

Task-based Learning through Dialogue Management

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ABSTRACT

We propose a new kind of task-oriented dialogue model designed to represent task-based learning (TBL) in second language learning. In order to evaluate a dialogue system that interacts with virtual learners in an Intelligent Tutoring System (ITS), this paper simulates learners' behavior by translating real learners' reactions into an Artificial Intelligence Markup Language (AIML) with a virtual tutor supported by a dialogue system. The proposed model describes knowledge-based Natural Language Understanding (NLU) components in the system, provides an example of dialogue between a virtual learner and a virtual tutor, and explains the design process of experimental computer simulation.

Keywords

AIML, computer simulation, dialogue management, Intelligent Tutoring System, task-based learning

INTRODUCTION

One of the topics in the second language acquisition has been placed more living scenario on language learning acquisition which enhances the learning performance of learner. In this paper, our objective is to demonstrate the applicability of dialogue management to represent task-based learning and provides hints to enhance the learning performance of learner. For this purpose, the function of a dialogue management model can help learners to finish their task.

1. RESEARCH CONTEXT

1.1 Task-based Learning

Task-based Learning (TBL) differs from grammar practice routines through which many learners previously failed to learn to communicate [1]. In the past, a task was often a piece of translation from a literary source. TBL inspires learners to experiment with whatever English they can recall, to try things out without fear of failure and public correction, and to take active control of their own learning [1]. In TBL, the tasks are central to the learning activity. TBL is based on the belief that learners may learn more effectively when their minds are focused on the task, rather than on the language they are using. In the task-based learning model described by Jane Willis, learners start with the task. Jane Willis presents the TBL framework as a three-stage process: (1) Pre-task - introduction to the topic and task; (2) Task cycle - task planning and report; and (3) Language focus - analysis and practice. In this research, we adopt a task oriented dialogue to present the TBL pedagogy.

1.2 Intelligent Tutoring System and Dialogue Management

In several researches, they have proved that one-on-one tutoring is an ideal learning environment for language acquisition. By adopting the learner and tutor model, it is possible to systematically manipulate tutoring tactics and observe the effect on the learner's performance. In previous studies [2], they use computer simulation approach to simulate learners' reaction (called virtual learner). A new trend is for computer tutors to simulate some teaching functions of a human tutor, so computer tutors may be viable alternatives. Such learning systems are commonly known as intelligent tutoring systems, one of which, the Virtual Tutor, is the focus of this research. Many intelligent tutoring systems provide feedback when learners enter solutions to problems or during intermediate steps, but only provide context-sensitive hints when students request them. There are good reasons for considering various strategies for providing hints for learning purposes. Our system provides guidance and feedback to help students understand the teaching goal. When learners cannot capture the key point from dialogue, the Dialogue Management module employs four types of hints to enhance learners' understanding. Recently, user simulation has been used in the development of spoken dialog systems. In contrast to experiments with human subjects, which are usually expensive and time consuming, user simulation generates a large corpus of user behaviors in a low-cost and time-efficient manner. For example, user simulation has been used in the evaluation of spoken dialog systems [3] and to learn dialog strategies [4]. We adopt the framework of computer simulation [2, 5] which originally proposed as modeling approach in ITS studies. The remainder of the paper is structured as follows. In Section 2, we describe the organization of the dialogue of script and also design four types of hints. In Section 3, we introduce the basics of AIML and the Dialogue system. In Section 4, we discuss the simulator in detail, explain the experiments and report the results. Then, in Section 5, we present our conclusions.

2. USING TASK-BASED LEARNING IN LANGUAGE LEARNING WITH A VIRTUAL AGENT

2.1 Form-based Dialogue in Language Learning

We have developed a task oriented dialogue for TBL through form-based dialogue management. The script follows the XML standard specification. Form-based systems provide an alternate and flexible approach. Here, the problem is cast as one of slot-filling: a

particular system action is tied to a form that specifies all relevant items of information for an action. Dialog management consists of monitoring the form for completion, setting learning objectives as specified by the tutors, and using empty slots to ask questions of the learners. Form-filling does not specify that slots must be filled in a particular order. Although suitable for task-oriented dialogues that can be expressed by filling a single form, form-filling can also be combined with graph representations to support a set of related key concepts that fit into the form-filling format. In figure 1, we show the form-based dialogue of script to design for TBL. From the viewpoint of TBL, the teaching scenario includes various topics, which are decided by the name property of issue tag in the script. The teacher sets the learning objectives in the script. The objectives are set into slot of tag and also provide hints for the learner. The teacher decides the order of the objectives. In this work, we have adopted the form-based structure and slot-filling model proposed in [e.g., 5, 6] as the way to implement the dialogue management. In this context, script simply refers to an explicit sequence of task-related topics. Each topic is expressed as a form-filling task, the slots can be completed arbitrarily. The topic-specific form is comprised of two parts: constraint slots (corresponding to elements of the learning objectives) and a hint slot (containing the hint or feedback about the learning objective). The control strategy of the dialogue management module is also more complex since slots are preordered based on the domain of the task.

2.2 The Hint Design Strategy

Hints are important components of natural language dialogues. Existing models of hints, however, are limited in capturing their various underlying functions, since a hint is typically treated as a unit directly associated with some problem-solving script or discourse. By emphasizing the cognitive functions of hints and allowing for automatic incorporation in a natural dialogue context, we present various types of hints, each of which defines a decision point for the associated function [7]. Our hint types were derived with regard to the function that can be common for different instruction motivation in problem solving.

