Best Practice

Predictive analytics in project management: Preventing problems before they arise.

Campana Schott

Time delays, budget overruns, increased resource requirements: there are many reasons why projects get out of hand. With the help of machine learning, companies can make use of current project management data to detect possible undesirable developments in real-time and correct them at an early stage.

Predictive analytics is not a completely new topic. Especially in the area of industry 4.0, machines are already being monitored in many places today with the aim of predicting possible errors or repair cases. This is achieved by using sensors, which permanently check the current performance data. Even small deviations or fluctuations that have been found represent indications of potential problems in the future. In this way, companies can plan at what point in time they take the machine out of the production process and repair it. As a result, production disruption is reduced to a minimum and the error can be rectified before having a negative impact on the manufactured goods.

Deployment scenarios are growing rapidly

According to IDG's latest study "Predictive Analytics 2018", two-thirds of the companies report that targeted data analyses have great potential in their business segment. Almost 60 percent are satisfied with the results of previous predictive analytics projects. 94 percent of companies use them to make better business decisions, especially in the areas of IT, management and production. There are, however, many further application scenarios. These include recommendation algorithms in online shops and streaming platforms, speech recognition and generation in smart home systems or image recognition in medical diagnostics.

The use of predictive analytics in project management is not very common yet, but is currently on the rise. Particularly in this area, the approach can help to overcome many challenges. Above all, this includes keeping the projects within scope, time and budget. The constant examination of whether the project is still on the right path to reach the essential goals is considered an important case of application, too.

There is data, but the mindset is (still) missing

Although the required data is generally available, predictive analytics have hardly ever been applied in project management so far. What is lacking is a big data mindset, hence the willingness to use large amounts of data in decision-making. Yet that is precisely what is important. The global project management survey by PMI confirms that conventional methods have not significantly improved the success rate of projects in recent years.

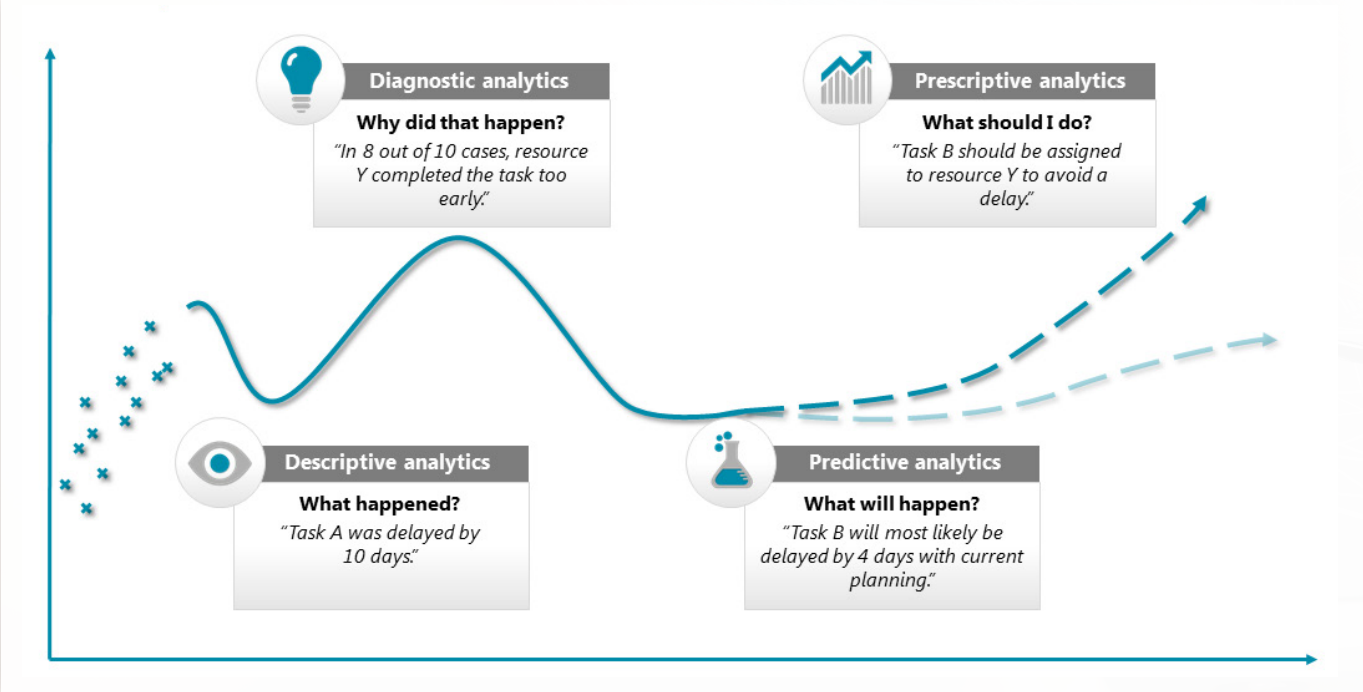
Big data analyses bear great potential in project management as the amount of general and project-related data in a company is increasing rapidly. At the same time, cloud storage and computing capacities are becoming easier and cheaper to access. These scalable solutions, some of which free of charge, create ideal conditions for initial use cases and proof-of-concepts. This enables enterprises to test in manageable scenarios how data analyses can be used within project management. Also, the ongoing technologization and digitization of the entire project management cycle – from portfolio management to lessons learned – has led to numerous synergies.

