Chapter 8
Extending Conversational Agents for Task-Oriented Human–Computer Dialogue

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ABSTRACT
We present the role of conversational agents in two task-oriented human-computer dialogue applications: Interactive Question Answering and Persuasive Dialogue. We show that conversational agents can be effectively deployed for interaction that goes beyond user entertainment and can be successfully used as a means to achieve complex tasks. Conversational agents are a winning solution in Persuasive Dialogue because, combined with a planning infrastructure, they can help manage the parts of the dialogue that cannot be planned a priori and are primordial to keep the system persuasive. In Interactive Question Answering, conversational approaches lead users to the explicit formulation of queries, allow for the submission of further queries and accommodate related queries thanks to their ability to handle context.

1. INTRODUCTION
Conversational agents are automatic systems able to interact with users via natural language. As a discipline, conversational agency has been introduced in 1966 by Joseph Weizenbaum’s program ELIZA (Weizenbaum, 1966) with the purpose of “fooling” users into believing that they were conversing with a real human.

Traditionally, conversational agents are used as “chatbots” for small-talk applications, such as the Eliza emulator series or AliceBot. Indeed, chatbots encode a large amount of knowledge to maintain variety and enjoyability of the conversation; however, they rarely contain mechanisms to control the dialogue flow or perform complex reasoning. This is prohibitive for task-oriented dialogue, where more structured conversations are required and advanced reasoning abilities are needed to dynamically generate knowledge presented to the user.
In this chapter, we present the role of conversational agents in two task-oriented human-computer dialogue applications: Interactive Question Answering and Persuasive Dialogue. We argue that conversational agents can be effectively deployed for interaction that goes beyond user entertainment and can be successfully used as a means to achieve complex tasks.

Our first illustration of conversational task-oriented dialogue is Interactive Question Answering (IQA), addressing the needs of users searching for information on the Web and their requests for clarification. We illustrate how an IQA system that denotes reasoning abilities can handle the dialogue context through a conversational interface and support dynamic information retrieval for the user.

The second task-oriented application of conversational agents we propose is Persuasive Dialogue (PD), where users engage in natural language conversation and interact with a system attempting to change their beliefs. This task requires the conversational agent to keep initiative in the dialogue and thus to control its flow more tightly than in conventional chatbots. Both applications show how conversational agents can be extended to include more complex dialogue management techniques on top of existing conversational mechanisms.

This chapter is structured as follows. Initially, we provide a background for automatic task-oriented dialogue approaches and the Persuasive Dialogue and Interactive Question Answering technologies. We then illustrate the use of conversational agents first in Interactive QA and then in Persuasive Dialogue and address their evaluation in both domains. Finally, we discuss future trends and draw our conclusions on these two pioneering-stage technologies.

2. BACKGROUND

A number of extensive analyses have been carried out, e.g. (Sinclair & Coulthard, 1975), (Churcher, Atwell, & Souter, 1997) and (Lewin et al., 2000), to identify the main types of human conversation based on their features and objectives. Among these, task-oriented dialogue (one subclass of which is information-seeking dialogue) is the most widely reproduced in the context of human-computer systems. Indeed, both Interactive Question Answering and Persuasive dialogue can be considered as forms of task-oriented dialogue.

Since we argue that conversational agents can be effectively used for task-oriented dialogue, the remainder of this section outlines the main features and challenges of modelling and reproducing this type of interaction and discusses related work specifically in the fields of Persuasive Dialogue and Interactive Question Answering.

Salient Features of Human Task Oriented Dialogue

Amongst the salient features of human task-oriented dialogue, the overall structure is the most noticeable: as observed by (Sinclair & Coulthard, 1975) or (Kitano, 1991), such dialogues usually have an opening, a body and a closing. Hence, they may be represented according to a hierarchical discourse grammar where the dialogue is a set of transactions, composed by exchanges, in turn made of moves, whose elementary components are dialogue acts.

In this framework, that has dominated the computational approaches to dialogue to the present, utterances are considered as dialogue acts as they aim at achieving an effect such as, for instance, obtaining information, planning a trip or driving an unmanned vehicle. This can also be seen in a goal oriented manner where each dialogue act tries to achieve a goal linked to the dialogue’s task, thus enabling planning approaches to task oriented dialogue management (Field & Ramsay, 2006).

Another aspect characterizing task-oriented dialogue is mixed initiative, which refers to who is taking control of the interaction: when one of the interlocutors is a computer system, the