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ELECTRE Method for the Selection of Best Computer System

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Abstract

Multi Criteria Decision Making (MCDM) Methods are regularly used to pick best choices in our genuine complex issues. With reference to the announcement, the present paper gives a review on the utilization of MCDM for the determination of best PC framework out of three PC frameworks known as choices i.e: A,B&C relying upon four criteria utilizing ELECTRE technique for which the choice is now gotten by Analytical Hierarchy Process (AHP).ELECTRE strategy is one of the positioning strategies and it gives brisk answer for the issue. Henceforth this strategy is connected in this study. In the present study acquired arrangements by the technique AHP and ELECTRE are thought about .It is clear that the arrangement got by both the strategies is comparable. The option is positioned first i.e: best PC framework .It is watched that there is consistency in the specimen information. Thus the arrangement will be comparable by every single positioning technique.

Keywords: Analytical Hierarchy Process (AHP), Consistency, ELECTRE, Multi Criteria Decision Making (MCDM) Method, Ranking

1. Introduction

AHP was presented and created by T.L. Saaty on 1970's to catch the answer for the quantitative and subjective components for chiefs in MCDM. From that point forward this strategy has been connected into numerous genuine applications[3]. However transitivity, correspondence principles and consistency test for combine savvy examination networks was clarified by Barzilai[4]. The match astute correlation grids contain the fresh judgments relying upon their relative significance concerning criteria and option. These match astute examination frameworks might be steady or conflicting because of the confinements of chief. Hwang K.Yoon[6] was given the utilizations of MCDM techniques in 1981. Allessio Ishizaka[7] disclosed how to determine needs in AHP. In detail AHP as a specialty of science and basic leadership was clarified by Patric T. Harker[8]. Later numerous strategies under MCDM techniques were presented. ELECTRE is one of the MCDM strategies. ELECTRE (Elimination and Choice Translating Reality) was initially created by Bernard Roy and was initially connected in 1965. SEMA and European consultancy organization is the inception of ELECTRE strategy. An examination group at SEMA dealt with complex true issues including different criteria. Multi criteria strategy for choice supporting, a hypothesis on out positioning methodology and establishment of ELECTRE technique was clarified by B. Roy[9,10]. Earlier this outranking system was connected in fields yet not to an issue of determination of best PC framework out of three PCs say A,B&C relating to four criteria (for ex: expandability, practicality, memory and so forth).

2. Methodology

2.1 AHP

The match insightful examination technique and the progressive model were created in 1980 by T.L. Saaty with regards to the Analytic Hierarchy Process (AHP)[1,2]. It is one of the best and most broadly utilized MCDM approaches. AHP is a way to deal with basic leadership that includes organizing various decision criteria into a

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chain of importance, evaluating the relative significance of these criteria, looking at options for every foundation and deciding a general positioning of the options[3]. AHP catches both subjective and target assessment measures, giving a valuable system to checking the consistency of the assessment measures and options proposed by the group in this manner decreasing predisposition in basic leadership[5]. Some of its applications incorporate innovation decision[7], merchant choice of a broadcast communications framework[6], extend determination, spending assignment. The means for actualizing the AHP procedure are outlined[4] as takes after:

- Define the Objectives.
- Identify the Criteria/Attributes.
- Choose the Alternatives.
- Establish the Hierarchy.
- Design Questionnaire and study
- Construct the Pair insightful Comparison lattices utilizing Saaty's 9-point scale.

Consider n components to be thought about, C1 … Cn and mean the relative "weight" (or need or noteworthiness) of Ci regarding Cj by aij and shape a square grid A=(aij) of request n with the limitations that aij = 1/aji, for i ≠ j, and aii = 1 for all i. Such a lattice is said to be an equal network. The weights are steady in the event that they are transitive, that is aik = aij.ajk for all i, j, and k. Such a network may exist if the aij are ascertained from precisely measured information. At that point discover a vector ω of request n with the end goal that Aω = λω . For such a framework, ω is said to be an eigenvector (of request n) and λ is an eigen esteem. For a predictable lattice, λ = n . For lattices including human judgment, the condition aik = aij.ajk does not hold as human judgments are conflicting to a more noteworthy or lesser degree. In such a case the ω vector fulfills the condition Aω= λmaxω and λmax ≥ n. The distinction, assuming any, amongst λmax and n means that the irregularity of the judgments. On the off chance that λmax = n then the judgments have ended up being reliable. At long last, a Consistency Index can be computed from (λmax-n)/(n-1). That should be evaluated against judgments made totally aimlessly and Saaty has computed vast examples of irregular lattices of expanding request and the Consistency Indices of those grids. A genuine Consistency Ratio (CR) is figured by separating the Consistency Index for the arrangement of judgments by the Index for the relating arbitrary network. Saaty recommends that if that proportion surpasses 0.1, the arrangement of judgments might be too conflicting to ever be dependable. By and by, CRs of more than 0.1 once in a while must be acknowledged. A CR of "0" implies that, the judgments are splendidly predictable.

