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Complete AI Stack with Qualitative Labeling and Qualicision

Deep Qualicision AI Framework

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Complete AI Stack with Qualitative Labeling and Qualicision

Deep Qualicision AI Framework

We developed the Deep Qualicision AI Framework to make influencing and customizing AI applications possible for more than just data analysts. Both users with a wide-ranging knowledge of business processes—but without AI expertise—and, as usual, data analysts can use the new software product. The improved explainability of AI applications is another novel advantage of the framework.

What makes the Deep Qualicision AI Framework unique is a machine learning and decision-making process based on the automated detection of KPI goal conflicts in both input data and data generated by machine learning. Using the Qualicision decision engine's goal conflict analysis, this data is ordered and labeled automatically. The Deep Qualicision algorithm then independently identifies how to proceed in different situations so that decisions and predictions match the data patterns in the best possible and consistent way.

The framework includes the decision engine and a complete stack of standard AI techniques that can be combined with Qualicision. Using the KPI analysis mechanism, decisions, analyses, and predictions generated via standard AI processes can be given an explainability comprehensible at the application level. As a result, users, especially key users who have process knowledge but are not necessarily data analysts, can also operate and configure AI systems created using the framework.

Qualicision as an Automated KPI-based Explanation Machine

At the same time, any Qualicision solution can be used as a KPI labeling machine and for implementing

AI learning strategies. By systematically translating data into so-called impact matrices new perspectives emerge for the explainability of AI analyses and results and thus for a more understandable use of AI procedures in business processes.

Figure 1: GUI elements of user group 1.

Three Main User Groups

The framework distinguishes between three main user groups: Preconfigured systems provide KPI-oriented, comprehensibly prepared recommended actions for users who rely exclusively on process knowledge and can incorporate the results into their business processes and continue using them there. Accordingly, this first user group acts in the sense of system operators.

By confirming or modifying actions (Yes, No, Another, and with a value suggested by the user), the users of the first group already generate important feedback information for the AI application, which, logged as time series, represent input for the rolling application training. The application is continuously monitored and improved in a self-learning manner (see Figure 1).

The second user group can be described as key users who can also configure and parameterize the operated application, and modify and expand it on the process KPI level. For this user group, the explanation mechanisms are available with KPI impact analyses, with the visualization of KPI relations, and the compatible preference relations that can be automatically learned and derived from them (see Figure 2).

For example, the F9118 learning algorithm[1] enables the automated computation of consistent solution and decision alternatives that combine historicized data relations with current data situations. The decision options are prepared so that the user acts like a Java-based PSI click designer. He works in the framework by clicking and navigating selection menus and other graphically designed GUI elements. Nevertheless, the key user configures his AI application, adjusts the sensitivity of the procedures, and couples the results of the KPI analysis back into the design of the application. However, without working at the code level as a programmer.

This way of working is intended for the third user group of the Deep Qualicision AI Framework. This can be described as the user group of data analysts. This group is provided with a complete AI stack in the framework and is also provided with all Qualicision and Deep Qualicision functionalities via appropriate Python imports and Jupyter notebooks. This allows the group to access all user roles mentioned so far and also to implement new applications independently. In this context, the Qualicision explanation mechanisms provide crucial support, as they simplify the insight into how the results are obtained, even for data analysts (see Figure 3).

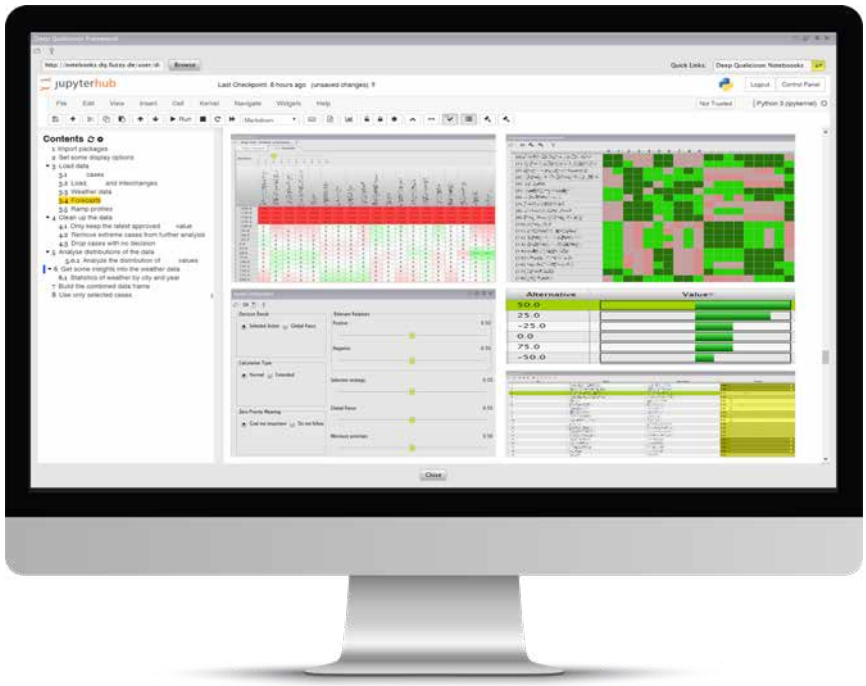

Figure 2: GUI elements of user group 2.