2.3 Types of Hint

We define four types of hint. These fine-grained distinctions support the constructive generation of hint specifications from modular knowledge sources. (1) The echo hint emphasizes the keyword of a sentence to help learners capture the key point. (2) The concept definition hint gives learners a clear explanation provided by Wikipedia or an expert. In our system gives the definition of a keyword from Wikipedia. (3) The concept expansion hint is a collection of related concepts. We adopt the Resource Description Framework (RDF) to describe the concept expansion [8]. (4) The sample sentence hint gives an example to the learner. We describe the four types of hint in more detail and give experimental result in Section 4.

3. THE EMPIRICAL STUDY DESIGN

To simulate learners' patterns of interaction with the learning environment that are close to real learners' behavior patterns, we based the Artificial Intelligence Mark-up Language (AIML) script on real learners' dialogues. The real learners' interaction patterns were derived from an experiment that interpreted the learners' dialogue. We discuss AIML and dialogue management (DM) briefly in Section 3.1 and Section 3.2.

3.1 Stimulated Learner

Artificial Intelligence Mark-up Language, an XML-like tagged language for defining both knowledge-based and inference rules, was developed by A.L.I.C.E. (Artificial Linguistic Internet Computer Entity) in 1995 [9]. The basic unit of knowledge in AIML is called a category. Each category consists of an input question or stimulus called the pattern, and an output answer or response called the template. We employ learners' conversation dialogues to make the AIML script and then generate learners' dialogues with an AIML software agent.

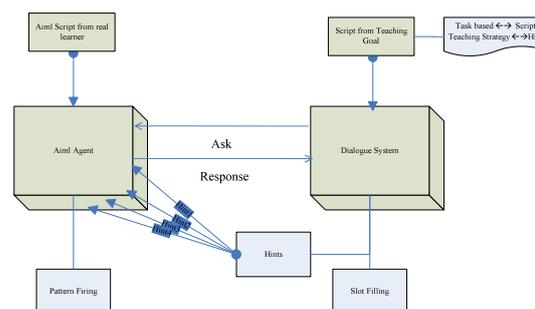


Figure 3: The Architecture of the Simulation Platform

3.2 Stimulated Learner

In this study, the virtual tutor is implemented by the dialogue system. Many dialogue systems have been proposed and many surveys of such systems have been conducted [10]. Several systems use a type of script language as a general mechanism to describe the dialogue flow [11]. The dialogue system is composed of natural language understanding (NLU) [12], natural language generation (NLG) and dialogue management modules. In the task-based learning framework, our system provides the course material for learners to read in the pre-task phrase and learners practice using the material in the task cycle. After the task cycle, learners might enhance their conversational ability on the specified topic. Here, we only discuss the task-cycle phrase, including the pedagogical characteristics. Our dialogue management is implemented with form-based approaches of spoken dialogue systems [6, 13]. The teacher sets the learning objectives in the slot of form-based script. The dialogue process is controlled by the dialogue management module. In the initial step, the virtual tutor asks a question of the virtual learner, and the virtual learner gives the answer. The virtual tutor receives the answer and proceeds with the next question of the task-based plan. If learners cannot

understand the dialogue, the tutor will give hints to the learners.

4. SIMULATION RESULTS

In order to explore some theoretical aspects of the hints, we construct a simulator that creates simulated test results of learners. The simulated learners (AIML) may use the correct dialogue in responding to questions that they are competent enough to return correct responses, but they may also make unintentional errors on question that they should be able to wait the feedback from virtual tutor (DM). For example, the virtual tutor says “What’s your nationality?” to the virtual learner. The virtual learner cannot understand the meaning of nationality in the question. Our simulation system is currently implemented in Chinese. For example, a learner goes to an immigration checkpoint and gives his/her passport to the officer. As shown in Figure 4, the virtual learner and virtual tutor have a conversation in Chinese. If the learner cannot understand the question: “What is your nationality?”, the Dialogue System will give a hint to the learner. The strategy of hint was decided randomly, so we can compare the different hint effect from various strategies of hint. We list four hint strategies in Table1.

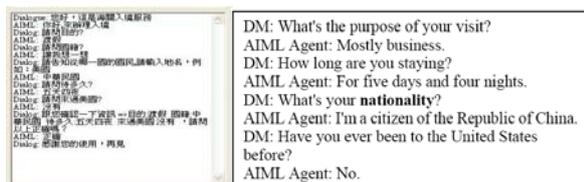


Figure4: Simulation result and translated result in English

Table1: Types of hints

Type of Hint	Content of the Hint
Echo	What's your nationality? Nationality?
Keyword Explanation	Nationality is the relationship between a person and their state of origin, culture, association, affiliation and/or loyalty. Nationality affords the state jurisdiction over the person, and affords the person the protection of the state.
keyword expansion	membership/ citizenship
Sample Sentence	I'm a citizen of the Republic of China.

5. CONCLUSION AND FUTURE WORK

In this paper, we have proposed the task-based learning through dialogue management. We have adopted a simulation platform that can decide which hint strategy is suitable for developing a task-based learning program. It provides details of the simulator that is developed and used for generating a task-oriented dialogue pattern. We have also proposed four types of hints to help learners understand key messages in conversations, and to help tutors to set learning objectives. This research not only shows that the simulator is instrumental for exploring the nature of the hint strategies, but also indicates how the simulator may be improved. In the future, we will collect more AIML scripts which have made by translating real learners’ reaction. Various virtual

learners’ dialogue patterns can examine the robustness of our task oriented dialogue system and the validity of the hint strategies. In addition, more experiments will be conducted with real students to fully identify the benefits and limitations of the system

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