THE BUSINESS EXPERT COMPETENCE RATING METHOD BASED ON VAGUE SETS

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Abstract
The problem of expert competence rating and choosing the best of them is being reviewed for business risk decreasing. A mathematic problem solution on mark necessity basis of Boolean vague arguments has been advised.
Key words: business risk, administrative decisions, investment, resource administration safety, vague rating, Boolean - vague functions, experts, criteria.

Introduction

The formalization process problem of expert rating is getting more important recently. But the universal rating model of chosen experts competence, which could allow to embrace administrative decisions more precisely, is absent. Expert marks are always subjective, that's why it's more appropriate to use unclear (vague) sets. Experts subjectivity, which can give conclusions for a final decision, has a risk to estimate the current object improperly [4]. That's why we need to evaluate the expert competence.

Let's review the expert competence rating model in case of obscured information accordance. Herewith using the necessity organ of obscured Boolean functions. Let's demonstrate the usage of this model in business risks and with enterprise rating in investment purposes.

1. The Description of the Mathematical Model of Task Solution.

We are to examine functions $f(p_1, p_2, ..., p_n)$, arguments of which are certainly determined on an unclear plural $U = [0;1]$, such as $f(p_1, p_2, ..., p_n) \in U$, when $p_i \in U(i = 1,2,...,n)$ [1]. Such functions are named as the functions fuzzy Boolean variables. We will designate through $M = (K_1, K_2, ..., K_m)$ - plural of criteria. In the future under the arguments $p_i \in U(i = 1,2,...,n)$ fuzzy function $f(p_1, p_2, ..., p_n)$ we will understand the plural of experts.

Under consideration are also some cases when there is uncertainty of experts in the estimation of different criteria. The approach offered by the authors concerning the construction of the ill-defined therm-plurals U', which consists of three therms, is a <bad index of criterion> (B), <index of criterion is standard> (S), <good index of criterion> (G), then a therm-plural U' is the following: $U' = (B, S, G)$ [2].

Belonging of variable $p_i (i = 1,2,...,n)$ to this or that therm is defined as follows:

{0,1;0,2;0,3} - we will refer to therm B;

{0,4;0,5;0,6;0,7} - we will refer to therm S;

{0,8;0,9;1} - we will refer to therm G.

The importance of experts estimation based on the ill-defined plural will characterize the information which can be received about an unclear function $f(p_1, p_2, ..., p_n)$ on the set *M*, knowing the value of its arguments. We will name such estimation as the estimation of importance W of fuzzy argument $p_i \quad (i = 1,2,...,n)$ nd we will also define it due to a formula from [3]:

$$W(p_n) = \frac{1}{N} \sum_{l \in U'} \max_m b_l^m \text{ , } (n = 1,2,...) \qquad (1)$$

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where b_l^m $(m \in U')$ is an amount of all sets in which an fuzzy variable p_i takes on a value l: $p_i = l$ $(i = 1,2,...,n)$, $l \in U'$. N - an amount of criteria.

Formula (1) turns out from the next consideration. Size b_l^m () can be interpreted as a probability of that fact that the function $f(p_1, p_2,...,p_n)$ takes on a value f_k $(1 \le k \le N)$ if the value on the set of fuzzy argument p_i is l $(i = 1,2,...,n)$. Let us designate through $\rho_l = \max_m b_l^m$. The size ρ_l reveals the maximal probability. We can state that the dimension ρ_l represents the information about the signification of the fuzzy function $f(p_1, p_2,...,p_n)$ which can be received on the plural *M*, knowing that on the set $(f_1, f_2,...,f_N)$ the value of the fuzzy Boolean argument p_i $(i = 1,2,...,n)$ is equaled to l. Consequently the argument p_i $(i = 1,2,...,n)$, for which this information is the biggest, and will have the most essential influence on the value of the fuzzy function $f(p_1, p_2,...,p_n)$.

The greater the value of importance of expert estimation is, the greater the competence will be.

2. The Practical Application of Task Solution on the Model of Borrower Selection.

Let us state that we need to define the competence of experts $p_1, p_2,...,p_n$, on the plural of some criteria $M = (K_1, K_2,...,K_m)$, and a distinguishing fuzzy function is set $f(p_1, p_2,...,p_n)$ in relation to which we will estimate the competence of experts.

Experts $p_1, p_2,...,p_n$ give fuzzy, subjective estimations from the plural of the value $U = [0;1]$ concerning all criteria. Criteria are built depending on the sphere of solution of this task. The further given estimations are converted into the offered plural therm. The formulation of the task consists in the estimation of competence of experts, which will be set due to its growth. For this purpose we will use the above offered approach.

Example

Let's imagine, we have five experts $p_1, p_2,...,p_5$, which consort with the management investment risk of enterprises in a bank. Each of them is evaluating a definite enterprise by 7 criteria $K_1, K_2,...,K_7$. And here is the defined function: $f(p_1, p_2,...,p_5)$ - "the adequate enterprise evaluation". We can review this function on practice, as an enterprise evaluation, which could satisfy the financial institution by all criteria.

