

TERMS & DEFINITIONS

Analytics | Operations Research |
Mathematical Optimization |
Artificial Intelligence | Machine Learning

OPTANO
a KEARNEY company

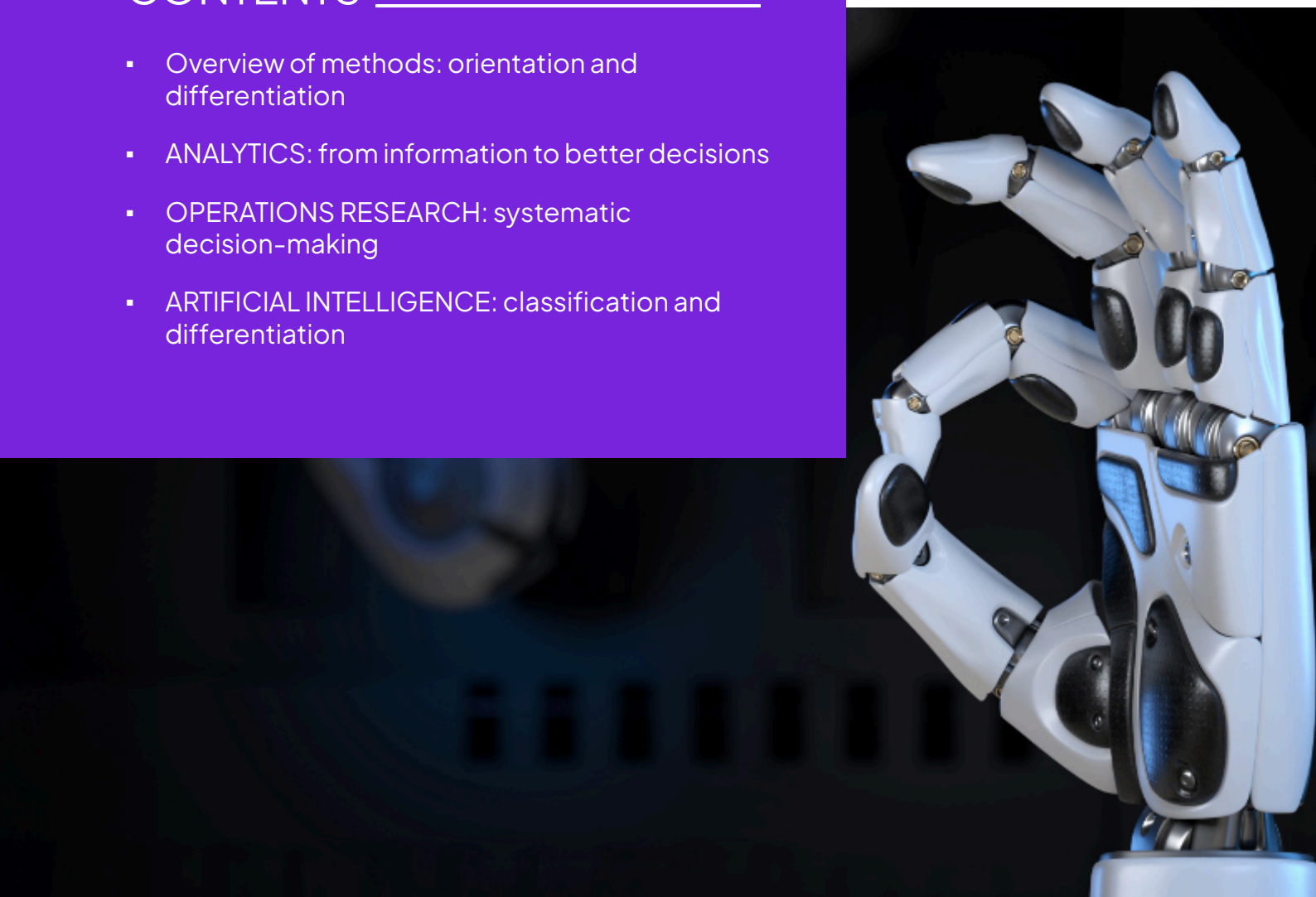
TERMS & DEFINITIONS: WHAT DOES IT MEAN?

In the field of mathematical optimization—where much of our daily work takes place—many terms are often used interchangeably, even though they are not always clearly defined. In this factsheet, our objective is not only to explain individual concepts, but also to illustrate how they relate to and interact with one another.

The selection of terms and application examples is shaped by our hands-on project experience. It is therefore not intended to be exhaustive, but instead focuses on the topics and use cases that are most relevant in our field of work.

