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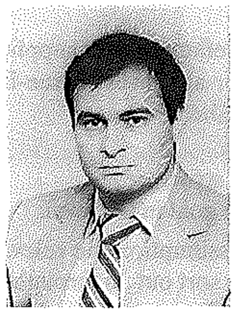
Method for Compressing the Process of Decision Making in a Set-time Interval

Possibilities for Realization in a PROLOG Environment



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In this issue it is theoretically proved that it is possible to realize the decision making process in a previously set time interval. Comprehensive facilities for this time related function in the PROLOG language environment are presented. (Author)

1. Introduction

Systems for Decision Making (DM) represent one of the application fields of Artificial Intelligence (AI). One of their characteristics is the developing of a tree-like structure of logical deduction. Different methods of logical deduction and related with them types of realization of the high-level logical languages are known. These methods try to minimize the search process to a certain extent by applying various strategies.

A main disadvantage of these methods is the uncontrollability of the process within time. If we accept that the search tree is large enough, then although a procedure for minimizing is effective, and although the computer is highly productive, the possibility of not reaching a logical deduction at all still exists or the logical deduction may require more time than suits the user. On the other hand, in some cases the searching process may be concluded ahead of time.

2. Synthesis of an evaluative function, varying with time

Decision Making is conceived of as an endless process, growing with time in details. A general purpose problem will be considered here, but it is a problem which must be solved in a specially set time-period.

In this case, if the problem can be solved by a block of known hight level, this is done. But if this procedure is a very approximating one and we have more time at our disposal, then the procedure can be divided into subproblems. These subproblems can be looked at as pointed above (i. e. if there is enough time, one goes into details, but if not, then the nearest value is assigned and the process stops). This search method is similar in principle to the "search-in-width" method, well-known in AI, but there is a difference in the fact that it includes the search time as well as other improvements. For that purpose we have assumed the following:

- The problem can be solved at each level and by each block, i.e. each block can put in details the value of the solution according to the level of its "competence". This value can be named as default value;

- Blocks from one and the same level can give solutions with various usefulness;

- When a block is asked for a solution, there can be two possible situations:

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II. Addition:

Addition occurs when all semantic components are not expressed in the surface structure (Barhudarov 1975:10). In our case we have addition when the terminological meaning is not transparent. Usually the result is a descriptive term with explicit terminological meaning, e.g. *klauza za razmestvane na tovara pri zapazvane na morekhodnostta mu* > 'seaworthy trim clause', *moment, izmenyashch diferenta s edin inch* > 'inch trim moment'.

The transformations mentioned above show that calquing is a conscious, controllable activity and not always a word-for-word translation.

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(2) Petkova, V.: Bulgaro-anglijski ezikovi kontakti v morsko-targovskata komunikacia, avtoreferat. (Bulgarian - English Language Contacts in the Maritime Field of Communication). Orig.bg., Sofia, 1988.
(3) Efremov E.P.: Osnovy teorii lexicheskogo kal'kirovania. (Fundamentals of Lexicology Calquing's Theory). Orig.ru., Al'ma-Ata, 1974.
(4) Barhudarov L.S.: Jazyk i perevod. (Language and Translation). Orig.ru., Moskva, 1975.

1) If there is enough time, the detailing blocks are resorted to;

2) If the time has expired, the default value is supplied. After having assumed all this for any level of tree-like structure we will have Si1...Sij...Sim, where:

Sij - current goal at level i;

i - current level from the structure;

j - current number of the goal in the level.

For every Sij by the second assumption the relevant usefulness Uij can be taken. If we sort out Sij throughout Uij, then every Sij will be greater than or equal to Sij+1. The sorted Sij can be signified by Sijsort. For these Sijsort it is then necessary to determine the quantity K ($1 < K < m$) in f(time), such that:

- every Sijsort with $j < K$ remains for further analysis;
- every Sijsort with $j > K$ is ignored.

The quantity K is named "cutting parameter" and must be a function of the time remaining for the process of Decision Making to come to an end, i.e.

$$K = F(tcurr) \quad (1)$$

where:

tcurr = current time in the interval:

Tstart > tcurr > 0;

Tstart = starting time of the process (time, given for DM).

The cutting parameter K may be confined by the following conditions:

$K > 1$ (i.e. the minimum number of solutions is one);

$K < m$ (i.e. the maximum number of solutions is all of them).

The influence of tcurr upon K is related to the following moments:

- when tcurr decreases, K must decrease too;
- when tcurr = 0, then K = 1;
- when tcurr = Tstart, then K = m.

If in a Cartesian coordinate system tcurr is represented by X and K is represented by Y, then two characteristic points A and B can be obtained, i.e. A(Tstart,m) and B(0,1). If we assume that between K and tcurr there exists a linear interdependence, then the equation of a line determined by two points [4] is presented:

$$\frac{K - 1}{tcurr - 0} = \frac{m - 1}{Tstart - 0} \quad (2)$$

After conversion the result is:

$$K = \frac{m - 1}{Tstart} \, . \, tcurr + 1 \quad (3)$$

i.e. a linear equation of the type:

$$K = R \, . \, tcurr + S \, ,$$

where:

$R = (m - 1) / Tstart$;

$S = 1$.

In particular situations a non-linear interdependence between K and tcurr is not excluded. The interdependndce as presented by formula (3) is easily computed at every step during the analysis of alternatives. Therefore, using formula 3 is recommended. It is considered, namely, that the balanced human thought is going in this way (F1 graphics - in the text presented), when it is put into the conditions for DM in a set time-interval.

3. Conditions and recommendations for an application of the method in a PROLOG environmnent

In the present analysis it is theoretically proved that the method for time-cutting in a PROLOG environment is working. We have suggested also some restrictions in the introduction of clauses deriving from the specifics of the method. A typical example of its functioning is presented. A particular way is suggested for involving the method in PROLOG IE as well as a modified version for the first-order predicate logic.