to the conversation.

The approach we have taken to address CS problems is by developing dynamic data structures that model it. We call this structure the "Socio-Semantic Model" - these conversation nets maintain in memory models of the conversation, participants, participants' immediate social connections, concepts, relationships and information flow.

2.2 Socio-Semantic Model

The Socio-Semantic Conversation Model is a dynamic memory data structure based on principles of experience based agent architecture.[10] It supports interleaved retrieval of information by applying different memory retrieval algorithms. The model maintains the user's social graph, the conversation graph with the extracted semantic net for the conversation.

Some essential properties of the model are as follows:

- The model is socially aware of the participant and his social network's availability (to aid with Cohort Matching)

- The model provides bi-directional recommendation and feedback. (Both agent and the participant can add recommendations)

- The model understands limited domain terminology and is able to find semantic relationships amongst concepts extracted from conversations.

- The model is aware of user's profile (such as interests and ratings) for the agent to be able to use that information.

The Socio-Semantic Model aims to provide storage and memory based retrieval for dynamic representation, update and reuse of users' knowledge and experiences. Figure 1 depicts the user-centric domain information modeling approach to jointly model the information context from users' perspective.

2.3 Aggregated Web Search

Identifying relevant documents for a particular user's need without extensive search, in conversational manner is the key objective for precise search. The right search queries need to be figured out with situation assessment from the conversational snippets. It is not desirable to return dozens or hundreds of remotely relevant results, even if some of them will be highly relevant. The aim is to retrieve successive recommendations that try to address the search problem precisely. Cobot uses different shallow semantic parsing techniques for operationalizing a user's intent into computational form, dispatching to multiple, heterogeneous services, gathering and integrating results, and presenting them back to the user as a set of solutions to their request.

2.4 Real time matching of participants to conversations

Communities are made up of users who are grouped by different information needs into dynamic cohorts. These online communities, through effective sharing and collaboration, increase the utility of systems and help solve individual problems more effectively. Cobot allows for connecting two or more individuals to an online conversation based on the topic and context of conversation, mutual interests, and what they want to talk about at that time. The system allows any individual to find/join that conversation.

2.5 Socio-Semantic Collaborative Filtering

Filtering and recommendation are crucial in collaborative systems enabling users to navigate an ever-growing deluge of information more effectively. Cobot's recommendation engine delivers quality information delivered through filters achieved from semantic and contextual understanding of text along with captured users' interests. It uses various personalization techniques such as collaborative filtering on conversations and other entities in context. Natural language processing techniques are used to enhance the content based recommendations.[8]

3. SYSTEM ARCHITECTURE

Figure 2 depicts the high level architecture of the Cobot system. The Conversational Agent uses different modules for conversation analysis, search and recommendation and maintains a short-term conversation memory for each conversation. The socio-semantic model/net is analogous to the agent's long term memory model where it stores all processed information about users, conversations, activities and content descriptors.

4. SYSTEM PROTOTYPE

Figure 3 shows one screenshot of the initial system prototype which is work in progress. This prototype is designed for health related searches by incorporating medical ontologies. Users actively engage in conversations by multi-user chat, rating or adding recommendations. The agent monitors the environment to build user interaction models and to improve search relevance.

5. CONCLUSION

This paper proposes a collaborative system for conversational search and recommendations. We are hypothesizing