CONTENTS

- Overview of methods: orientation and differentiation
- ANALYTICS: from information to better decisions
- OPERATIONS RESEARCH: systematic decision-making
- ARTIFICIAL INTELLIGENCE: classification and differentiation



FINDING YOUR WAY THROUGH THE TERMINOLOGY

The following terms shape our daily work and describe the methods we use to tackle complex analysis, planning, and decision-making challenges. Together, they cover nearly all aspects of data-driven decision support.

- Predictive, Prescriptive, Diagnostic, and Descriptive Analytics
- Operations Research (OR)
- Mathematical Optimization
- Simulation
- Heuristics
- Artificial Intelligence (AI)
- Machine Learning (ML)

Because many of these terms are used inconsistently in everyday practice, misunderstandings are common—especially when it comes to the interplay between analytics, artificial intelligence, and machine learning. These concepts are often treated as interchangeable, even though they address different questions and are based on distinct methodological approaches.

In the following sections, we aim to bring clarity: we structure the terminology, explain the differences, and show how these concepts work together in real-world applications.

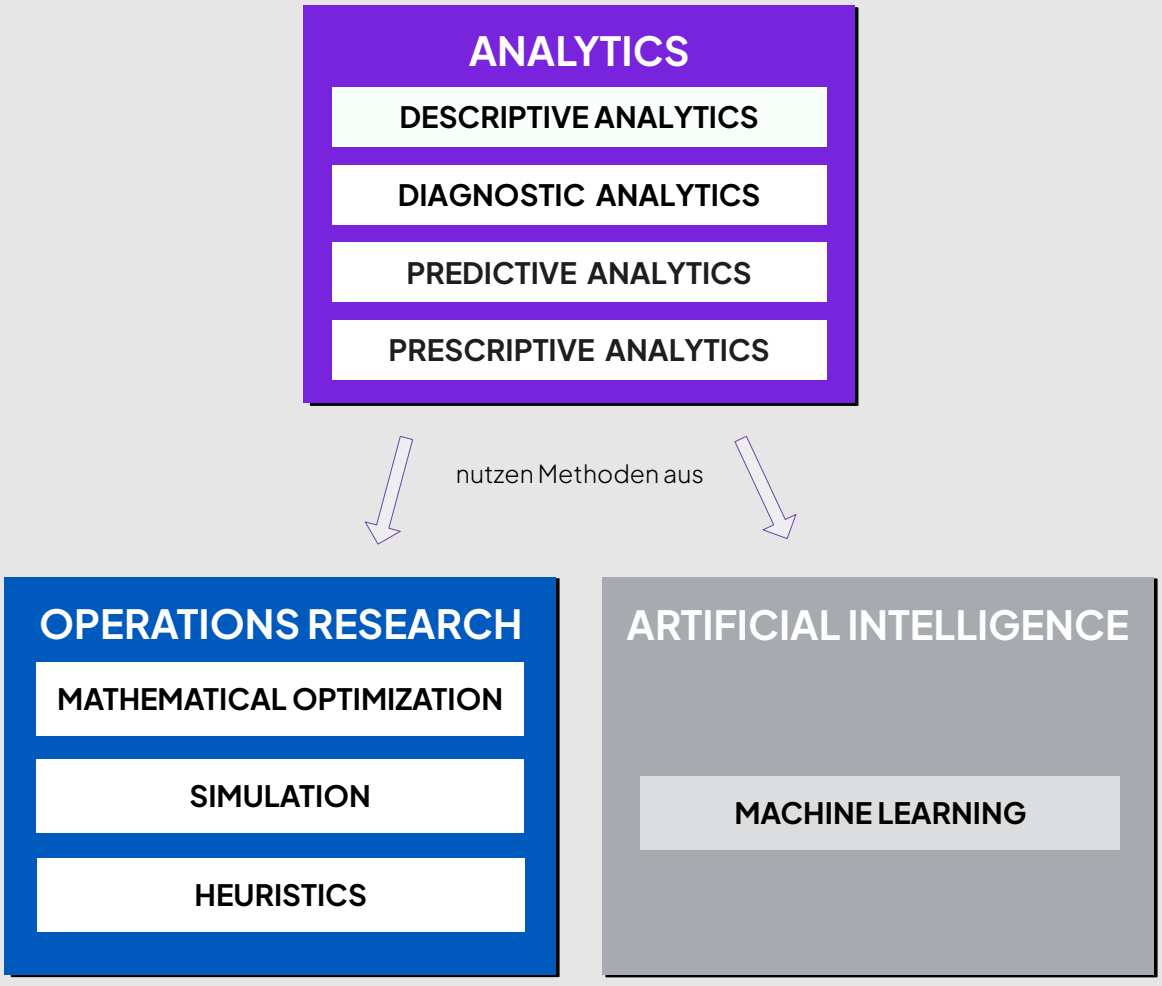


OVERVIEW OF METHODS: ORIENTATION AND DIFFERENTIATION

To provide clearer orientation, we have consolidated all previously introduced concepts into a single visual overview. The illustration is deliberately simplified and designed to highlight the fundamental relationships between the different methods.

