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# Natural Language Query Processing for Model Management

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## ABSTRACT

The communication between an MIS and its users would be greatly facilitated if the users could query and instruct the system in a sufficiently large subset of their natural language that the system appears to be conversing in the language. In large measure this has been accomplished for MISs that retrieve and display stored data and that perform simple calculations (summations, plots, regressions) with the data. A number of natural language database query systems have been developed, a few of which are now commercially available. However, little attention has been paid to the development of natural language interfaces for systems containing decision models. This paper examines the issues that may arise in the development of natural language query processors for model management systems.

In this paper we address four topics. The first is the state-of-the-art in natural language database query processing. The principal issues here are the parsing of sentences and the resolution of ambiguities. The ambiguities may be those internal to a sentence (such as misspellings, ambiguities in the meanings of words, and ambiguities inherent in the syntax of the language in which the query is written), ambiguities resulting from explicit or implicit reference to previous queries (such as the use of pronouns whose referents must be identified), and ambiguities that arise when several files must be combined to respond to a single query. These issues have been examined in detail and may provide a foundation for natural language model query processing.

The second issue is the development of a high-level target language -- a well-structured, user-friendly, machine-independent language into which natural language queries will be translated prior to model execution. A target language for model management, called MQL (Model Query Language), has been designed, and its linguistic properties have been investigated. The language is described, and some examples are given.

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The third issue is the structure of the model query translator. The translator will consist of five components. The Parsing Component receives the query from the user and analyzes it. It identifies the functions to be performed (e.g., optimization, sensitivity analysis), identifies the inputs and outputs of the models to be used, and attempts to resolve ambiguities. The Model Definition Component is used by the model builder to define the inputs and outputs of the models in the model bank. The Memory Component contains the model definitions, any previous queries (in case reference, such as pronoun reference, is made to them), and information about possible spelling errors and synonyms. The Model Processing Component executes the model or models needed to prepare a response, and the Report Writing Component formats the response.

The final issue is the possible integration of data management and model management in a way that allows users to enter a natural language query that requires access to both databases and model banks. Such an integration may eventually lead to the development of systems that provide a comprehensive range of decision support services.