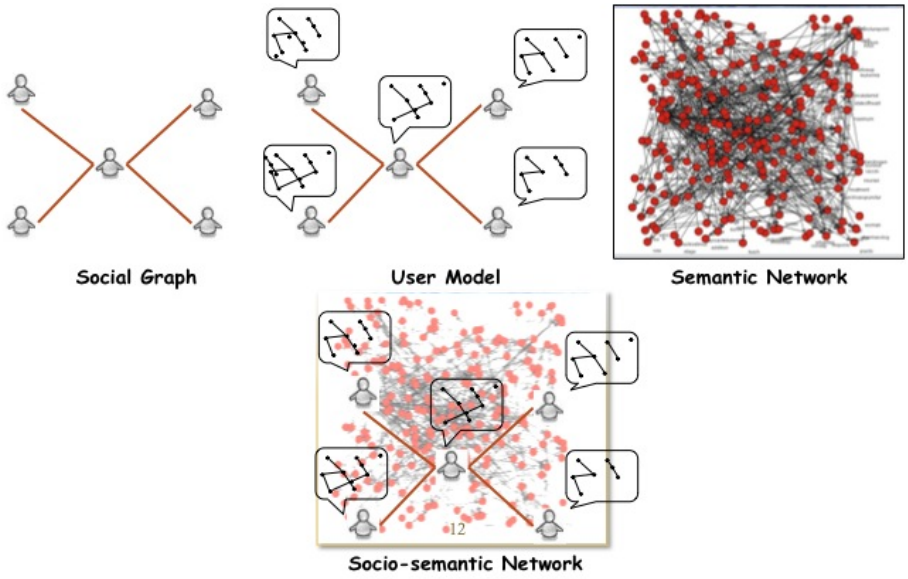

Figure 1: Socio-Semantic Net

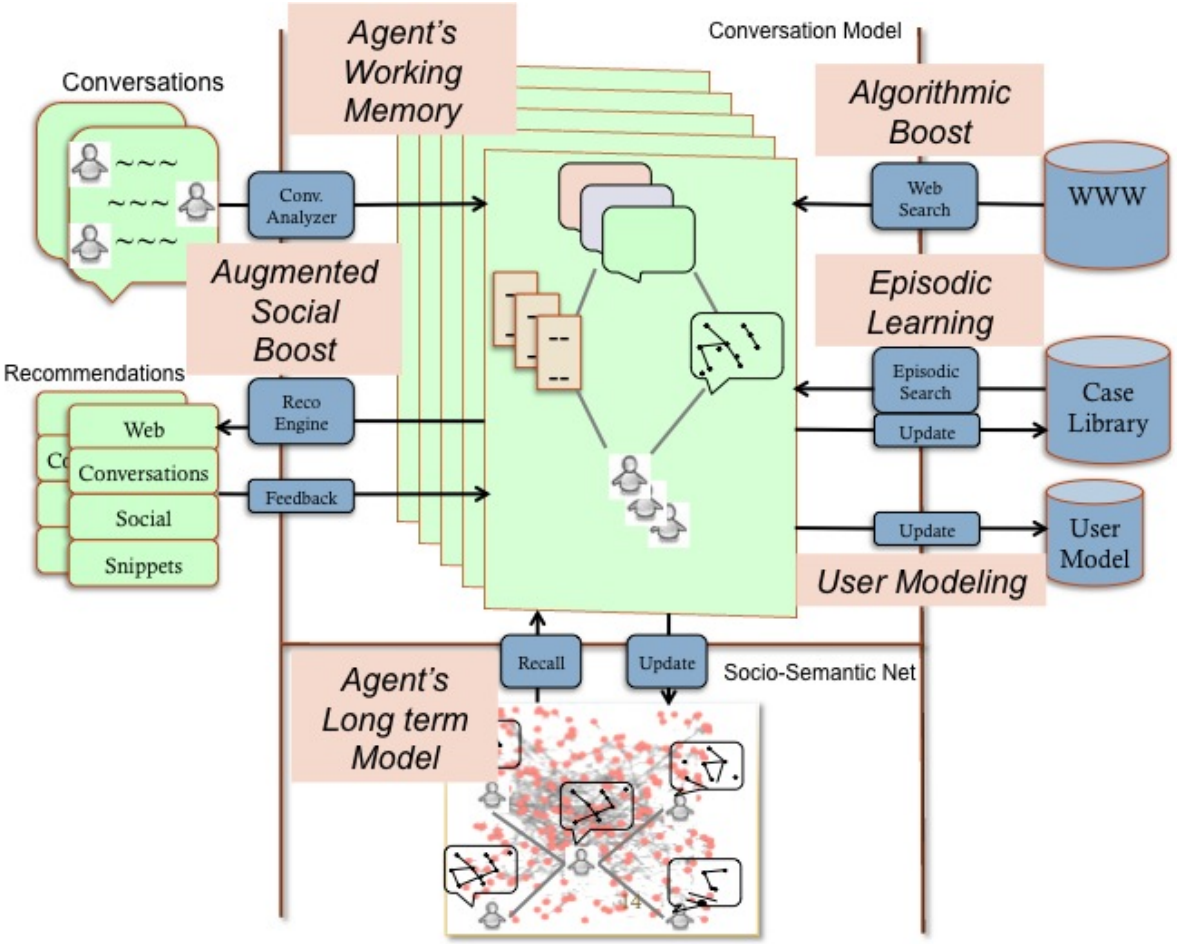

Figure 2: System Architecture

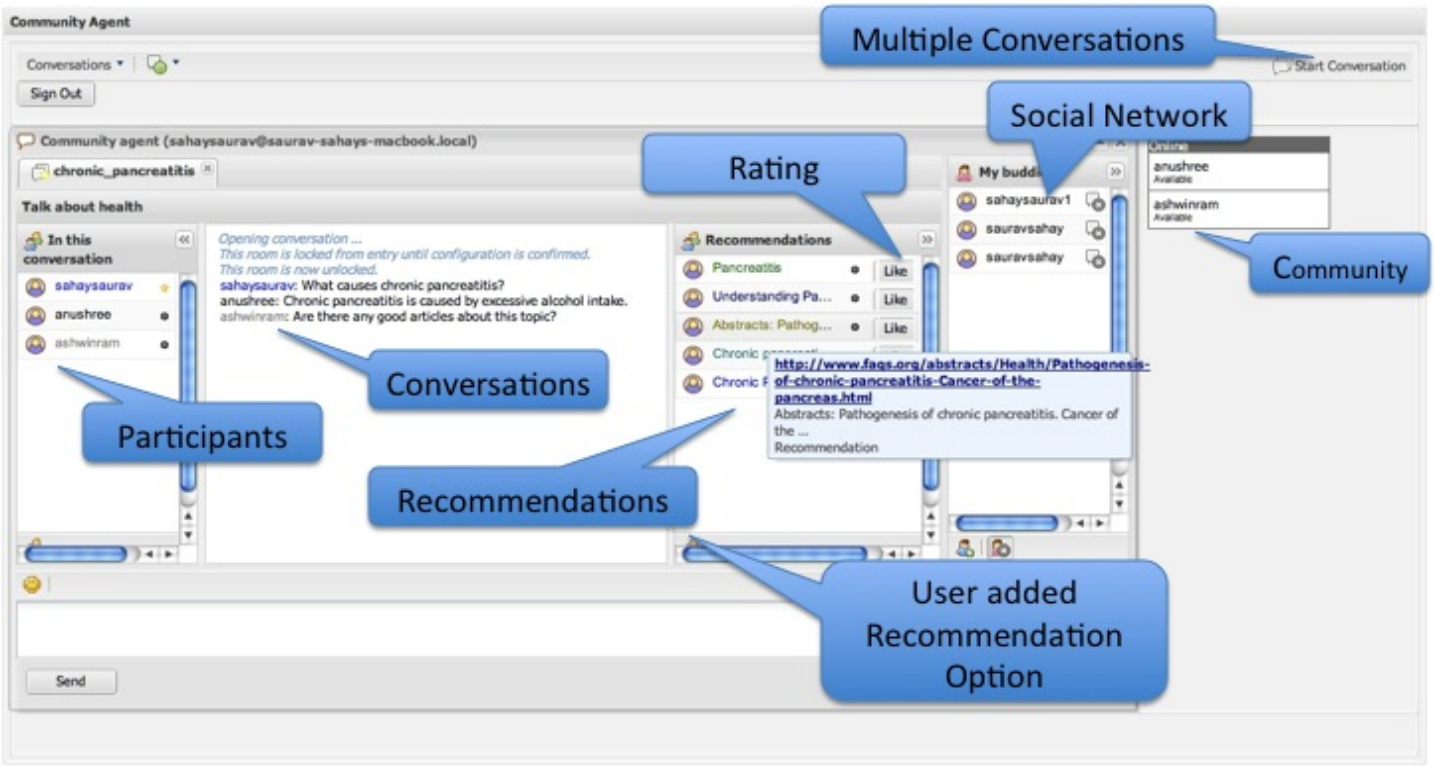

Figure 3: Prototype Interface

that such a Conversational Search system is more usable for information access as compared to a solitary web search experience. We briefly describe the design goals and features involved in construction of the Cobot system. Socio-Semantic Conversation Modeling using Experience-based Agency is a unified approach for addressing Conversational Search problem. The dynamic and self configuring memory structures and the semantic net details enable memory retrieval from the storage. Automatic Cohort Matching based on Conversations and User Profiles incorporate a methodology to dynamically pull users for conversations. Unlike users themselves having to find relevant conversations, the conversations find the users using this approach.

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