The four steps of machine learning

An important prerequisite for advanced big data analyses and predictions based on them is machine learning. Four levels can be defined:

1. **Descriptive analytics:** analysis of the actual state without linking data points
2. **Diagnostic analytics:** recognition of patterns in data allows to draw conclusions regarding the causes of past developments, but tells nothing about future trends
3. **Predictive analytics:** updating recognized patterns into the future
4. **Prescriptive analytics:** concrete recommendations based on the recognized patterns in order to achieve a pre-defined goal

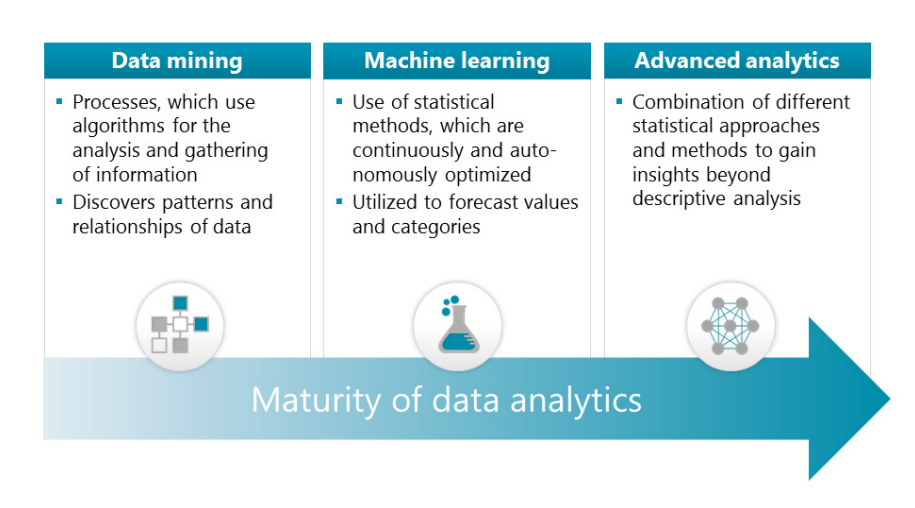
Machine learning must be clearly distinguished from data mining and advanced analytics. **Data mining** describes processes with the goal of recognizing data patterns and relationships. **Machine learning** makes use of data mining and complements it with statistical methods, which are optimized semi-automatically by the computer. These learning processes are used to make predictions about unknown or future values. **Advanced analytics,** on the other hand, is a collective term that combines methods from machine learning and both descriptive as well as diagnostics analytics. Due to that, a company's data pool can be used holistically, thereby supporting the decision-making.



Development stages of Analytics: From Descriptive to Prescriptive

When using machine learning, enterprises frequently face a trade-off between the high accuracy of a forecast and its explicability. High-performance algorithms such as neural networks many times deliver better results, but usually work as black boxes. In other words, they offer little or no explanation on how a result came about, neither which factors were involved nor to what extent.

With algorithms such as decision trees, decision processes can be graphically displayed in a transparent manner, making it easy to identify relevant input factors.



