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Adjusting to User's Style in Dialogue Systems

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Abstract. The current research is extending the Asynchronous Dialogue System framework (ADS framework) – a software system that we implemented previously. The ADS framework is a collection of reusable components. This framework can be used in developing text-based natural language dialogue systems. The framework is currently tailored for Estonian language, yet it can be used for English language as most of the components are language independent. The goal of our current research was to explore the adaptability issues in dialogue systems. Mainly, we were looking how to adjust the response from the system to the user's style, in order to provide better interactions with the users. To achieve this goal we needed to implement two additional components for the ADS framework. In text-based human-computer conversations on the internet, the user input is a written request to the dialogue system in a natural language and the output of the system is an answer to the user in the same language. We implemented two additional components for the ADS framework that would analyze the style of the user input and adjust the output of the system accordingly.

Keywords. dialogue systems, adaptability issues

Introduction

The Asynchronous Dialogue System framework (ADS framework) [1] was implemented in 2008 by Margus Treumuth. The ADS framework is a collection of reusable components. This framework can be used in developing text-based natural language dialogue systems. The dialogue system is a computer program that receives user input in a sentence (in this case in Estonian) and corresponds to the user in Estonian as well. As a result, a coherent conversation is formed, during which people in general receive information on a narrow domain. The framework is currently tailored for Estonian language, yet it can be used for English language as most of the components are language independent.

The current research is extending the ADS framework to explore the adaptability issues in dialogue systems. Mainly, we were looking how to adjust the response style from the system to the user's style, in order to provide better interactions with the users.

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1. Overview of the ADS Framework

The ADS framework includes these main components and methods listed below:

- Asynchronous turn-taking strategy, so that both parties (human and computer) can provide input at any given moment and can take any number of sequential turns without waiting for the other party to acknowledge each turn.
- AI-assisted live agent chat, so that the unanswered questions can be handled by an optional human operator.
- A language independent solution for the word-order problem, thus allowing skipping the syntactic analysis and optionally ignoring the word-order problem in the knowledge engineering process. This is essential for languages with relatively free word order (such as Estonian).

In addition, the following features can be found in the ADS framework:

- A web-based conversation interface with optional speech synthesis.
- Separation of declarative domain knowledge and procedural code. The domain specific knowledge and temporal constraints are separated from the central dialogue management.
- Robust language analysis, so that the misspellings in the user input are corrected by the system. This method also includes the stemming (the process of reducing a word to its root word), to ease the pattern creation in knowledge engineering.
- Easy and compact representation of knowledge, so that the domain adaptation and knowledge base engineering would contain a minimal amount of programming effort. The knowledge is represented as a set of pattern-response pairs. The system also includes pattern-function pairs to represent procedural knowledge.

The ADS framework provides a hybrid approach – "a human assisted chat system" that allows a single human agent to handle a number of simultaneous chat sessions by having an AI-engine handle the bulk of common, repeat questions [2]. The AI-engine will allow the human agent to focus his or her attention on the few chat sessions needing unique service and will effectively lower the cost of supporting chat sessions. The server-side technology of the ADS framework uses an AI-engine as well as a live agent backend interface for a site to deliver live-agent experience without the customer having to know whether the answer is from the AI-engine or from the human agent.

This approach allows us to put these dialogue systems into practical use and avoid user disappointment. Although, the dialogue systems developed in the ADS Framework, can be assisted by a human, still the goal of this research has always been maximizing the AI-participation in the conversation and minimizing the human intervention.

2. Related Work

In this section we present a brief overview of the other frameworks for building dialogue systems.

The Center of Spoken Language Understanding Toolkit (CSLU Toolkit) [3] [4] was created to provide the basic framework and tools to build, investigate and use

interactive language systems. The CSLU Toolkit incorporates speech recognition, natural language understanding, speech synthesis and facial animation technologies.

Olympus [5] is a dialogue system framework; RavenClaw is the dialogue manager that acts in this framework. Olympus/RavenClaw is a freely available framework for developing dialogue systems. It has been deployed by several dialogue systems in various domains.

Semantra is a commercial Natural Language Interface (NLI) framework [6] for building search tools that let non-technical users make ad hoc queries in plain English. As Semantra is a commercial closed-sourced framework, it is not available for general development activities such as development of dialogue systems.

3. Defining the Problem and the Adaptability Aspects

In this chapter we define the problem and the goal of the current research.

We had tested the ADS framework in various dialogue systems. One of the complaints of the users was the slow response rate. The test users were mostly computer literate and fast in typing. So, they expected the same from the system – a fast response. Yet, the real users are not so fast and expressed the opposite. The real users (as opposed to the test users) said that the response rate was a bit too fast for them. This was the first problem that we looked into. We decided that the solution to this would be adjusting the response rate based on user typing speed or based on user's request to speed up or to slow down.

In addition, some users were using initial capital letter in the beginning of the sentence and they expected the same response style from the system. The other users were used to using only lowercase (even in the beginning of the sentence) and expected the same response style from the system. Again, we decided that the solution to this would be adjusting the response style based on user's style.

So, two features of style were selected based on user feedback from a previous evaluation of two dialogue systems built on the ADS framework: user's typing speed and user's capitalization preferences (using initial upper case letters or not using them).

Our goal was to implement these new features to the framework so that a resulting dialogue system should be to adapt to the user's style in two ways:

1. adjust its response speed based on user's typing speed
2. adjust its response capitalization based on user's input capitalization.

4. Implementation and Evaluation

The ADS framework is developed as a client-server framework. The components handling the user input style analysis are located on the client-side. So, most of the work was done modifying the client-side modules of the framework. We implemented two additional components for the ADS framework that would analyze the style of the user input and adjust the output of the system accordingly.

We also made a single adjustment on the server-side where the natural language modules reside. We added a slang dictionary [7] to the morphological analysis [8], so that slang input would also be parsed correctly.

In order to test the new features, we created a sample dialogue system with the updated version of ADS framework. We manually adjusted the knowledge base for a

new domain by adding the new pattern-response pairs. The resulting dialogue system could answer the basic questions about a certain museum. This knowledge engineering process involved using the human-assistant mode of the ADS framework. This means that a human consultant could provide immediate assistance in case the computer failed to answer. This helped us to gather the questions that repeatedly occurred in every conversation and represent these as pattern-response pairs.

There were 15 people involved in testing the dialogue system and then they were asked to fill out the questionnaire. The answers showed that in general users liked the new modules and they provided valuable feedback, which can be used in further development of these modules.

It turned out that 87% of the tested users considered themselves to be rapid in typing. About 53% of the users thought that they were satisfied with the response speed of the dialogue system. This suggests that the users generally expect to get the response from the system faster than their own typing speed. So, the typing speed of the user is not a good feature to be used as a base for the system's response speed.

We switched to an alternative approach in the framework and implemented a new adjustability feature for the response speed. Now, the system speeds up or slows down based on users commands, such as "speed up", "slow down", "too fast", "too slow".

The next test involved using (or not using) a capital letter in the beginning of the sentence. In this test, 67% of the users said that they had used the initial capital letter in the beginning of the sentence. Yet, in fact they did not. So, this was a wrong response from the users as from the chat logs it came out that 60% of users consistently use a small initial letter in the beginning of the sentence.

This suggests that the users believe themselves to be using correct spelling although in reality they don't. Nevertheless 87% of the users felt that they liked when system adapted to their style regarding the use of the initial capital letter.

We also tried to investigate the attitude of the users when the system understood their slang words. Examining the logs of the conversations revealed that no slang forms were used by test users in this case. Thus, at the time, we could not check the positive effect of the slang dictionary.

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