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Soft computing-based aggregation methods for human resource management ☆

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Abstract

We are interested in the personnel selection problem. We have developed a flexible decision support system to help managers in their decision-making functions. This DSS simulates experts' evaluations using ordered weighted average (OWA) aggregation operators, which assign different weights to different selection criteria. Moreover, we show an aggregation model based on efficiency analysis to put the candidates into an order.

Keywords: Fuzzy sets; Personnel selection; OWA operators; Efficient aggregation

1. Introduction

Making the right decisions about human resources policies can determine success in companies. Accurate personnel selection, taking into account the company circumstances, allows managers to optimize production costs and achieve corporative goals [1]. This process is complicated because of human nature, and implies focusing on concepts like validity, trust and criteria fixing. The main goal of managers is to obtain a ranking of a set of candidates who have been evaluated according to different competences. Therefore, the development of efficient and flexible information aggregation methods has become a main issue in information access methods.

Some authors classify the problem of personnel selection as an unstructured decision problem, that is, no processes or rules have been defined for making decisions [9]. Despite this difficulty and the large amount of information involved [24], we think that our procedures could be useful in most real-life situations.

Fuzzy set theory considers some elements that are essential for dealing with economic, social and technological situations: the uncertainty in data, and the modeler or manager capacity to provide additional information.

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Weighted aggregation has been widely used in fuzzy decision-making, where a set of weights is used to represent the relative importance that the decision-maker gives to different decision criteria [11,16]. Jaquet-Lagrèze and Siskos review in [14] some useful methods to establish a ranking based on the importance of every competence [23]. Classical aggregation operators are the arithmetic mean and quasi-arithmetic means [2], and the well-known OWA operators [22,28], in which no weight is associated to any particular input, the relative magnitude of the input deciding which weight it corresponds to. In addition, we analyze the case in which the competences are not important separately, but the case in which good and bad valuations can be compensated for. In case that a set of priorities for the competences are given, a generalized OWA operator can be used [20].

Other approaches consider aggregation operators based on parametric weights depending on a parameter α which represents the exigency level [15]. In some cases, an important attribute with a low satisfaction value can be penalized by means of its weight, making the given attribute less significant in the overall evaluation.

In this paper, we present two personnel selection models. In Section 3, we deal with some OWA operators for crisp and interval-valued inputs, and we use them to imitate the experts' opinion in the selection process. In Section 4, we introduce a parametric aggregation model based on the fuzzy weighted mean whose performance is shown on a numerical example.

A number of papers propose personnel selection procedures which also make use of OWA operators. Some of them cannot be applied in our case because the weights associated with the competences are unknown [6–8]. Even if the weights are given, we prefer parametric models based on fractional programming because they are closely related to the analysis of efficiency and this framework is more comfortable for the decision-makers [5,17,25].

2. Problem statement

We have n candidates to fill a vacancy. They have been evaluated in R competences. It is not easy to assign crisp valuations for these competences, especially when the candidates are valuated by different experts. In our opinion is more appropriate to state the valuations in terms of intervals or fuzzy numbers [21].

In this paper, we have considered two different situations depending on the kind of information that we deal with. In the first case, there is not information which allows us to associate a weight to each competence (even in a vague way), and/or the firm decides to contract some specialists. These experts might provide a global evaluation of the candidates. The first case can be subdivided into two subcases: with or without trade-off. We assume perfect trade-off when the exigency degree required for each candidate in each competence is the same, this degree being valuated by a parameter $\alpha \in [0, 1]$.

In the second case, we assume that the weights associated with the competences can be stated *a priori* as fuzzy numbers. Our proposal is to evaluate the candidates by means of a fuzzy weighted mean of their competences. We are able to sort the candidates using a ranking method for fuzzy quantities.

In summary, our proposals for the different situations are the following:

Case 1. Unknown weights: *OWA techniques*
- C.I Aggregating crisp inputs.
- C.II Aggregating interval-valued inputs.
  - C.II.1 Assuming perfect trade-off.
  - C.II.2 Without trade-off.

Case 2. Available weights: *Parametric aggregation techniques*

3. Personnel selection by using ordered weighted average (OWA) operators

If the company decides for economical reasons or expediency, that the experts should only evaluate one set of candidates, using the OWA aggregation operators will allow us to perform the remaining evaluations.

Let us assume that the experts have given a global evaluation independently of previous valuations by using their intuition and experience for $\{P_i\}_{i=1}^{L}$ candidates ($L < n$), see Table 1.

Clearly, the company would be interested in the experts' opinions for the remaining candidates [3]. However, when a personnel selection involves many candidates, the evaluation process performed by external