Rather than going into detailed explanations, its purpose is to offer an initial structural understanding and a clear point of reference.

Building on this overview, the following sections explain the individual concepts in more detail, distinguish them from one another, and assign them to the types of questions they are typically used to address. This makes it clear what role each method plays, how they complement each other, and in which contexts they are most commonly applied.



ANALYTICS: FROM INFORMATION TO BETTER DECISIONS

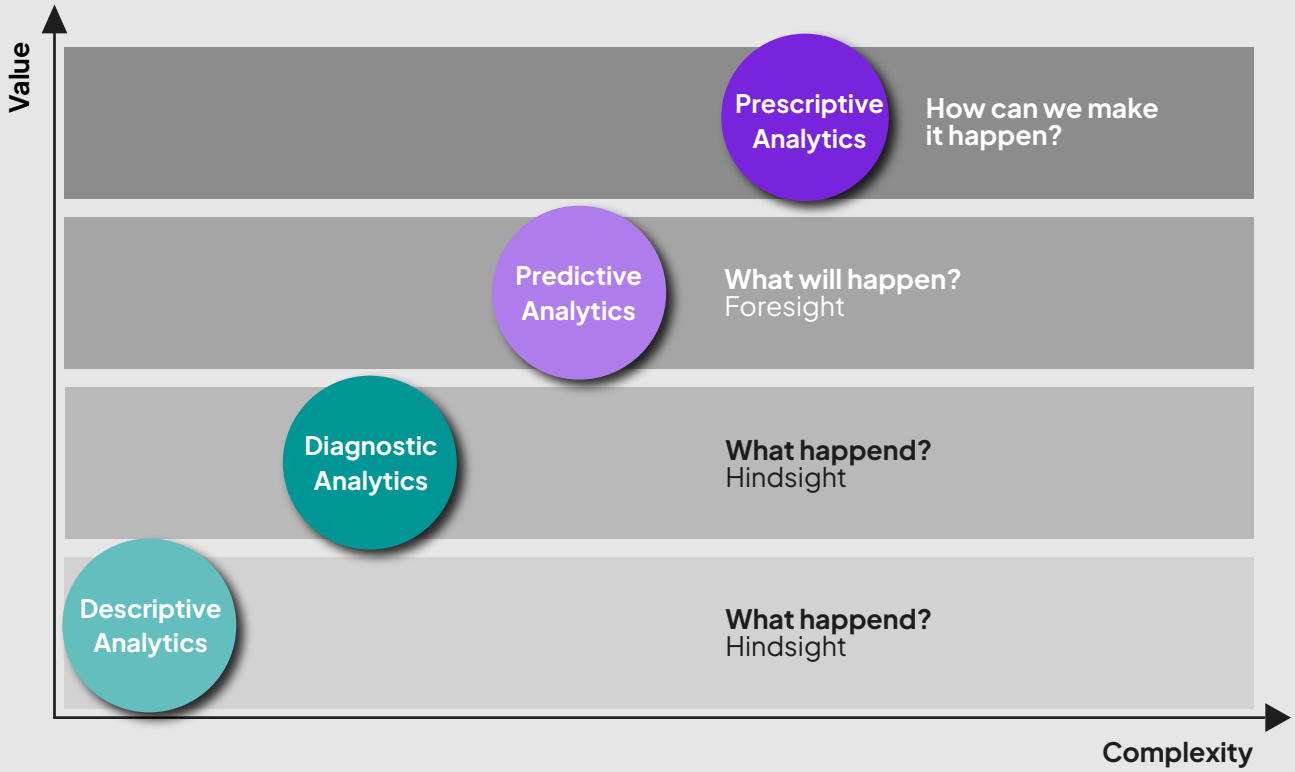
Analytics applies scientific and mathematical methods to analyze complex business systems with the goal of improving decision-making. Depending on the question at hand, methods from Operations Research are often used to support this process.

