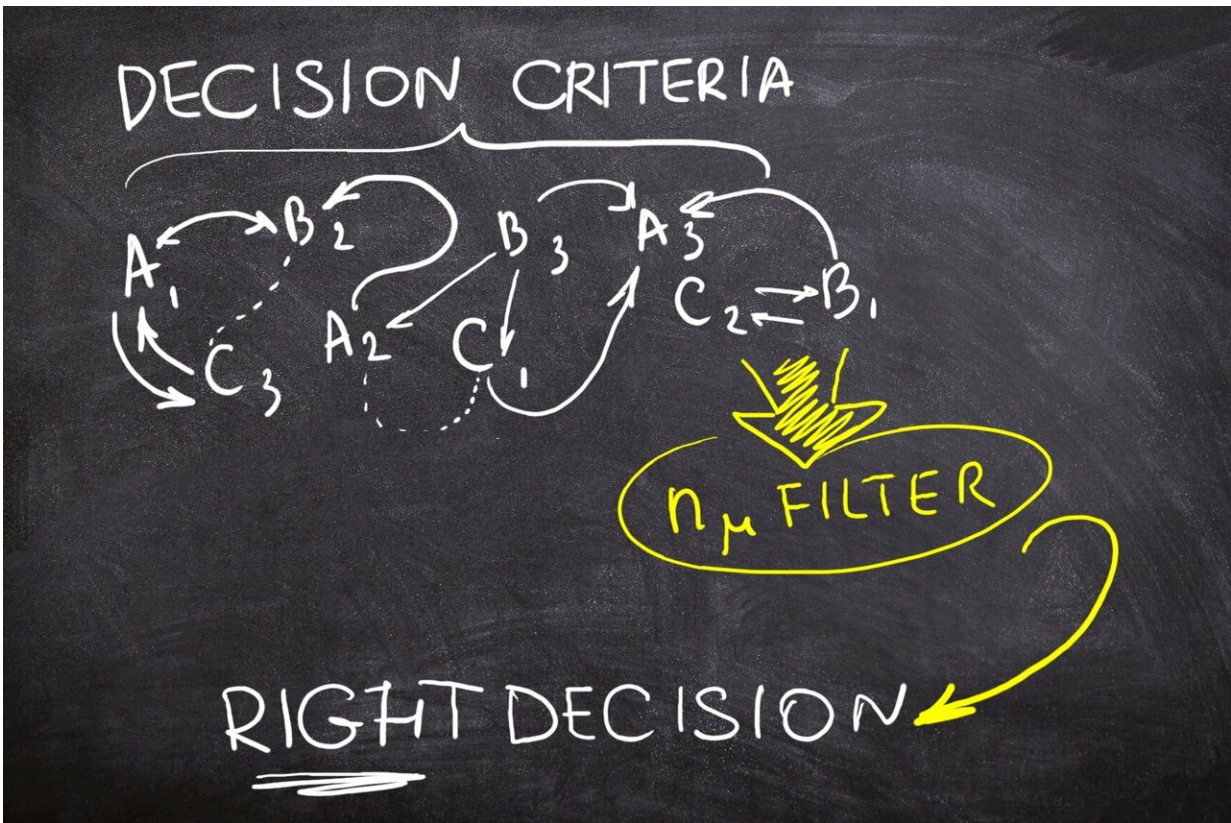


A balanced filter for making optimal decisions

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Credit: Natalia Deryugina

A RUDN mathematician has suggested a method of evaluating the level of nonadditivity in a choice problem, i.e. to calculate how the parameters of the choice are connected to each other, and how it influences the end

result. The study provides a method to analyze such systems and find out the most optimal decision by means of calculations. The work was published in *Information Sciences*.

Decision-making is an integral part of our daily lives. We decide what to have for dinner, which shirt to put on, or which movie to watch. These are relatively easy decisions, but some are much more difficult—for example, buying a car or making an analytical report. In this case, people employ big data sets, use a number of criteria based on their preferences, and finally decide on an optimal solution. The same process takes place on a higher level in private and state organizations when they determine the site for a [nuclear power plant](#) or select a new drug to treat a dangerous disease. Even a minor error can cost millions of dollars and thousands of human lives. Therefore, it is important to perfect the decision-making algorithm.

Systems with multiple criteria have a peculiar feature called nonadditivity. It means that the final weight of all selection criteria is not equal to the sum of weights of each individual criterion added up together. This happens because the criteria are connected to each other. Today's mathematical methods for analyzing such systems are unable to correctly evaluate the obtained results. RUDN mathematicians now suggest a more efficient way of solving this problem.

"Multi-criteria decision analysis helps make justified decisions in complex situations involving big volumes of initial data. In the course of this process, we face the phenomenon called nonadditivity of capacity. When several criteria apply, the end result may alter considerably due to their interplay. We suggest using a nonadditivity index that takes possible influence on the result into account and evaluates it," says Gleb Belyakov, a visiting professor from RUDN.

Traditionally, the index used in multi-criteria decision analysis is the

index of cooperation. However, it doesn't always take into account the overlap of criteria or their replacement, or expression of these phenomena. It becomes difficult for a decision-making specialist to evaluate the actual value of the obtained results and to interpret them correctly. The index suggested by the RUDN mathematician is free of this disadvantage: it shows not only the type but also the level of nonadditivity.

"We suggest an alternative approach to describing the preferences set out by criteria. We showed on examples that the method could be used for developing a transparent and flexible model, a so-called decision-making filter. The values of the nonadditivity index may be limited to a certain range. This will not reduce its efficiency but will make the comparison of calculation results much easier. In our future studies, we will focus on the application of the nonadditivity index to real, practical tasks, and on the development of support instruments for [decision-making](#) based on the [index](#)," concludes Gleb Belyakov.

More information: Jian-Zhang Wu et al. Nonadditivity index and capacity identification method in the context of multicriteria decision making, *Information Sciences* (2018). [DOI: 10.1016/j.ins.2018.08.007](https://doi.org/10.1016/j.ins.2018.08.007)

Provided by RUDN University

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