Product report: Deep Qualicision connects the decision engine Qualicision with neural networks

Learning how to set systems

Deep Qualicision connects the decision engine Qualicision with neural networks. This solution concept efficiently learns to adjust parameters so that decisions as consistent as possible can be modelled.

In general, Deep Qualicision can be used to determine multi-criteria rankings efficiently on the basis of individual rankings, consistently taking into account the goal conflicts in business processes to be optimised. Deep Qualicision learns the priorities of the criteria so that consistent priorities are automatically recommended for any sequences of decisions.

Software-based connection between rankings and goal criteria

Deep Qualicision thus enables a deeper software-based connection to be established between the rankings and the goal criteria. The following example of a purchase decision illustrates the principle behind Deep Qualicision:

The decisions to be modelled here are about creating a ranking of decision alternatives on car types in such a way that the ranking fulfils as many of the desired criteria as possible.

The selection of car types includes compact car, coupé, cabriolet, sedan, limousine, minivan, large capacity car, sports car and cross country. The criteria that are important in the decision example are low price, high power, low fuel consumption, family-friendliness, high prestige and low running costs (see also Fig. 1).

Decisions by rankings

If a purchasing decision maker ranks the car types above then certain criteria are connected to the ranking as individual decision goals that are implied by the ranking of car types (consciously or unconsciously). Other goals may therefore be either indirectly negated or ignored.

For example, a ranking with the compact car and the large capacity car in the first two places tends towards low price and low fuel consumption, and probably slightly towards family-friendliness. Rankings that prioritise the sports car and the cabrio-

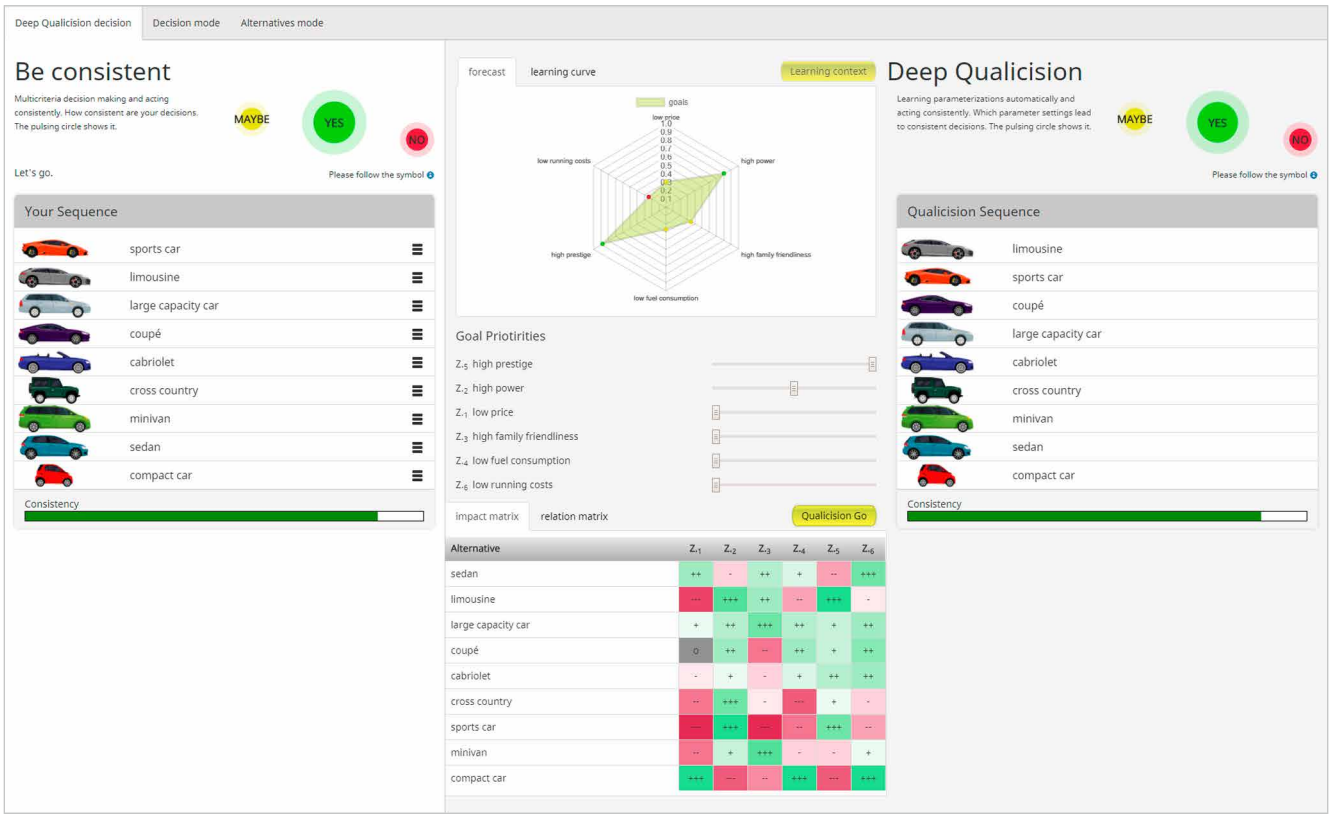

Fig. 1: Decision-making rankings with multi-criteria consistency.

let are more inclined towards high power and perhaps the desire for a little more prestige, while ignoring the low price criterion. In this case, the low price goal is even negated to a certain extent.