2.2 ELECTRE Method

ELECTRE Method (Elimination and decision Translating the truth) was presented by B. Roy in 1960's later it was connected in numerous fields to tackle multi measure issues. This technique gives the main option, when one option is contrasted and another option. Contingent upon concordance network, harshness lattice and limit values we can discover predominance between the choices .Hence positioning of options can be acquired by relying upon the components of concordance, conflict strength grids . As per E. Triyantaphyllu the accompanying strides are utilized for basic leadership by ELECTRE Method.

Step 1: Normalizing the Decision Matrix

This methodology changes the passages of the choice framework into dimensionless tantamount sections by utilizing the accompanying condition:

$$x_{ij} = \frac{a_{ij}}{\sqrt{\sum_{k=1}^{m} a_{kj}^2}} \tag{1}$$

Along these lines, the standardized network X is characterized as takes after:

$$x = \begin{bmatrix} x_{11} & x_{12} & . & x_{1n} \\ x_{21} & x_{22} & . & x_{2n} \\ . & . & . & . \\ x_{m1} & x_{m2} & . & x_{mn} \end{bmatrix} \tag{2}$$

Step 2: Weighting the Normalized Decision Matrix

The weights, denoted as $(W_1, W2, W3, \bullet\bullet\bullet, Wn)$, were determined by the decision maker. Therefore, the weighted matrix, denoted as Y, is:

$$y = xw. \quad \text{and} \quad \sum_{i=1}^{n} wi = 1 \tag{3}$$

Step 3: Decide the Concordance and Discordance Sets

The concordance set Ckl of two options Ak and AI, where m ≥ k, I ≥ 1, i

$$c_{kl} = \left\{ j, y_{kj} \geq y_{lj} \right\}, \text{ for } J= 1, 2, 3\ldots\ldots,n \tag{4}$$

The corresponding subset is known as the harshness set and it is portrayed as takes after:

$$d_{kl} = \left\{ j, y_{kj} < y_{\lg} \right\}, \text{ for } J=1, 2, 3\ldots\ldots,n \tag{5}$$

Step 4: Build the Concordance and Discordance Matrices

The concordance list Ckl is the aggregate of the weights connected with the criteria contained in the concordance set. That is, the accompanying is valid:

$$c_{kl} = \sum_{jec_{kl}} wj \quad \text{for J=1, 2, 3……n}$$

The concordance list demonstrates the relative significance of option Ak as for option Al. Obviously, 0 ≤ Ckl ≤ 1.

Where the sections of lattice C are not characterized when k = l.

The components dkl of the harshness grid are characterized as takes after:

$$d_{kl} = \frac{\max_{j \in D_{kl}} \left| y_{kj} - y_{lj} \right|}{\max_{j} \left| y_{kj} - y_{lj} \right|} \tag{7}$$

as with the C matrix, the entries of matrix D are not defined when $k = I$.

Step 5: Decide the Concordance and Discordance Dominance Matrices

The concordance strength framework is built by method for a limit esteem for the concordance list. That is, this happens if the accompanying condition is valid: .The edge esteem f. can be resolved as the normal concordance list.

$$\bar{c} = \frac{1}{m(m-1)} \sum_{k=1 and k \neq l}^{m} \sum_{l=1 and l \neq k}^{m} c_{kl} \tag{8}$$