According to Gartner's analytics maturity model, four levels of analytics can be distinguished. They differ based on the type of question being addressed and the insights they deliver:

ANALYTICS

- **DESCRIPTIVE ANALYTICS**
- **DIAGNOSTIC ANALYTICS**
- **PREDICTIVE ANALYTICS**
- **PRESCRIPTIVE ANALYTICS**

- **Descriptice Analytics** provides insights into past events using historical data.
- **Diagnostice Analytics** explains why things happened and how they occurred.
- **Predictive Analytics** enables forecasts of future events.
- **Prescriptive Analytics** supports decision-making by recommending actions and measures.



THE FOUR ANALYTICS LEVELS ACCORDING TO GARTNER

DESCRIPTIVE ANALYTICS
WHAT HAPPENED?

Descriptive analytics summarizes past events. Data is processed to reduce complexity and results are presented in the form of reports, dashboards, and key performance indicators. Typical use cases include KPI reporting and condition monitoring.

DIAGNOSTIC ANALYTICS
WHY DID IT HAPPEN?

Diagnostic analytics analyzes historical data to identify root causes and relationships. Interpreting the results and deriving actions requires both domain expertise and methodological know-how. Typical applications include the analysis of operational disruptions and quality issues.

PREDICTIVE ANALYTICS
WHAT IS LIKELY TO HAPPEN?

Predictive analytics uses historical data to build models that forecast future events. Machine learning is often applied to generate more accurate predictions. These insights support early intervention and the optimization of business processes. Common use cases include resource planning and predictive maintenance.

PRESCRIPTIVE ANALYTICS
WHAT ACTIONS SHOULD BE TAKEN?

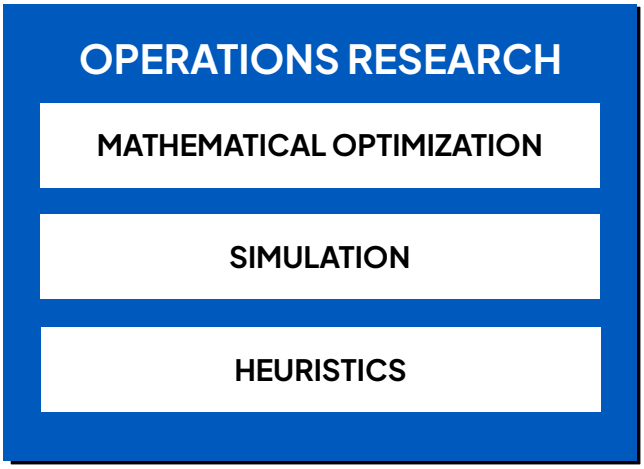
Prescriptive analytics derives concrete decision options and delivers directly actionable recommendations, often based on methods from Operations Research. It makes the impact of decisions on future outcomes transparent—for example in logistics and planning processes.

The four analytics levels build on one another: from describing and explaining past events, to predicting future developments, and ultimately to deriving concrete decisions and actions.

OPERATIONS RESEARCH: SYSTEMATIC DECISION-MAKING

Operations Research develops and applies mathematical methods to support decision-making processes. Commonly used approaches include simulation, heuristic methods, and—most importantly—mathematical optimization.

Typical problem types include sequencing, routing, and combinatorial optimization challenges. Even though these problems are modeled in an abstract way, the resulting solution approaches can be transferred to many real-world applications.



MATHEMATICAL OPTIMIZATION

The goal of mathematical optimization is to identify the best possible solution given a set of objectives and constraints. To achieve this, all relevant influencing factors are identified and represented in a mathematical model that simplifies the real-world situation.

A key challenge lies in selecting the right level of model complexity. Too much detail can make problems difficult or impossible to solve, while overly simple models may fail to deliver meaningful insights.

Based on the model, an appropriate optimization approach is selected. Depending on the problem structure and requirements, this may involve established algorithms, customized solution methods, or alternative Operations Research techniques such as heuristics.

SIMULATION

Simulation analyzes how outcomes change when specific decisions or boundary conditions are adjusted. It answers “what-if” questions—for example, what happens if a different route is chosen or an existing scenario is modified. Simulations are most commonly used in the context of predictive analytics.

HEURISTICS

Heuristic methods are applied when finding an optimal solution is either too complex or too time-consuming. They reduce the solution space in order to generate practical results within an acceptable timeframe. While heuristics do not always yield an optimal solution, they often deliver solutions that are highly effective in practice.

