STAMMER2: A RULE-BASED APPLICATION*

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STAMMERS is a working rule-based system for identifying objects detected by sensors on board Navy vessels and for interactively explaining the identification process. It is currently in use as a demonstration system at the riaval Postgraduate School in Monterey, California, and serves as the basis of continuing artificial intelligence development efforts at the Naval Ocean Systems Center.

Many rule-based systems utilize a data base which is fixed and regarded as complete, except for inferences added by the system itself. In contrast, STAMMER? operates in an environment which is never complete and where later information may supersede or even negate earlier data. Others also deal with the issues of incomplete and inconsistent data, but propose solutions differing from those adopted in STAMMER2. Besides handling unstable information, STAMMER2 is required to process large amounts of data as it is received. This combination of constraints introduces problems for which novel solutions have been adopted.

STAMMER2 operates on a data base of assertions relating to ocean-going craft. Periodically, packets of information in the form of messages are added to the data base. The unsolicited nature of data entry suggests a data-driven approach, and the rule interpreter operates primarily in a bottom-up, forward-chaining mode. To facilitate the bottom-up processing, inference proceeds in an incremental fashion. That is, a rule may be partially evaluated on the basis of currently available information. The evaluation is then suspended and may be revived when further relevant information IS received. This technique eliminates duplication of effort by the rule interpreter. An implication of this approach is that if later information satisfies the remaining conditions of a rule in a prior context, then that context is recalled and the rule finally fires.

The confidence computation mechanism, while using formulas similar to those of MYCIN, has three novel aspects. The first two, cycle breaking and invalidation of earlier inferences by later information, are a result of a dynamic confidence calculation which is undertaken only on request. Confidences are not stored. The third innovation is the introduction of an "UNLESS" logical operator to permit default inferences based on an absence of information.

A facility is provided for the system to explain the reasoning underlying its inferences. For this purpose, stored with each system inferred assertion is a "derivation record" which contains all the rules and particular condition satisfiers which participate in concluding the assertion.

The explanation system has four interesting features:

1. The specific assertions involved in a rule application are provided
2. Graphics are used to illustrate relevant aspects of the ocean situation
3. General question-answering capabilities are provided with respect to the data base
4. User interaction is in a constrained "natural language-like" format.

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