Based on the threshold value, the elements of the concordance dominance matrix F are next determined as follows:

$$f_{kl} = 1 if c_{kl} \geq \underline{c}$$

$$f_{kl} = 0 if c_{kl} < \underline{c}$$

Similarly, the discordance dominance matrix G is defined by using a threshold value $\underline{d}$, where $\underline{d}$ could be defined as follows:

$$\underline{d} = \frac{1}{m(m-1)} \sum_{k=1 and k \neq l}^{m} \sum_{l=1 and l \neq k}^{m} d_{kl} \tag{9}$$

$$g_{kl} = 1 ford_{kl} \geq \underline{d}$$

$$g_{kl} = 0 ford_{kl} < \underline{d}$$

Step 6: Determine the Aggregate Dominance Matrix

$$e_{kl} = f_{kl} \times g_{kl} \tag{10}$$

Step 7: Dispose of the Less Favorable Alternatives From the total strength lattice one can determine a fractional inclination requesting of the choices. In the event that ekl= 1, then this implies elective Ak is liked to option Al by utilizing both the concordance and conflict criteria..If any section of the total strength lattice has no less than one component equivalent to 1, then this segment is "ELECTREally" overwhelmed by the relating column. In this way, one can basically dispense with any column(s) which have a component equivalent to one. At that point, the best option is the one which overwhelms every single other option in this way.

3. Illustration

As an illustrative application, consider the case in which one wishes to overhaul the PC arrangement of a PC coordinated assembling (CIM) office. There are numerous arrangements accessible to look over. The diverse frameworks are the options. A choice ought to likewise consider issues, for example, cost, execution qualities (i.e., CPU speed, memory limit, RAM, and so on.), accessibility of programming, support, superfluity, and so on. These might be a portion of the choice criteria for this issue. In the above issue we are keen on deciding the best option (i.e., PC framework). In some different circumstances, in any case, one might be keen on deciding the relative significance of the considerable number of choices under thought. Case in point, in the event that one is occupied with financing an arrangement of contending tasks (which now are the options), then the relative significance of these undertakings is required (so the monetary allowance can be appropriated relatively to their relative importance).Suppose consider the case of selecting the best PC system[1], there are three option setups, say A, B, and C. Likewise, assume that one of the choice criteria

Table 1. Priority vector by AHP

	C1 (0.553)	C2 (0.131)	C3 (0.271)	C4 (0.045)	Final Priority (PV_{old})
A	0.754	0.233	0.745	0.674	0.680
B	0.181	0.055	0.065	0.101	0.130
C	0.065	0.713	0.181	0.226	0.190

is equipment expandability (i.e., the adaptability of connecting to the framework other related fringe gadgets, for example, printers, new memory, and so on.). Assume that framework An is greatly improved than framework B, and framework C is the minimum wanted one to the extent the equipment expandability rule is concerned.

4. Calculations by ELECTRE Method

Table 2. Normalised decision matrix

	C1	C2	C3	C4
WT	0.553	0.131	0.271	0.045
A	0.968977	0.309791	0.968259	0.938692
B	0.232606	0.073127	0.084479	0.140665
C	0.083533	0.947988	0.235241	0.314754

Table 3. Weighted normalised decision matrix

		C1	C2	C3	C4
	WT	0.553	0.131	0.271	0.045
Y =	A	0.535844	0.040583	0.262398	0.042241
	B	0.128631	0.00958	0.022894	0.00633
	C	0.046193	0.124186	0.06375	0.014164

Concordance matrix

$$C = \begin{bmatrix} 1 & 1 & 0.869 \\ 1 & 0 & 0 \\ 0 & 0.131 & 1 \end{bmatrix}$$

Discordance matrix

$$D = \begin{bmatrix} M & 0.063 & 0.170 \\ 0.831 & M & 0.234 \\ 1 & 0.168 & M \end{bmatrix}$$

Table 4. Threshold values

c	d
0.4166	0.1951

Concordance dominance matrix

$$f_{lk} = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

Discordance dominance matrix

$$g_{lk} = \begin{bmatrix} 0 & 0 & 0 \\ 1 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix}$$

Aggregate Dominance matrix

$$\begin{bmatrix} 1 & 1 & 1 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} 0 & 0 & 0 \\ 1 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix} = \begin{bmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix} = e_{lk}$$

5. Conclusion

As indicated by Saaty if the consistency proportion of match shrewd correlation grids is under 0.1, the judgments are said to be predictable. In the present study for the choice of best PC framework ELECTRE technique is connected to look at the positioning of options got by AHP strategy. The outcome acquired by both strategies is comparative, since the match astute examination lattices in the specimen information are reliable. The option An is positioned initially, elective C is next and the option B is slightest .So obviously elective An is more prevailing than the other two choices B and C. Henceforth it is watched that if the consistency proportion of combine astute correlation frameworks is predictable then the arrangement got by all positioning strategy will be comparative.

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