THE CHOICE OF OPTIMAL DECISIONS ÎN UNCERTITUDE SITUATIONS

Cătălin Angelo IOAN
Danubius University Galatz

Abstract: *The Electre method is a classical algorithm for the decidence of a suitable choice în the process of launching on market of some products. In this paper I shall give a variation of the last part of the algorithm în the direction of simplifying the finally computations.*

In many practical situations, it exists many informations refered to the actions which can be developed, but for each action choice it exists many possibilities.

The Electre method gives us a way which will make out between different possibilities.

Let therefore n choices V_1, V_2,...,V_n for a decident. We have also m criterions C_1,C_2,...,C_m who have, each of them, a weighty coefficient (by rule subjective assigned) k_1,k_2,...,k_m.

For each pair (V_i,C_j) we have a numerical value (if it is a qualitative estimation we shall convert în hierarchy numbers).

The algorithm will determine the best choice of action.

<u>Step I</u>

We settle, for the beginning the method nature: maximisation or minimisation. We shall add two lines under the table, on which will compute the maximum and the minimum of all numbers on columns.

<u>Step II</u>

We shall determine the utilities U_{ij} corresponding to all pairs (V_i,C_j):

- for the maximisation problem: $U_{ij}=\dfrac{v_{ij}-\min\limits_{k=1,...,n} v_{kj}}{\max\limits_{k=1,...,n} v_{kj}-\min\limits_{k=1,...,n} v_{kj}}$;
- for the minimisation problem: $U_{ij}=\dfrac{\max\limits_{k=1,...,n} v_{kj}-v_{ij}}{\max\limits_{k=1,...,n} v_{kj}-\min\limits_{k=1,...,n} v_{kj}}$.

and after we shall draw the table with these results.

<u>Step III</u>

We shall compute the correspondence indicators: $c(V_i,V_j)=\dfrac{\sum\limits_{\substack{p=1,...,m\\ U_{ip}\geq U_{jp}}} k_p}{\sum\limits_{r=1}^{m} k_r}$ and after the disunity indicators: $d(V_i,V_j)=\max\limits_{p=1,...,m}(U_{jp}-U_{ip},0)$.

<u>Step IV</u>

We shall draw a new table for each pair (V_i,V_j) where on each cell we shall write on the left the correspondence indicator and on the right the disunity indicator.

<u>Step V</u>

We shall establish two values p and q (with a significance of complementary probabilities) such that $p,q\in(0,1)$ and $p+q=1$ which will extent the admissible limits for correspondence, respectively disunity. We shall say that V_i is better than V_j if

$$\begin{cases} c(V_i, V_j) \geq p \\ d(V_i, V_j) \leq q \end{cases}$$

Let now the matrice $G=(g_{ij})\in M_n(\mathbf{R})$ such that: $g_{ij}=1$ if V_i is better than V_j and 0 în the other situations. If it exists a row i with all elements equal with 1 it follows that V_i is better than all others therefore it will be preffered. If it not exists such a V_i we shall diminish the value of p (and o course increase q) till we shall obtain the better choice.

In what follows I shall present another way to choice p and q.

The system: $\begin{cases} c(V_i, V_j) \geq p \\ d(V_i, V_j) \leq q \end{cases}$ can be write as: $\begin{cases} c(V_i, V_j) \geq p \\ d(V_i, V_j) \leq 1-p \end{cases}$ therefore:

$$p\leq\min(c(V_i,V_j),1-d(V_i,V_j))$$

We shall compute $\min\limits_{j=1,n} c(V_i,V_j)$ and $\min\limits_{j=1,n} (1-d(V_i,V_j))$ from where:

$$p\leq\min(\min_{j=1,n} c(V_i,V_j),\ 1-\max_{j=1,n} d(V_i,V_j))$$

In the last table, we shall add therefore three columns, on which we compute $\min\limits_{j=1,n} c(V_i,V_j)$, $1-\max\limits_{j=1,n} d(V_i,V_j)$ and the minimum of these two values. The better choice will be those who give the maximum value on this last column.

Example

Let the following problem (of maximisation):

Criterion Choice	**C_1 (k_1=0,4)**	**C_2 (k_2=0,4)**	**C_3 (k_2=0,2)**
V_1	1000	0	50
V_2	800	1	56
V_3	600	2	60
V_4	700	1	54
V_5	500	2	58

Criterion Choice	**C_1**	**C_2**	**C_3**
V_1	1000	0	50
V_2	800	1	56
V_3	600	2	60
V_4	700	1	54
V_5	500	2	58
min	500	0	50
max	1000	2	60
max-min	**500**	**2**	**10**

The utilities table is:

Criterion Choice	**C_1 (k_1=0,4)**	**C_2 (k_2=0,4)**	**C_3 (k_3=0,2)**
V_1	1	0	0
V_2	0,6	0,5	0,6
V_3	0,2	1	1
V_4	0,4	0,5	0,4
V_5	0	1	0,8

And the table of correspondence indicators and the disunity indicators:

	V_1		**V_2**		**V_3**		**V_4**		**V_5**	
V_1	1	0	0,4	0,6	0,4	1	0,4	0,5	0,4	1
V_2	0,6	0,4	1	0	0,4	0,5	1	0	0,4	0,5

V_3	0,6	0,8	0,6	0,4	1	0	0,6	0,2	1	0
V_4	0,6	0,6	0,4	0,2	0,4	0,6	1	0	0,4	0,5
V_5	0,6	1	0,6	0,6	0,4	0,2	0,6	0,4	1	0

If we try for p from 1 back to 0 we shall obtain that, for the first time, we shall have for p=0,4 and q=0,6:

$$G=\begin{pmatrix} 1 & 1 & 0 & 1 & 0 \\ 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 1 \end{pmatrix}$$

therefore each of V_2 and V_4 is better than the others.

I shall suggest at this last step the following:

	V_1		**V_2**		**V_3**		**V_4**		**V_5**		$\min_{j=1,n} c(V_i,V_j)$	$\max_{j=1,n} d(V_i,V_j)$	min
V_1	1	0	0,4	0,6	0,4	1	0,4	0,5	0,4	1	0,4	1	0
V_2	0,6	0,4	1	0	0,4	0,5	1	0	0,4	0,5	0,4	0,5	**0,4**
V_3	0,6	0,8	0,6	0,4	1	0	0,6	0,2	1	0	0,6	0,8	0,2
V_4	0,6	0,6	0,4	0,2	0,4	0,6	1	0	0,4	0,5	0,4	0,6	**0,4**
V_5	0,6	1	0,6	0,6	0,4	0,2	0,6	0,4	1	0	0,4	1	0

therefore each of V_2 and V_4 is better than the others, but without consecutive tests.