OPERATIONS RESEARCH APPLICATIONS IN PRACTICE

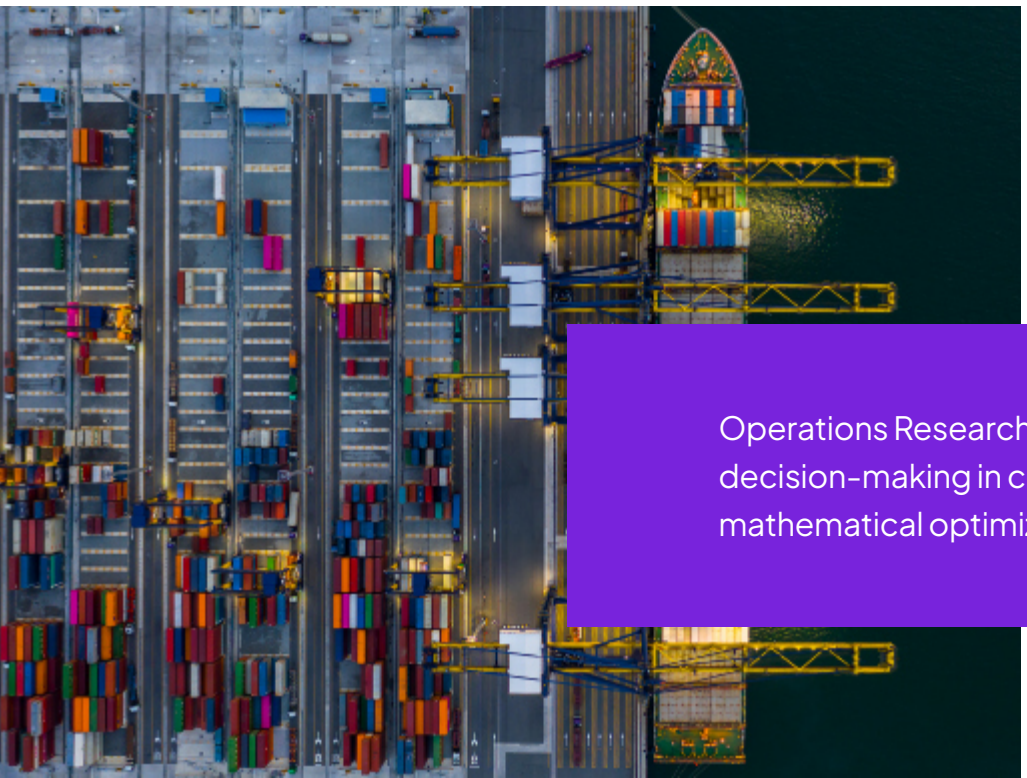
Methods from Operations Research—and in particular mathematical optimization—are deeply embedded in many areas of modern life. They often operate behind the scenes, yet are applied regularly across a wide range of use cases to support structured, transparent decision-making.

Whether it is route planning in navigation systems, dispatching and tour planning in transportation, or production and resource planning in companies, mathematical optimization helps manage complex interdependencies and systematically resolve conflicting objectives. Factors such as cost, time, capacity, and sustainability are often considered simultaneously.

Many of these decision problems are so complex that they would be difficult to address efficiently without analytical methods. Operations Research creates transparency, enables the comparison of alternative courses of action, and supports sound decision-making in complex, interconnected systems.

Optimization supports decision-making in complex systems.

Operations Research is often invisible—but highly effective.



Operations Research enables sound decision-making in complex systems through mathematical optimization.

