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SOME REMARKS ON A SYSTEM OF SEMANTICAL INTERPRETATION IN NATURAL LANGUAGES

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It is well known that a knowledge of vocabulary and grammatical rules do not suffice for the proper use of a language. On the other hand, the meaning of words and the word context are necessary for the proper understanding of statements. There are terms in all natural languages, which cannot be precisely characterized, because of their vagueness. This is one of the problems the fuzzy set theory deals with. A system of semantical interpretation in natural languages, which will be proposed, is based on L. Zadeh's concept of a linguistic variable.

A linguistic variable X is a variable, whose values are words or sentences in a natural or artificial language. A linguistic variable consists of:

$$(X, T(X), U, P, M)$$

where

X — the name of a linguistic variable,
$T(X)$ — a term-set, where each of the terms in $T(X)$, is label of a fuzzy subset of the universe
U — the universe of discourse.

A linguistic variable is associated with two kinds of rules:

P — the syntactic rules, which define the well-formed sentences in T(X),
M — the semantic rules, which determine the meaning of the terms in T(X).

If X is a term in $T(X)$, then its meaning is a subset of U. A primary term in $T(X)$ is a term, which meaning is a primary fuzzy set, that is a term, which meaning must be defined a priori. A primary term serves as a basis for the computation of the meaning of the nonprimary terms in $T(X)$.

Some of the words in natural languages have a few meanings. Some of them cannot be precisely characterized, because of their vagueness. It is necessary to know the accurate meaning of words and their contexts to understand properly the whole sentences. A simple system of semantical interpretation of natural

language statements is proposed, in which some interrelations between semantic and syntactic rules are used. The system consists of:

$$(V, V_t, G, G_i, S, M(S_i, V_l))$$

where

V — a vocabulary,

V_t — a terminal vocabulary,

$V - V_t$ — an nonterminal vocabulary,

$$V_t = V_{t_f} + V_{t_n}$$

V_{t_f} — a group of fuzzy terms from V_t,

V_{t_n} — a group of nonfuzzy terms from V_t,

G — a finite set of syntactic rules,

$G_i = \{r_i,\ i = 1, 2, \ldots, n\}$ — a set of labels for the productions in G,

S — the sequences of rules, which are used to create proper sentences,

$M(S_i, V_l)$ — a semantical interpretation of terms from V_t,

S_i — a subset of S, containing the rules, which generate terms from V_{t_f},

V_l — a linguistic variable.

If a sentence is generated by rules from $S - S_i$, then it is interpreted literally, without fuzziness. If a sentence is generated by rules from S_i, then it contains fuzzy terms and their meaning will be denoted by a linguistic variable V_l.

Example

The word "foggy" has two meanings:

(1) the nonfuzzy meaning: dense, not clear, because of fog (abnormal darkened atmosphere),

(2) the fuzzy meaning: obscure, turbid, vague.

Let V be a very simple vocabulary:

$V = \{\text{A, B, C, D, foggy, it, was, yesterday, to, see}\}$

$V_t = \{\text{foggy, it, was, yesterday, to, see}\}$

$V - V_t = \{\text{A, B, C, D}\}$

$V_{t_f} = \{\text{foggy}\}$

G and G_i are given as follows:

r_1 : S $\longrightarrow$ ABC
r_2 : A $\longrightarrow$ it
r_3 : B $\longrightarrow$ was
r_4 : C $\longrightarrow$ foggy
r_5 : C $\longrightarrow$ foggy D
r_6 : D $\longrightarrow$ yesterday
r_7 : D $\longrightarrow$ to see

$S = \{ r_1r_2r_3r_4, r_1r_2r_3r_5r_6, r_1r_2r_3r_5r_7 \}$
$S_i = \{ r_1r_2r_3r_5r_7 \}$

We get three different sentences, which are generated by rules r_1, r_2, ..., r_7: "It was foggy", "It was foggy yesterday", "It was foggy to see".

If there is association of rules r_5r_7 in the sequences of rules, it means that the meaning of "foggy" is fuzzy. Then, the semantical interpretation is given by the linguistic variable "vagueness". In the opposite case, the semantical interpretation of a sentence is literally, nonfuzzy.

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