Easy Access

From the customer's perspective, getting started with the AI framework is as simple as can be. It usually begins with preconfigured applications and the support of experienced Qualicision experts. For example, suppose that in the first step an analysis of potential or feasibility is to be conducted. In that case, besides providing relevant data it is only necessary to specify the key performance indicators and criteria (KPIs) according to which the quality of the results is to be evaluated and, if necessary, optimized[2].

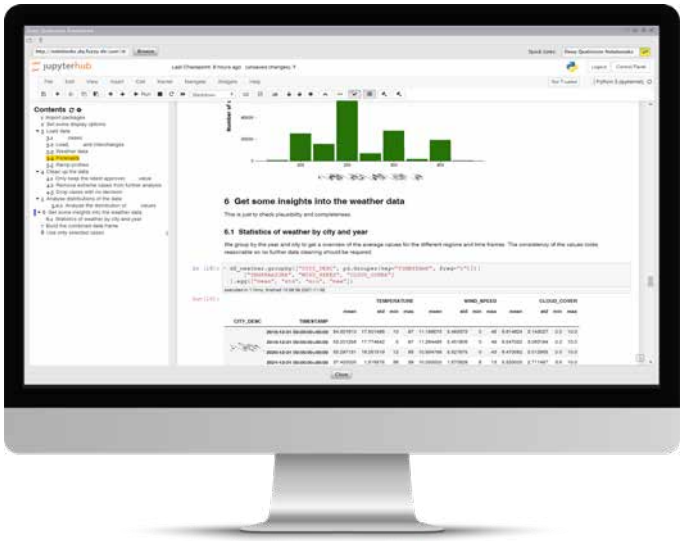

Figure 3: GUI elements of user group 3.

Framework Applicable to All Levels of Business Processes

Classic KPIs here are, for example, efficiency criteria such as deadline compliance, utilization of resources, or the availability of capacities and materials. In analysis and diagnosis scenarios, KPIs are used to evaluate the patterns in the business process data, for example, to describe out-of-spec criteria.

The framework can be used for all levels (Level 1 to Level 5) of business processes. In addition to classic data such as sensor or machine data, higher levels up to process planning and design as well as process or product quality features can be processed. Examples of data from higher process levels are KPI criteria such as employee satisfaction, homogeneity of resource utilization, or process stability. In addition, there are product variance assessments, order structure scattering, and the development of the KPIs above over time, also in terms of the usability of historicized data time series.

Business Process Data Enhanced by KPI Labels as Input

Deep Qualicision AI means that, in addition to the classic components of an AI stack, descriptions of KPIs are included that provide prediction business process-related qualifications of the raw data. If the raw data of the business process is then available, it is qualitatively labeled and thus processed and fed to further AI analyses. Qualitative Labeling and data handling can be performed in the framework depending on the user role.

The basic structure of the GUI elements and the components of the corresponding user roles are shown in Figures 1, 2, and 3. The GUI layouts show interface examples for the different user roles.

Predictor as Part of the Framework

Combining Qualicision with existing machine learning (ML) methods already improves the explainability of results of both ML and other AI applications.[3]

In addition, the Deep Qualicision AI Framework contains a new development, a special generic prediction algorithm that can be explained at the process level, the Qualicision Predictor (Q-Predictor). It is based on decisions made by the core algorithm using goal conflict analysis and modeling with impact matrices.

The Q-Predictor calculates prediction decisions in the same way as Qualicision calculates general decisions. Accordingly, the predictions can be visualized point by point in the respective composition of the prediction decisions via the user's GUI and are understandable from the perspective of the respective data points even for those familiar with the process knowledge at the business process level.

Compared to classical approaches such as Gradient Boosting, it delivers comparably good results. Still, it has clear advantages in terms of the explainability of the predictions and the ability to be influenced by the user. The decisions can be visualized and understood or even re-parameterized by key users. This means that they can directly influence the Q-Predictor without having to program as data analysts at the AI code level.

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(2) Production Manager 4/2017
(3) Production Manager 1/2020

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