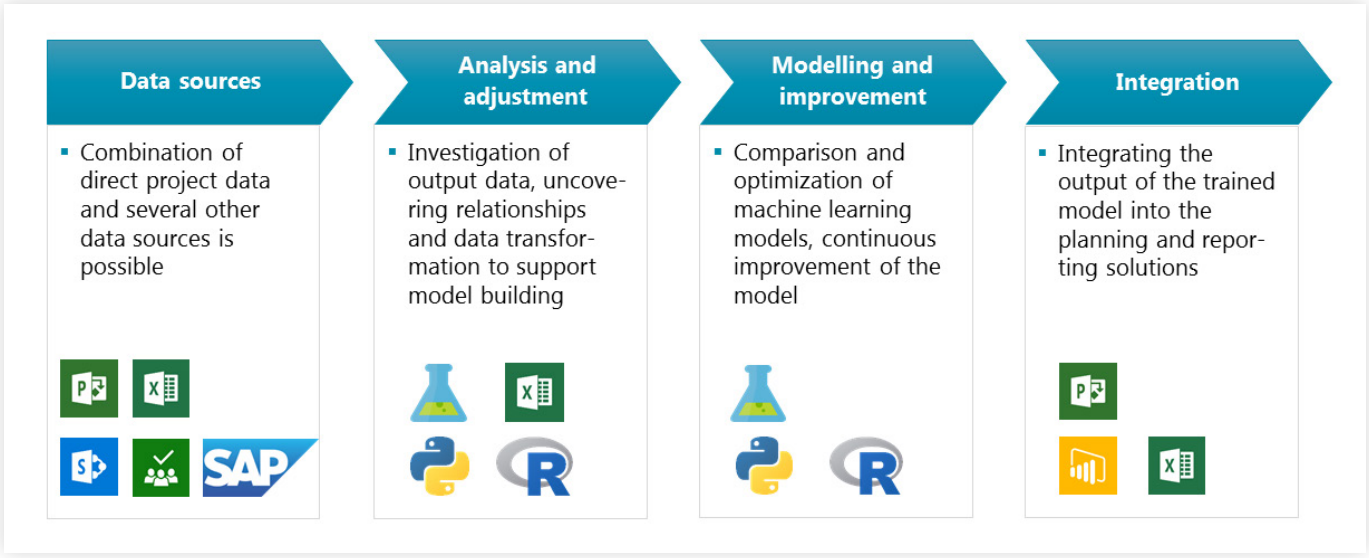
Machine Learning: The Core of the Data Analytics Maturity Level

Effort for data analysis decreases

As input data for predictive analytics in project management, companies can basically use all data sources for a machine learning model. The most important are, of course, the project management systems. Data that is only given in unstructured text form can be utilized by means of text mining. Natural Language Processing (NLP) reduces them to the most important core information and makes them categorizable at the same time. Even underlying moods can be analyzed (Sentiment Analysis) and made usable for project risk management, for instance. Moreover, information from external sources such as social media or websites can be integrated into the trend analysis.

Firms no longer need high initial investments, as many tools already offer support for machine learning models. Neither data storage in the form of a comprehensive data warehouse nor data lakes are necessary to implement the first use cases. An analysis and cleansing of the data can be done in Excel or directly in the machine learning environment. The Azure machine learning studio, for example, can be used for model creation.

First use cases can be implemented again without additional costs and without any other Azure services used. The results can then be integrated directly into project planning and reporting tools via a web interface.



Use and combination of existing technologies

Possible application scenarios

Machine learning can be used in numerous project management scenarios. The most important are probably the prediction of the duration and length of the project phases as well as the classification of risky tasks.

Predicting the duration of the project and the length of the project phases:

Based on the project metadata, the planned tasks and previous project data, a regression algorithm is used to predict the length of the project phases. Also during a project, these analyses can be continued based on the latest project information. Their results can be displayed in dashboards and reporting tools such as Power BI or Tableau.

Classification of risky tasks:

On the basis of data on used resources, similar tasks and further input, a task is classified as at risk of delay or on time using a random decision forest.
Risky tasks are marked accordingly in the project plan and in project dashboards. The project manager receives suggestions directly from his planning tool – such as Microsoft Project or Jira – for measures to address the hazard, for example alternative resources, including updated task duration.

Advantages

With the help of machine learning and predictive analytics:

- You receive valuable planning support and make your gut feeling quantifiable
- You uncover previously unrecognized relationships in your data and receive recommendations for action based on them
- You act preventively rather than limiting damage and increase your planning quality
- You benefit from an already existing data pool and low technological investments to launch initial deployment scenarios

Risky tasks are marked accordingly in the project plan and in project dashboards. The project manager receives suggestions directly from his planning tool – such as Microsoft Project or Jira – for measures to address the hazard, such as alternative resources, including updated task duration.

Conclusion

Machine learning will change many sectors and enable new applications in the coming years. Especially in project management, predictive analytics can provide an important basis for detecting and correcting possible undesirable developments at an early stage. For this to succeed, however, project managers must be prepared to use the amount of data in order to make decisions. Technical solutions for implementing first use cases or proof-of-concepts are usually available in form of scalable cloud applications at low cost.