

Demo Description of the Danish Spoken Language Dialogue System

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P1 is the first prototype of a realistic spoken language dialogue system (SLDS) developed in the Danish Dialogue Project. The project began in 1991 and involves an effort of 28 man/years by the Center for PersonKommunikation, Aalborg University, the Centre for Language Technology, Copenhagen, and the Centre for Cognitive Science, Roskilde University. A more advanced version of P1 will be finished in early 1995.

P1 is a real-time, 500 word vocabulary, speaker-independent SLDS in the domain of Danish domestic airline ticket reservation over the telephone. P1 speaks and understands Danish only. The P1 speech recogniser runs partly on a Digital Signal Processor (DSP) board and partly on a PC. The rest of the system runs on a Sun/Sparc station but is currently being ported onto a PC.

The system architecture of P1 is based on the SUNSTAR DDL/ICM architecture developed in the Esprit SUNSTAR project. Communication between modules is based on messages which are passed around by a bus called the Dialogue Communication Manager that has been implemented in C. All modules communicate with the bus through drivers. The core module is the Interpretation and Control Module (ICM) implemented in C++, which interprets a dialogue description. Every time input is expected by the dialogue description the ICM looks if there is a message. Output from the dialogue description is sent as messages as well.

The P1 speech recogniser is a further developed version of the recogniser from the Esprit SUNSTAR project and is implemented in C. It is a speaker-independent continuous speech recogniser based on Hidden Markov Models (HMMs). In addition to user input, the speech recogniser receives predictions from the dialogue handling module on the sub-grammars and vocabulary to be downloaded onto the DSP-board. The sub-grammars are word pair grammars represented as finite state transition networks in which the transitions represent HMMs. Viterbi search is used to find a 1-best path through the network. This path represents a string of lexical references and constitutes the input to the parser from the speech recognition module.

The parser which is implemented in C++ makes a syntactic and semantic analysis of the string and represents the result in a set of frame-like structures called semantic objects. The semantic objects to be filled and the sub-grammars to use are indicated to the parser by the dialogue handling module. The sub-grammars are unification-based Augmented Phrase Structure Grammars (APSGs) implemented in a sub-set of the Eurotra formalism. The parser analyses the input based on the active sub-grammars using a chart data structure and an object-oriented implementation of the Earley parsing algorithm. Semantic mapping rules are used for assigning semantic interpretations which in turn are used for filling in the active semantic objects.

The dialogue handling module constituted by the ICM and the dialogue description interprets the contents of the semantic objects received from the parser and decides on the next action to take, which may be to send a query to the database, send relevant output to the user or wait for the next user input. In the latter case, the dialogue handling module also sends predictions to the speech recogniser and the parser on the next sub-grammars to use, i.e. on

which input now to expect from the user. The dialogue description is implemented in DDL (Dialogue Description Language) which is an experimental language originally intended for primitive dialogues not involving natural language. DDL has been extended in the Dialogue Project to meet the particular needs of the P1 system.

The output module is based on pre-recorded speech. A number of words and (parts of) sentences have been recorded in advance and are selected, put together and replayed according to instructions from the dialogue description.

Specification of system requirements:

Sun Sparc with:

- Solaris 2.3 (including OpenWindows 3.3)
- 32 Mb RAM
- 50Mb free disc

A system administrator may be needed.