OPERATIONS RESEARCH APPLICATIONS AT OPTANO

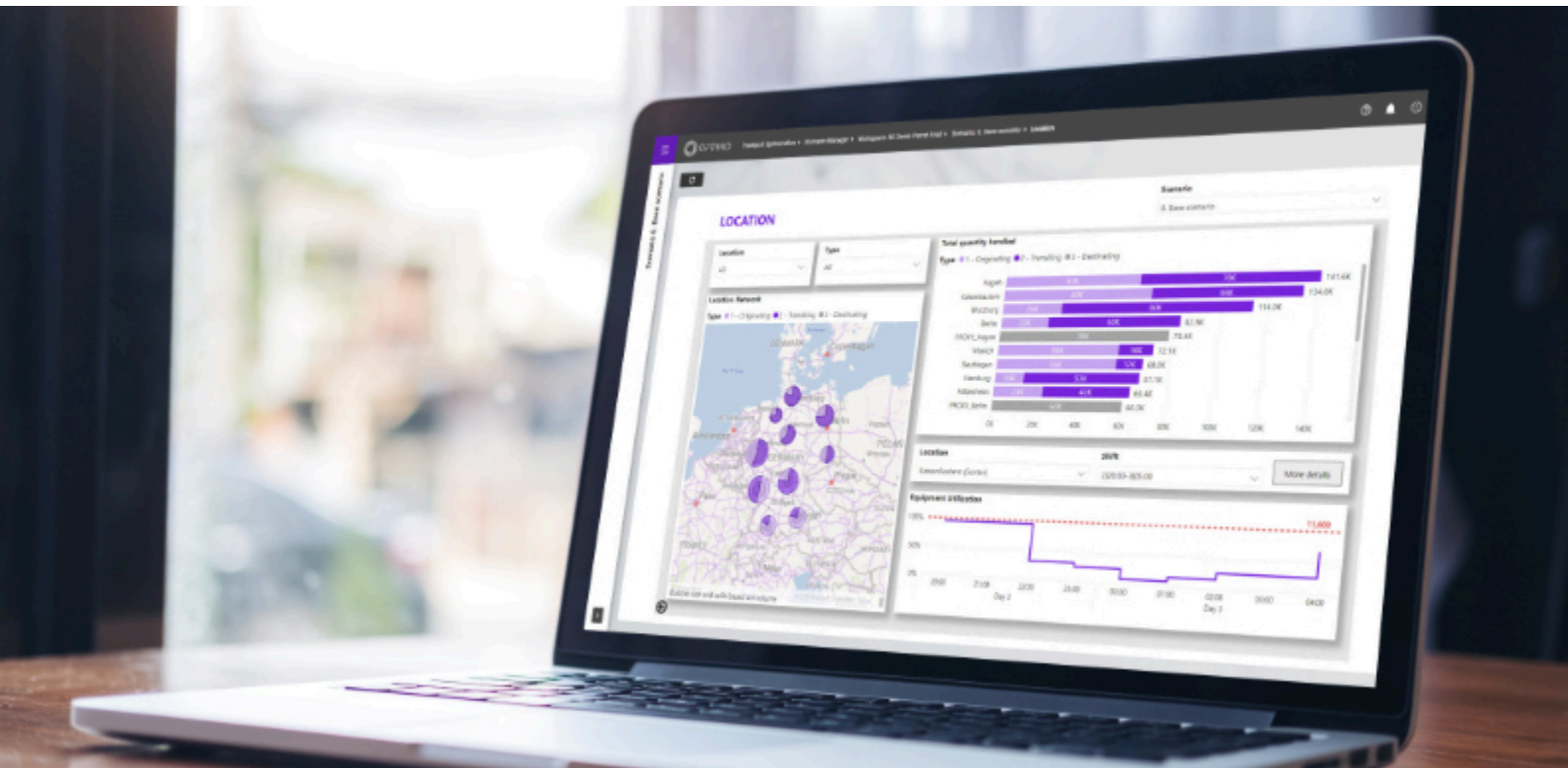
Operations Research forms the methodological foundation of OPTANO.

Mathematical optimization is at its core.

The application of mathematical optimization is the central pillar of the OPTANO solution. It enables complex decision problems to be solved in a structured way while accounting for numerous constraints and conflicting objectives. Depending on the specific use case, simulation and heuristic methods are applied as complementary approaches—for example, to model uncertainty or to generate practical solutions within acceptable timeframes.

At OPTANO, Operations Research specialists, mathematicians, and software engineers work closely together to translate mathematical models into technically sound, high-performance, and user-friendly applications.

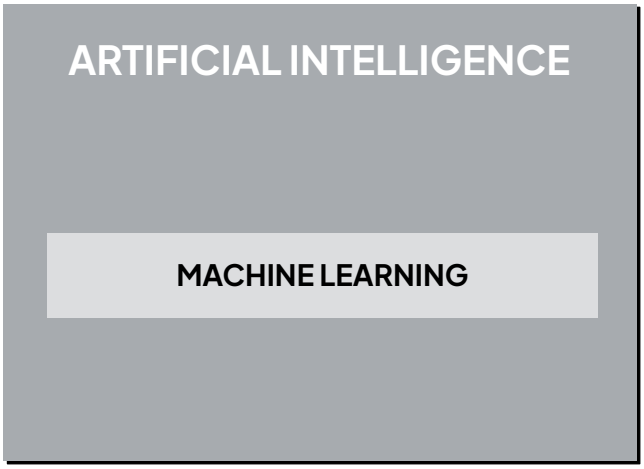
With OPTANO Modeling, OPTANO provides its own .NET API that allows mathematical optimization to be integrated directly into customers' software solutions. The goal is to flexibly embed optimization models into existing IT landscapes, use resources efficiently, and support well-founded, transparent decision-making in complex systems.



ARTIFICIAL INTELLIGENCE: CLASSIFICATION AND DIFFERENTIATION

In everyday usage, artificial intelligence and machine learning are not always clearly distinguished. However, many modern AI applications are in fact based on machine learning methods.

