Natural Language, Knowledge Representation and Discourse

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PROJECT GOALS

The principal objective of this project is to develop a system for representing and reasoning about the discourse context in extended man-machine dialogs. Current focus areas include the development of a general theory of multi-agent planning to account for the structure of natural-language dialog, the development of a general knowledge representation for capturing a wide range of natural language semantics, and the development of a general, error-tolerant parser and semantic interpreter for English that can be guided by discourse information. Specifically, we are developing a model of discourse plans that includes actions such as introducing a new topic, as well as the actions of clarifying, correcting or acknowledging parts of the previous dialog. We are exploring how far the planning approach can be extended, and how the "traditional" language components, i.e. parsing, semantic interpretation and discourse processing, relate to the planning component.

RECENT RESULTS

The major initiative this year is the development of a prototype NL dialog system, TRAINS, operating in a simple, but realistic task domain requiring considerable man-machine interaction. This domain is one of scheduling transportation actions in a complex (simulated) world where only partial knowledge of the world state can ever be obtained. The system's responsibility is assist the human in constructing, monitoring and debugging the transportation plans. The first demo of this system, operating in an initial small subset of the domain was produced in September 1990.

We are continuing work on extending the prototype system. We are completing a GPSG-style parser, which will show human-like preference-seeking behavior and error tolerance. *Episodic logic*, as described in last SNLP proceedings, is well developed at this point, and addressing such issues as causal connections between events, propositional attitudes of agents (goals, beliefs, etc.), and "defeasible" generalizations. The process of deriving a meaning representation from input text, which previously involved direct generation of episodic variables at the level of initial logical form, has been reformulated so that episodic variables are now introduced into the preliminary logical form in a top-down, context-dependent manner, using context structures called tense trees.

TRAINS currently has a simple domain-plan reasoning system and a dialog model. We are now making a substantial effort to better characterize the capabilities needed of the discourse components, as reported in the paper in these proceedings.

In summary, the major recent results are:

• the completion and demonstration of a prototype dialog system, including parsing, semantic and contextual interpretation, domain plan reasoning and a discourse model;

• an implemented detailed theory of tense and aspect, with emphasis on context-dependent, compositional semantics and on ease of computational realization, which addresses well-known problems in the systematic determination of "reference times" for tense-aspect constructs; and

• the specification and construction of a dialog database, including the data collection, the development of a taxonomy or discourse acts, and initial prosodic labelling.

PLANS FOR THE COMING YEAR

Our plans for the coming year include the following:

• continue to collect data and construct the dialog data-base, refining the taxonomy of discourse acts as necessary to maintain complete coverage of the corpus;

• extend the discourse model to handle additional acts from the taxonomy, concentrating on the acts relating to maintaining the shared discourse state (e.g. acknowledgements, corrections, clarifications, etc);

• develop a morphological model including a compositional semantics based on morpheme meaning in a way that addresses the alleged "bracketing paradoxes";

• implement a model of syntactic and lexical disambiguation based on information derived from the habituation of rules, explanation-based interpretation, and semantic priming;

• perform some statistical studies on the dialog-database to examine the relationship between discourse acts and prosodic cues.