We also have to set the experts in order of their competence. Information is given in Table 1.

tabl.1.

	p_1	p_2	p_3	p_4	p_5	$f(p_1, p_2, p_3, p_4, p_5)$
K_1	0,4	0,4	0,3	0,2	0,3	0,4
K_2	0,4	0,5	0,6	0,7	0,4	0,5
K_3	0,8	0,9	0,5	0,3	1	0,8
K_4	0,4	0,5	0,3	0,4	0,1	0,4
K_5	0,4	0,2	0,4	0,1	0,2	0,2
K_6	0,6	0,7	0,9	1	1	1
K_7	0,5	0,2	0,5	0,7	0,4	0,4

1. The given estimations are converted into therm –plurals, Table 2

tabl.2.

	p_1	p_2	p_3	p_4	p_5	$f(p_1, p_2, p_3, p_4, p_5)$
K_1	S	S	B	B	B	S
K_2	S	S	S	S	S	S
K_3	G	G	S	B	G	G
K_4	S	S	B	S	B	S
K_5	S	B	S	B	B	B
K_6	S	S	G	G	G	G
K_7	S	B	S	S	S	S

2. Let us calculate the evaluation $W(p_1), W(p_2), W(p_3), W(p_4), W(p_5)$ - due to the formula (1). Further on we will search for each expert the size $b_l^m \quad m = \{B, S, G\}$:

$$p_1: \begin{matrix} b_B^B = 0, & b_S^B = 1, & b_G^B = 0, \\ b_B^S = 0, & b_S^S = 4, & b_G^S = 0, \\ b_B^G = 0 & b_S^G = 1, & b_G^G = 1. \end{matrix} \qquad p_2: \begin{matrix} b_B^B = 1, & b_S^B = 0, & b_G^B = 0, \\ b_B^S = 1, & b_S^S = 3, & b_G^S = 0, \\ b_B^G = 0, & b_S^G = 1, & b_G^G = 1. \end{matrix}$$

$$p_3: \begin{matrix} b_B^B = 0, & b_S^B = 1, & b_G^B = 0, \\ b_B^S = 2, & b_S^S = 2, & b_G^S = 0, \\ b_B^G = 0, & b_S^G = 1, & b_G^G = 1. \end{matrix} \qquad p_4: \begin{matrix} b_B^B = 1, & b_S^B = 0, & b_G^B = 0, \\ b_B^S = 1, & b_S^S = 3, & b_G^S = 0, \\ b_B^G = 1, & b_S^G = 0, & b_G^G = 1. \end{matrix}$$

$$p_5: \begin{matrix} b_B^B = 1, & b_S^B = 0, & b_G^B = 0, \\ b_B^S = 2, & b_S^S = 2, & b_G^S = 0, \\ b_B^G = 0, & b_S^G = 0, & b_G^G = 2. \end{matrix}$$

We will substitute the given values in the formula (1) and will calculate the proper estimations of importance:

$$W(p_1) = \frac{1}{7}(\max(b_B^B, b_B^S, b_B^G) + \max(b_S^B, b_S^S, b_S^G) + \max(b_G^B, b_G^S, b_G^G)) = \frac{1}{7}(0+4+1) = \frac{5}{7};$$

$$W(p_2) = \frac{1}{7}(\max(b_B^B, b_B^S, b_B^G) + \max(b_S^B, b_S^S, b_S^G) + \max(b_G^B, b_G^S, b_G^G)) = \frac{1}{7}(1+3+1) = \frac{5}{7};$$

$$W(p_3) = \frac{1}{7}(\max(b_B^B, b_B^S, b_B^G) + \max(b_S^B, b_S^S, b_S^G) + \max(b_G^B, b_G^S, b_G^G)) = \frac{1}{7}(2+2+1) = \frac{5}{7};$$

$$W(p_4) = \frac{1}{7}(\max(b_B^B, b_B^S, b_B^G) + \max(b_S^B, b_S^S, b_S^G) + \max(b_G^B, b_G^S, b_G^G)) = \frac{1}{7}(1+3+1) = \frac{5}{7};$$

$$W(p_5) = \frac{1}{7}(\max(b_B^B, b_B^S, b_B^G) + \max(b_S^B, b_S^S, b_S^G) + \max(b_G^B, b_G^S, b_G^G)) = \frac{1}{7}(2+2+2) = \frac{6}{7}.$$

Consequently we can draw a conclusion, that the most competent expert is – p_5, which got the most estimation. All other experts have an identical competence – $(p_5, p_1, p_2, p_3, p_4)$.
Thus, we can reduce the subjectivity of experts, which will result in lower business risk.

Conclusion

The result of the performed scientific research is a mathematic model of expert competence rating, which is based on the necessity of vague Boolean argument rating. This model allows to make administrative

decisions, to decrease business risks and to increase the recourse administration safety by knowing the chosen experts competence. It's a new approach, which has a high adaptive possibility for different spheres of application in business.

This model can be used for taking more adequate decisions in different financial institutions, which have an opportunity to form a criteria set, supplement it, to define the limit of criteria ratings and to install own term-set level.

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