CONFERENCE I
COMUNICACIONES

INTERNATIONAL FUZZY SYSTEMS ASSOCIATION

FIRST I.F.S.A. CONGRESS

ABSTRACTS
Vol. III

GOVERN BALEAR
CONSELLERIA D’EDUCACIÓ I CULTURA

UNIVERSITAT DE
PALMA DE MALLORCA

PALMA DE MALLORCA, SPAIN
JULY 1 TO 6, 1985
INFEERENCE ENGINES BASED ON FUZZY REASONING

Ulises CORTES GARCIA
Ramon LOPEZ DE MANTARAS BADIA
Carlos SIERRA GARCIA
Alfredo VILLAR MIRAVAL

Facultat d'Informàtica
Universitat Politècnica de Catalunya
Jordi Girona Salgado, 31
Barcelona 08034
SPAIN

CEAB (Centre d'Estudis
Avançats de Blanes)
CSIC
Camí de Santa Bàrbara s/n
Blanes (Girona) SPAIN

The MILORD* system contains a management module of the knowledge bases and three inference engines (forward, backward and mixed). It has been developed using NIL-LISP and it is compatible in any common-LISP environment.

KNOWLEDGE BASE DESCRIPTION

The knowledge Base has been designed to enable the engines have a fast access to the information. This is done by transforming the external high level structure of the rules and facts into an appropriate internal structure.

The result gives a very good performance in the followings aspects:

* Motòrs d'Inferència basats en la Lògica del Raonament Difús
  (Inference Engines based on Uncertain Reasoning).
- Easy access to the certainty value of an event
- Easy access to the components of the rules
- Easy access to rules which conclude a given fact
- The identification of the non-deducible events of the applicable rules.

The main element in the achievement of such efficiency is the appropriate use of the atomic properties of LISP instead of the sequential access to the information common in other systems. This has also the advantage that the efficiency is less dependent on the size of the knowledge base.

**INFERENCE ENGINES**

The inference engines use several techniques in order to improve its speed and in order to prune the paths which would lead to a failure. Some techniques are based on:

- the use of a minimum certainty validity for the validation of the concluded facts
- the use of a backward chaining with lookahead to eliminate deduction which have no chance to end up with a fact than the validity level
- the use of a dynamic interaction between the engines in order to switch from one another according to the particular situation
- the selection of the rule to apply according to different criteria:
  * the number of conclusions
  * the number of non-instantiate premises
  * the certainty values of the rules
  * combinations of the previous criteria.
The system has communication facilities, in order to assist the user and to explain its reasoning process, the functions used in the propagation and combination of certainty values, in the interval \( 0,1 \), are those of MYCIN i.e.:

The certainty value \( CF \) of a fact deduced by means of a rule with certainty value \( CR \) is given by:

\[
CF = CR \cdot \min_{P_i} C_{P_i}
\]

being \( C_{P_i} \) de certainty values of the premises of the rule.

The certainty value \( CF \) of a fact deduced by means of two different rules with certainty values \( C_1 \) and \( C_2 \) is:

\[
CF = C_1 + C_2 - C_1 \cdot C_2
\]

Although MILORD due to its modularity, easily accepts the definition of new propagation and combination functions this allows us to easily compare the results using different functions working with the same application. We are working on an extension in order to deal with possibility distributions modeling the imprecision of fuzzy predicates in the premises and/or the uncertainty expressed using linguistic values instead of numerical values.