The DIAMOND Project

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ABSTRACT

On this poster we describe the DIAMOND project. This project has recently started and brings together the work of several PhD projects (including those of the authors) related to dialogue management research at Tilburg University.
The project aims to develop a dialogue manager prototype which implements an information state approach. The project is subdivided in three subprojects: theoretical foundations, dialogue manager prototype, and annotated corpus.

1 Introduction

Many of the existing dialogue managers (DM) today are based on the exploitation of domain and task specific properties, using simple frame-based techniques or finite-state models, such as parameterized task models that support slot-filling dialogues. This typically leads to a rigid form of dialogue, that may be acceptable for very simple tasks, but does not allow natural language dialogues. In order to allow more 'natural' language dialogues, DMs should have reasoning mechanisms to allow grounding and modeling of beliefs and intentions. Among others, the DM of the TRAINS project [1] can be considered an example of such an approach. The DM strategies to be developed in this project follow the same direction, and are characterized by combining probabilistic and symbolic methods.

2 Theoretical foundations

The theoretical foundations are based on Dynamic Interpretation Theory (DIT) [2].

- DIT is a framework for interpreting dialogue utterances in terms of context changing operators.
- In DIT a dialogue is viewed semantically as a sequential structure of dialogue acts, defined as operators that update contexts in several ways. Dialogue acts are functional units used by the speaker to change the context.
- A context in DIT includes both an agent's information about the domain of discourse and the task, as well as information about the communicative process.

The goal of this part of the project is to define information states in terms of context changes and mechanisms for the update of information states.

Since dialogue acts are the key entities in updating the information state, we need to make use of a dialogue act typology of which the dialogue acts can be determined from the utterance features. For this purposes, a revised version of the dialogue act typology in [2] will be used. An example of a dialogue act specification is depicted on the right.

Dialogue Act / Dialogue Control / Feedback / Auto

POSITIVE AUTO FEEDBACK

Code DA_DC_F_AU_P

Definition

S wants to provide information to H about his processing of Hs utterances (auto feedback). More specifically, S wants H to know that the processing has been successful (positive).

Motivation

* success on perception (Ex. 1)
* success on interpretation (Ex. 2)
* success on evaluation (Ex. 3)
* success on execution (Ex. 4)

Features

* "OK", "Yes", "Right, "uhu", ... (with falling intonation)
* nodding head approvingly

Related propositional content

none

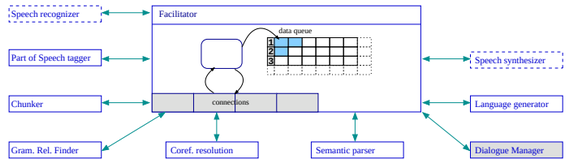
Examples:

1. : "I can hear you!"
2. : "ahh...,now I understand."
3. : "Yes, (I agree)."

4.A : "Can you give me that pencil?"
.B : "Yes."

3 Dialogue system/manager prototype

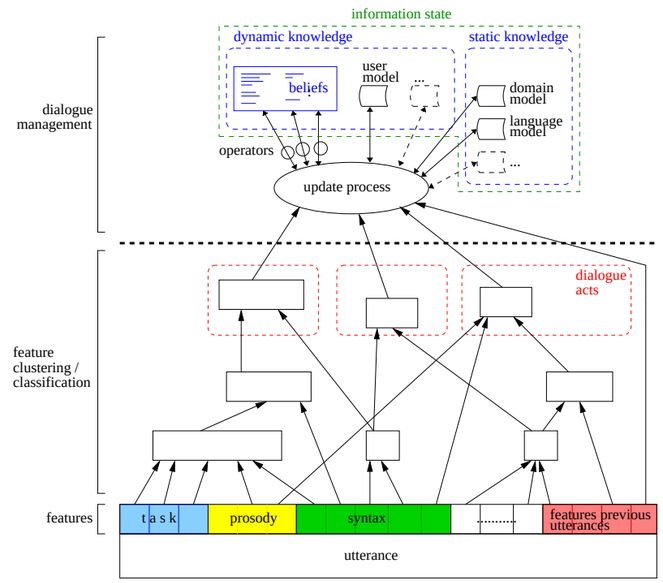
The dialogue manager will be developed in parallel with the dialogue system in which it will be embedded. The communication architecture of the system will be based on a distributed message-based publish/subscribe framework. This framework and the major components of the dialogue system are depicted below:



For the components other than the dialogue manager we will use both home-made software and software developed at other universities. For example, for PoS-tagging and grammatical relation finding we intend to use machine learning (ML) software from Tilburg University [3].

4 Conceptual overview of information flow (generation excluded)

At the lowest level of the understanding stage, different kind of features derived from the utterances will be clustered. The highest level of feature clustering we consider to be the input for the updating process of the information state, as depicted in the figure below.



For feature clustering, we will rely on both ML clustering techniques and hand-crafted rule sets. The features derived from the utterances are annotated in the corpus to provide training instances for (dialogue act) classification. This particular ML part of the project will be based on recent work at Tilburg University in dialogue act classification using ML [4].

5 Annotated corpus

The DIAMOND corpus will be used to:

- Study dialogue phenomena and strengthen the empirical basis of the underlying theory.
- To train classifiers to recognize dialogue acts from utterance features.
- To evaluate the dialogue manager prototype.

The corpus has the following characteristics:

- It consist of dialogues in Dutch resulting from Wizard-of-Oz (WoZ) experiments. In the WoZ experiments, the user interacts with a 'system' that is supposed to help the user operating a fax machine (see illustration below).

1:U: "hoe voer je een korte code in?"
"how do you enter a short code?"
2:S: "wilt u een verkorte kodelijst wijzigen?"
"do you want to change a short code list?"
3:U: "nee."
"no."
4:U: "er moet een verkorte code ingevoerd worden."
"a short code needs to be entered."
5:S: "druk op VK en houd deze toets twee seconden ingedrukt."
"press VK and hold this button for two seconds."
6:U: "okay."
"okay."

- The dialogues will be annotated with diffend kinds of information listed below. Some of the annotations can be done automatically (cheap), the other annotations need to be done by hand (expensive) or partly automated (cheap/expensive):
  - Timing (expensive)
  - Part-of-Speech (cheap)
  - Phrase chunking + grammatical relations (cheap)
  - Dialogue acts + communicative functions (expensive)
  - Task related information (cheap/expensive)

6 Future (research) activities

- Extending the corpus by running new WoZ-experiments.
- Running ML experiments on feature clustering.
- Constructing update mechanisms (with focus on beliefs) to update the information state.
- Building the dialogue manager and dialogue system.

References

[1] J. Allen *et. al.*, Dialogue Systems: From Theory to Practice in TRAINS-96, in R. Dale, H. Moisl, and H. Somers (eds.), *Handbook of Natural Language Processing*, Marcel Dekker, New York, 2000, pp 347-376.

[2] H. Bunt, Dialogue pragmatics and concept specification, In H. Bunt and W. Black (eds.), *Abduction, Belief and Context in Dialogue*, pp 81-150, John Benjamins, 2002.

[3] Induction of Linguistic Knowledge (ILK), Tilburg University, the Netherlands, `http://ilk.uvt.nl/`.

[4] P. Lendvai, A. van den Bosch, and E. Krahmer, Machine Learning for Shallow Interpretation of User Utterances in Spoken Dialogue Systems. In: *Proc. of EACL-03 Workshop on Dialogue Systems: interaction, adaptation and styles of management*, pp 69-78, Budapest, 2003.