Because machine learning has the greatest practical relevance for business applications—and for OPTANO in particular—the following sections focus on this area.



MACHINE LEARNING

Machine learning describes methods in which systems derive models from data, identify patterns, and apply these patterns to new data. The focus is not on memorizing individual examples, but on learning relevant structures and relationships from large, heterogeneous datasets.

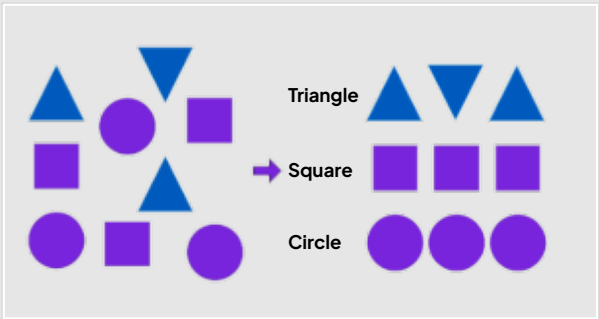
In general, a distinction is made between supervised and unsupervised learning. In addition, hybrid approaches such as semi-supervised learning exist, which differ in the type and amount of training information provided.

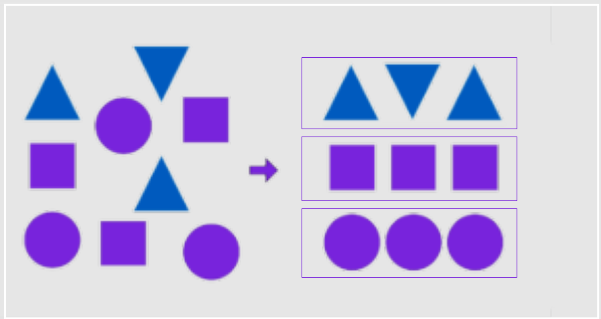
SUPERVISED LEARNING

In supervised learning, systems are trained using data with known target values. Based on this data, the model learns to correctly map inputs to outputs. Typical use cases include forecasting tasks, such as demand or cost predictions.

UNSUPERVISED LEARNING

In unsupervised learning, systems are provided with data without predefined target values. The model independently identifies patterns and structures—for example, for data segmentation or anomaly detection.





MACHINE LEARNING APPLICATIONS

Machine learning typically operates in the background.

It supports forecasting and pattern recognition.

Applications of artificial intelligence are often embedded behind the scenes, supporting analysis, forecasting, and decision-making processes in both everyday life and business environments. In this context, AI serves as an umbrella term for a wide range of intelligent system approaches.

Machine learning is a core component of many AI applications. It is used, for example, in image recognition, where algorithms identify objects, patterns, or structures in visual data, as well as in the automated analysis of large datasets and the detection of anomalies.

In industrial settings, AI based on machine learning is frequently applied to condition monitoring of equipment, failure prediction, and quality assurance. In addition, AI-based systems—so-called AI agents—are gaining importance. They use analytical results to prepare actions or to control processes.

Artificial intelligence enables well-founded decision-making based on large volumes of data.



Machine learning identifies patterns in data and supports forecasting across a wide range of applications.

