SFB 378 - Fortsetzungsantrag (4. F rderperiode: 2005, 06, 07) zu
Teilprojekt MI 3 DALOG: Tutorielle Kommunikation f r ein mathematisches As - sistenzsystem

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MI 3 DIALOG: Tutorial dialog with a mathematical assistant system

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The goals of the DIALOG project are (i) to empirically investigate the use of flexible natural language dialog in tutoring mathematics, and (ii) to model and gradually embody the observed phenomena in a prototype tutoring system with flexible natural language dialog that supports the development of problem solving skills in mathematics. The language in our domain is characteristic by mixing of natural language and formal symbolic expressions, and varying degree of precision in expressing mathematical concepts and relations. We focus on addressing the requirements this imposes on input understanding and dialog management, and the ensuing challenges for linguistic and domain knowledge modelling and processing.

Previous and current work

So far we have concentrated on the following research problems:
- modeling of a fraction of the domain (naive set theory)
- preliminary design and implementation of a tutorial strategy
- corpus of dialog data collected in WOZ-experiments
- preliminary analysis of the corpus
- formulation of shallow and deep processing methods
- medium grained system architecture
- abstract proof representation for the proof manager

Till the end of this funding period we will contribute
- the implementation of a demonstrator
- various interfaces between the individual modules of the intended system
- elementary module functionalities
- an implementation of the dialog manager using of the proprietary CLT tool
- a second round of experiments

Plans for the proposed funding period

The research methodology of the DIALOG project has been top-down so far, i.e. deriving from the general goals of the project and the empirical Wizard-of-Oz experiments a general architecture and the functionalities of the individual modules.

We will now change our research strategy using the demonstrator for a bottom-up approach, i.e. extending its functionalities in concrete settings.

This new approach requires a broadening of the corpus, other tutorial strategies, as well as new mathematical domains. On the other hand we intend to explore ways of restricting the freedom of input to a manageable and realistic setting, while allowing for varied interaction strategies.

In particular we will concentrate on the following specific phenomena in the analysis:

- mutual dependencies between the mathematical domain and the NL analysis
- semantic analysis and classification of user utterances (proof steps suggested by the user) with the help of a domain reasoner; the relevant aspects are
  a) utterance-completeness: Is the ratio of explicit and implicit (i.e. not given) proof step information acceptable?
  b) correctness of proofs: Is the proof step suggested by the user correct?
  c) relevance of proof step: Does the proof step get us closer to the proof goal and how close is it to the proof step we would like to teach?
  d) size of proof step: Is the size of the proof step suggested by the user acceptable?

The main goal is then to implent these new findings in a final prototype.

Wrapping up the project

- This relatively new project of the SFB is currently reaching its scientific core issues: the demonstrator at the end of this period will address some key issues w.r.t. the already identified phenomena; however many scientific aspects still have to be explored.
- By the end of the next period we will have specified a number of major issues and implemented them in a prototype system.
- This proptotype will still be restricted in some respects such as: mathematical domains, linguistic coverage, tutorial sophistication and modalities. However it should be possible to use the prototype for the development of a fully fledged system without too much further basic research.

Cooperation within the SFB

- OMEGA (Siekmann/Benzm ller/Autexier): Mathematical Assistant System (Do - main Reasoner)
- NEGRA (Uszkoreit): NL Analysis
- CHORUS (Smolka/Pinkal): NL Analysis

External cooperation

- University of Edinburgh (Johanna Moore, Alan Bundy, Claus Zinn)
- DFKI LeActiveMath Project (Erica Melis)
- International University of Bremen (Michael Kohlhase)
- CLT Sprachtechnologie, Saarbr cken
- Ergosign, Saarbr cken

Requested funding*:*

- 2 BAT IIa positions (1 Coli/1 CS)
- 2 Hiwis + 2 Hiwi GA: in addition to the Hiwis for the experiments we need further two Hiwis for the implementation task

Special:

- Contract cooperation with CLT for the adaptation and extension of a dialogue system development tool
- Subjects and setup for WOz experiments