Purchase decision alternatives and purchaser preferences

The correlations between the car types as purchase decision alternatives and the criteria can be represented easily for each criterion when sorted (on a single-criterion basis) by purchaser preference. On the other hand the interaction of the criteria in groups is much more difficult due to the wide range of options.

For the nine decision alternatives in this example, there are already 9! = 362,880 options available that, with six criteria, can be represented in 6! = 720 sequences of criteria, if we assume an equally decreasing sequence of criteria.

Consistent rankings despite high degree of complexity

It immediately becomes clear that this can be even more complex if we consider that some criteria can be equally important and that the strength of the equal weighting can differ. For example, if the criteria are completely excluded in the sequences of adjustments, then there are already 1956 options.

In this scenario it is not easy for the human mind to keep track and map out consistent rankings. However, the use of Qualicision makes it possible to take the single-criterion rankings, i.e. rankings that only sort the decision alternatives by exactly one of the criteria in each case, and efficiently calculate approx. 300 rankings on a multi-criteria basis so that the goal conflicts are balanced in the most consistent way possible.

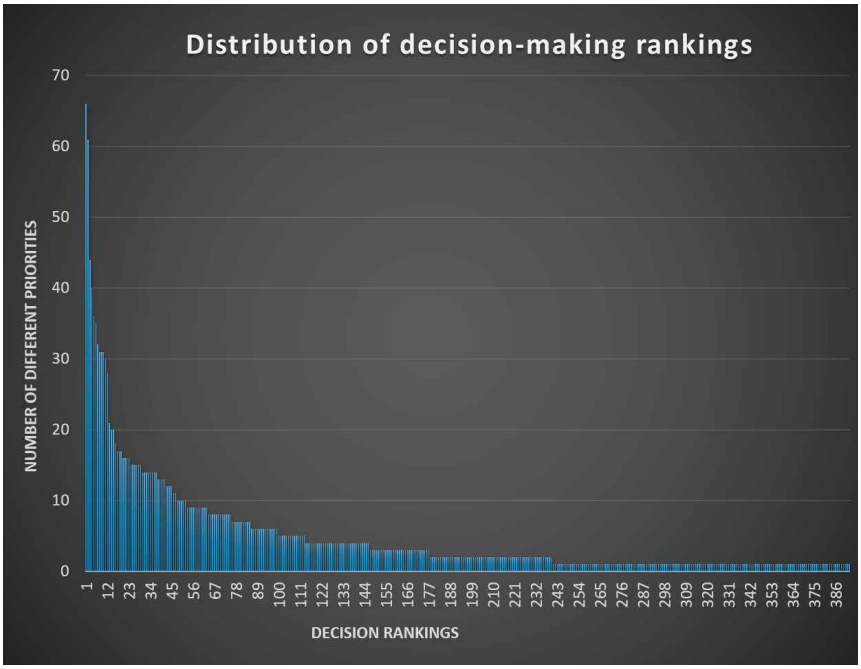

Fig. 2: Distribution of decision-making rankings.

Goal conflicts require decision-making intelligence

The fact that the goal conflicts are not equally distributed per se and thus require decision-making intelligence can be seen in the distribution of decision-making rankings in relation to the priorities of the decision-making criteria (see Fig. 2).

As a result, for individual goal priorities Deep Qualicision provides learned priority allocations that match the goal conflicts and synchronisms and are therefore consistent priority allocations for the goals in the example.

Deep Qualicision offers a broad range of applications

Deep Qualicision offers a broad range of applications: The prospect is that future optimisation solutions based on Qualicision that use Deep Qualicision will be able to learn their own parametrisation automatically. The work towards achieving this goal is well under way.

The long-term goal is for the Deep Qualicision principle to be used not just to identify interdependencies automatically in the input data of the business processes that Qualicision already optimises but also to learn targeted Deep Qualicision adjustments of the goal priorities automatically from representative input data.

Self-adjusting optimisation processes

By the targeted method Deep Qualicision will therefore be able to handle self-adjusting optimisation processes with consistent decision-making even when configurations of process input data are widely varied. Such a solution is required for example when optimising production sequences on the basis of ever-changing order quantities and compositions.

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