ELECTRE METHODS (PART II)

José Rui FIGUEIRA
(figueira@tecnico.ulisboa.pt)

Universidade de Lisboa

MCDM Summer School, Chania-Crete, Greece

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1. The qualitative nature of some criteria
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Strong features

1. They have the possibility of taking into account the qualitative nature of some criteria. They allow thus to consider the original data.
2. They can deal with very heterogeneous scales to model noisy, delay, aesthetics, cost, . . . Whatever the nature of scales, every procedure can run by preserving the original performances of the actions.
3. The compensatory effects are not pertinent. This is due to the fact that the weights cannot be interpreted as substitution rates. Contrarily to other methods there is no need in ELECTRE methods to use, from the starting point of their application, identical and commensurable scales.

Strong features

Consider the following example with 4 criteria and only 2 actions (scales: [0,10]). The weighted-sum model was chosen, i.e, $V(a) = \sum_{j=1}^{n} w_j g_j(a)$. In the considered example, the weights, w_j, are equal for all criteria:

	g_1	g_2	g_3	g_4
a_1	9.5	9.5	8.1	5.4
a_2	8.3	8.3	7.3	8.5

- $V(a_1) = 8.125 > V(a_2) = 8.100$.
- This example shows, in an obvious way, the possibility that a big preference difference not favorable to a_1 on one of the criteria (g_4) can be compensated by 3 differences of weak amplitude on the remaining criteria, in such a way that a_1 becomes finally preferred to a_2. In ELECTRE methods this effect does not occurs in a systematic way.

Strong features

4. They are adequate to take the imperfect knowledge of the data and the arbitrariness related to the construction of the criteria. This is modeled through the indifference and preference thresholds. Consider the same example with the following (constant) discrimination thresholds:

	g_1	g_2	g_3	g_4
a_1	9.5	9.5	8.1	5.4
a_2	8.3	8.3	7.3	8.5
q_j	1	1	1	1
p_j	2	2	2	2

Strong features

- If on criterion g_3 we change the performance from 7.3 to 7.1, the score moves from 8.100 to 8.050 ($V(a_1) - V(a_2) = 0.050$). Consequently there is a reinforcement of the preference in favor of a_1.
- On the other hand, with ELECTRE $c(a_1, a_2)$ and $c(a_2, a_1)$ remain unchanged.
- Now, if we consider 7.5 instead of 7.3, then $V(a_2) = 8.150$, and consequently $a_2 P a_1$. Again this small variation is too small.
- When adding the discrimination thresholds and using ELECTRE methods, $c(a_1, a_2) = 0.25 + 0.25 + 0.25 = 0.75$ and $c(a_2, a_1) = 0.2 + 0.2 + 0.25 + 0.25 = 0.8$. Thus, $a_2 P a_1$.

Strong features

5. They are based in a certain sense in the *reasons for* and the *reasons against* of an outranking between two actions (concordance and discordance). Consider the same example and that a veto threshold should $v_j = 3$, for all $j = 1, \ldots, 4$.

	g_1	g_2	g_3	g_4
a_1	9.5	9.5	8.1	5.4
a_2	8.3	8.3	7.3	8.5
q_j	1	1	1	1
p_j	2	2	2	2
v_j	3	3	3	3

If $s = 0.8$ then $a_2 S a_1$ and $not(a_2 S a_1)$. But, if $s = 0.7$, $a_1 I a_2$. Since $d_4(a_2, a_1) = 1$, g_4 imposes a veto, for whatever the chosen s. We get allays $not(a_2 S a_1)$.

2.7. Weaknesses

Introduction

Summary

1. Scoring actions
2. The quantitative nature of family of criteria
3. The independence with respect to irrelevant alternatives
4. The intransitivities

Some weaknesses

1. Scoring the actions. In certain contexts it is required to assign a *score* to each action. When the decision makers require each action should appear associated with a score, the ELECTRE methods are not adequate for such a purpose and the scoring based methods should be applied instead. The decision makers should be, however, aware that they cannot provide information that leads, for example, to intransitivities or to incomparabilities between certain pairs of actions. Indeed, this score is very fragile.

Some weaknesses

2. The quantitative nature of the family of criteria. When all the *criteria are quantitative* it is “better” to use other methods. But, if we want to take into account a completely or even a partial noncompensatory method, the reasons for and against, or the imperfect character of at least one criterion, even under such conditions, we can use the ELECTRE methods.

Some weaknesses

3. The independence with respect to irrelevant alternatives. Except ELECTRE TRI-B, TRI-C, the remaining ELECTRE methods does not fulfill the *independence w.r.t. irrelevant alternatives* (Roy, 1973). In 1973, B. Roy shows that rank reversal may occur and consequently the property of independence with respect to irrelevant alternatives can be violated when dealing with outranking relations. Notice that rank reversal may occur only when the set of potential actions is subject to evolve, which is quite a natural assumption, but one that is not present in many hard decision-aiding processes where the number of alternatives is rather small and easily identified.

Some weaknesses

4. Intransitivities may also occur in ELECTRE methods (Roy, 1973). It is also well-known that methods using outranking relations (not only the ELECTRE methods) do not need to fulfill the transitivity property. This aspect represents only a weakness if we impose *a priori* that preferences should be transitive. There are, however, some raisons that lead us to do not impose transitivity.