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Solution for the investment decision making problem through interval probabilities

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Abstract

Decision making theory further improved in the modern world. However the decision making theory, based on classical probability is not considered promising now. Interval decision making problem through probabilities provided in intervals is based on interval computation.

We have solved the investment decision making problem through probabilities provided in intervals in this article.

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Keywords: decision making; imprecise probability; interval probability; interval result

1. Introduction

Investment is capital expenditures in various areas and spheres of economy, including in entrepreneurship activity. Stable economic development causes revival of the investment environment. Such situation ensures not only growth of long-term investments, but also creates opportunity for application of advanced management methods in investing process for strengthening competitiveness[1].

Investment processes aim to cumulate financial reserves in the spheres and directions ensuring speeding up scientific-technical progress by taking into consideration acquiring and marketing the innovations[2]

The main goal of the investment process in any type of the investment activity is to gain income. The basis of the investment management is to maximize income to be gained by an investor and minimize capital expenditure risks.

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Upper and lower levels as well as range of intervals are considered while applying rational and natural ranging method of the alternatives based on the principle of superiority in the multi-criteria decision making process with intervals[4].. Imprecise probabilities are widely applied when impreciseness differs from variability.

Imprecise intervals are used for estimating reliability based on generalized intervals in this case[5]. The suggested method is applied to the investing problem. The obtained results prove reliability of the proposed method for investment decision making process.

1.1. Setting the problem

If $p_1, p_2, ..., p_n$ probabilities are known for various cases, it's possible to choose such T_i solution that the expected benefit of $C_i = p_1 C_{i1} + ... + p_n C_{in}$ function for it will be the highest. Quantity of C_{ij} will cause solution of T_i in S_j case. We are given $P_j = \left[P_j^-, P^+{}_j\right]$ probability intervals, but not precise p_j probabilities in real situations.

However real situations are usually accompanied by uncertainty. The methods enumerated are impossible to be applied in this case.

We will consider the information in decision making environment through imprecise figures, i.e. figures given in certain intervals in this article.

One of the important issues in decision making is to choose the best out of the alternatives given. If quantities of criteria and probabilities are provided for the alternatives, then

$$C_i \to \max$$

will be chosen.

Probabilities for various cases should be known for choosing the best alternative.

2. Definitions

Definition 1. Interval probabilities[5]

When we say P, we consider $P = \left[P^-, P^+\right] \subseteq [0,1]$.

Definition 2. Sequence of interval probabilities[4]

If $P_1 \in P_1, ..., \mathrm{P}_n \in P_n$ quantities exist, then we consider sequence of probabilities as $P_1, ..., \mathrm{P}_n$.

If $P_1 + ... + P_n = 1$, then one operation will be carried out based on average quantity of probability intervals. The operation is carried out as follows:

$$C\left(\left\langle\left[P_1^-, P_1^+\right], C_1\right\rangle, ..., \left\langle\left[P_n^-, P_n^+\right], C_n\right\rangle\right) = \tilde{P}_1 \cdot C_1 + ... + \tilde{P}_n \cdot C_n \; [1]$$

If $$\tilde{P}_j = \frac{\sum^+ - 1}{\sum^+ - \sum^-} \cdot P_j^- + \frac{1 - \sum^-}{\sum^+ - \sum^-} \cdot P_j^+ \; [2]$$

$$\sum{}^- = P_1^- + ... + P_n^- \; [3]$$

and $$\sum{}^+ = P_1^+ + ... + P_n^+ \; [4]$$

Definition 3. Superiority of intervals

$$d(I, J) = \begin{cases} \dfrac{\overline{I} - \overline{J}}{\left|(\overline{I} - \overline{J}) + (\underline{I} - \underline{J})\right|}, & \overline{I} > \overline{J},\ \underline{J} > \underline{I} \\ 1, & \overline{I} = \overline{J},\ \underline{I} > \underline{J} \text{ or } \overline{I} > \overline{J},\ \underline{I} \geq \underline{J} \text{ or } \overline{I} = J,\ \underline{I} = \underline{J} \\ 1 - d(J, I), & \text{otherwise} \end{cases}$$