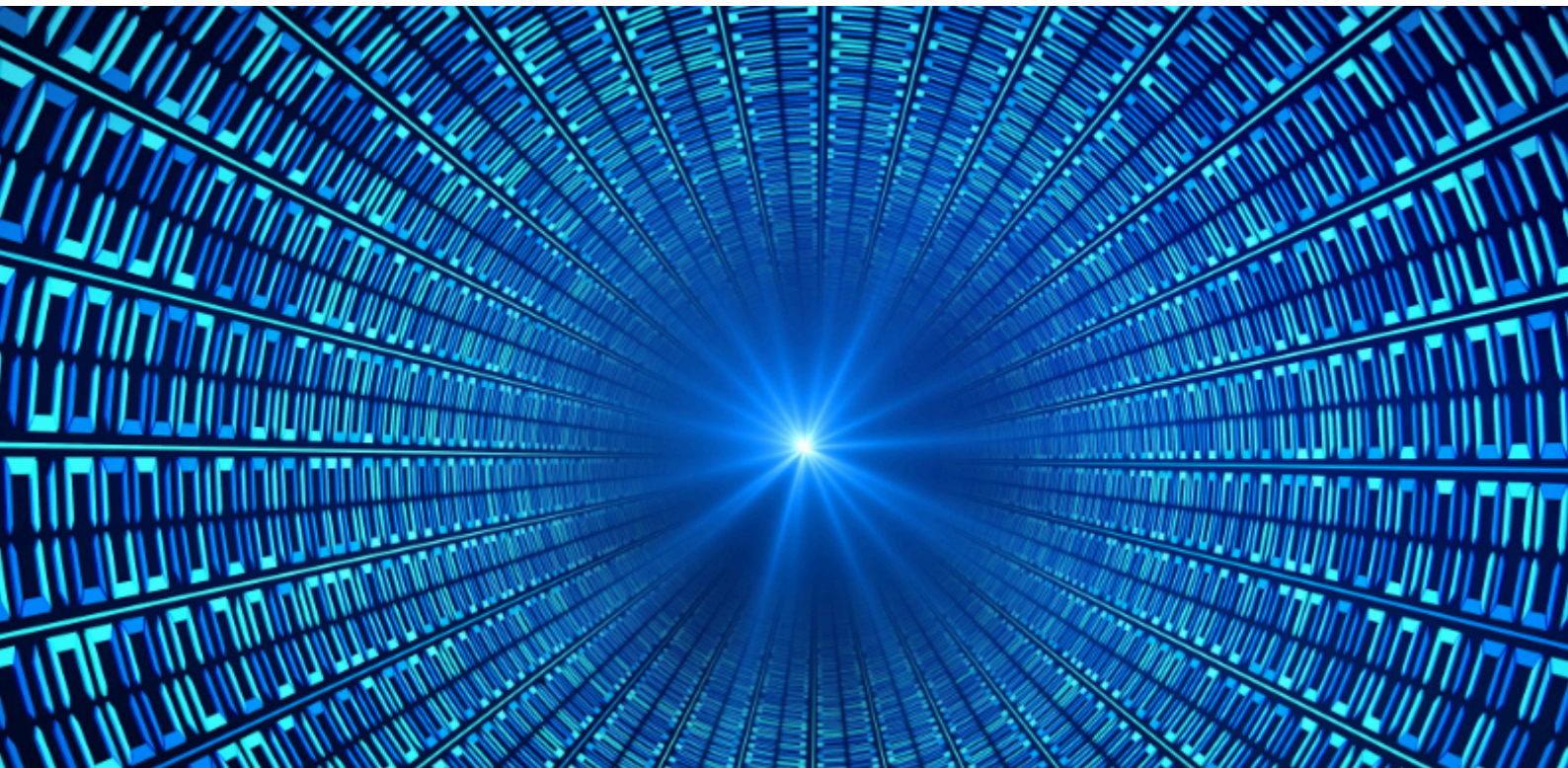
MACHINE LEARNING APPLICATIONS AT OPTANO

At OPTANO, machine learning is applied selectively where data-driven forecasts deliver direct value for decision-making and optimization processes. ML models are trained on customer-specific data and integrated into existing optimization and decision workflows.

The resulting forecasts—such as cost, demand, or system state predictions—feed directly into prescriptive optimization models and support well-founded decisions. In addition, OPTANO uses machine learning to adapt optimization algorithms to specific use cases and available input data. This reduces runtimes and increases overall algorithm efficiency.

Machine learning enables forward-looking forecasts.

Optimization translates these forecasts into concrete decisions.



SUMMARY: FROM ANALYSIS TO DECISION

Analytics, AI, and Operations Research work hand in hand.

Together, they enable well-founded decisions.

Analytics refers to the application of scientific and mathematical methods to analyze complex business systems with the goal of improving decision-making. It is typically structured into four levels: Descriptive, Diagnostic, Predictive, and Prescriptive Analytics.

While Descriptive and Diagnostic Analytics focus on describing and explaining past events, Predictive and Prescriptive Analytics rely on more advanced methods. These include artificial intelligence—particularly machine learning—for forecasting future developments, as well as Operations Research techniques to derive optimal decisions.

The interplay of analytics, artificial intelligence, and Operations Research enables data-driven decision-making in complex systems and supports sustainable improvements in processes and organizational structures.

The combination of analytics, artificial intelligence, and operations research enables well-founded decisions in complex systems.



WHO WE ARE

OPTANO provides innovative solutions, enabling businesses to plan faster, better and more easily. Thanks to mathematical optimization, OPTANO finds the optimal solution to any problem.

Our software is customized to suit your specific needs. Whether you want to optimize your supply chain, your entire network or your production plans, OPTANO makes your planning process efficient, clear and flexible.

And that's not all: OPTANO supports you in your strategic decisions using Prescriptive Analytics. This means that you can consider various options in what-if scenarios and get sound recommendations for action - based on the sound analysis of your data and targets.

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