WHITE PAPER

Solve a Different Class of Problems

Prescriptive Analytics: The Data Science Master Key

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GUROBI OPTIMIZATION

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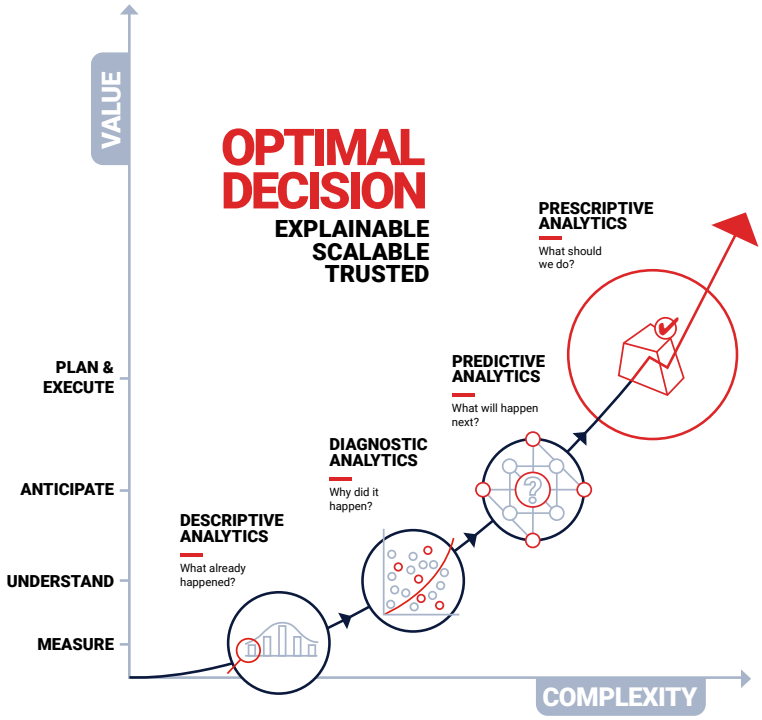
Introduction

We are in the midst of a “golden age” of data analytics, where high-quality data abounds, and powerful advanced analytics tools are readily available.

Enterprises across the business spectrum are looking to leverage these analytics tools to generate solutions to their mission-critical problems, guide their predictions and decisions, and gain a competitive advantage. But with so many analytics tools on the market, many companies have difficulties determining which ones they need.



The Four Main Types of Data Analytics Tools

Descriptive

Using data aggregation, data mining, and business intelligence tools, you can get insights on what has happened in the past or what is happening currently in your business environment.

Diagnostic

Using analytics and business intelligence tools, you can use pivoting, search, stories, drill downs, and displays to understand the “why.”

Predictive

Using regression, decision trees, neural net, random forest, and other approaches with training data, you can forecast and predict what will happen in the future.

Prescriptive

Using mathematical optimization tools, you can make (and often automate) complex decisions about which courses of action to take to achieve your business objectives.

Overview

You probably have a very firm grasp of descriptive, diagnostic, and predictive analytics tools, but perhaps are not that familiar with prescriptive analytics in general and mathematical optimization (the primary prescriptive analytics tool) in particular.

In this white paper, you'll hear about organizations—across a wide range of industries—that are using mathematical optimization to conduct prescriptive analysis at massive scale and complexity.

Federal Communications Commission (FCC)

Repurposing wireless spectrum to generate billions in revenue and reduce federal deficit

New, unoccupied spectrum cannot be created, but it can be repurposed in order to meet explosive demand.

In 2012, Congress directed the FCC to relieve the "spectrum crunch" by conducting the world's first two-sided "incentive auction." This required the FCC to analyze massive quantities of data, create optimization and feasibility models, and determine appropriate policy objectives to serve American consumers, the wireless industry, and television broadcasters.

To do so, the FCC used the Gurobi Optimizer, combined with a set of custom heuristics and a highly customized portfolio of satisfiability solvers that determined whether a given station repacking was feasible.

Thanks to operations research and optimization supported by Gurobi, the FCC was able to determine the maximum amount of spectrum to repurpose while giving all stations that remained on air a channel equivalent to their pre-auction channel. In doing so, they significantly reduced transition costs and TV viewer inconvenience.

> "By some estimates, the deployment of this new spectrum capacity will increase productivity and stimulate the US economy by many billions of dollars and hundreds of thousands of jobs."

JEAN L. KIDDOO, CHAIR
INCENTIVE AUCTION TASK FORCE, FCC

Air France

Optimizing schedules and routes for 500+ aircraft

Keeping a fleet of 500+ aircraft running efficiently is no small feat. To do it, Air France needs to account for many variables: how long a plane can fly before it needs maintenance, which planes should serve top destinations, and even parking spaces at airports.

So Air France tapped Gurobi to help them optimize their tail assignment: picking the best routes for each aircraft. We worked with them to build a decision support tool powered by our Gurobi Optimizer. It takes their inputs and generates a visual schedule to help plan ideal flights every day. And it's flexible enough for them optimize on the fly, like to adjust for weather.

Now, Air France has a tool that helps keep their flights on schedule, use less fuel, and assign the best craft to a route. All of which helps them save millions of Euros a year—and keep their passengers flying high.

“With this new Decision Support Tool powered by the Gurobi solver, we estimate that we are saving [millions in] fuel costs with huge volumes for the entire fleet. We also estimate that we save on delay propagation and on operational costs.”

SOLENE RICHARD
DATA SCIENCE AND OPERATIONAL RESEARCH TEAM LEADER
AIR FRANCE KLM

Swissport

Cutting scheduling time in half and saving $1 million annually

At Zurich airport alone, Swissport employs 2,000 people who handle essential tasks like check-ins, baggage management, aircraft loading, and more. All of these employees have different skills, contract types, and shift duties, which can make putting together a schedule quite complex.

Swissport needed a scheduling process that could take into account operational constraints, labor regulations, individual preferences, and ad-hoc requests for schedule changes, like when an employee is sick. For a while, Swissport tried to do this on their own, since none of the available commercial software for staff scheduling could meet their needs.

Since doing this manually could take weeks, Swissport set out to build their own automatic scheduling tool, Auto-Roster. They brought in the Gurobi Optimizer to speed things up even more, cutting their planning time in half. Swissport can now easily account for 95-100% of employee scheduling preferences and save an estimated $1 million each year.

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“Gurobi has consistently brought major performance improvements (often 10-20%) with each new release, which has been of enormous benefit to us”

BRUNO RIESEN
VICE PRESIDENT OF BUSINESS SUPPORT
SWISSPORT

Vodafone

Helping CSPs optimize network planning, supply chains, and marketing campaigns

To remain competitive in the age of 5G, telecom leaders can use mathematical optimization for everything from fiber optic network planning to coverage, frequency, and radio planning.

Mathematical optimization also allows telecom leaders to re-imagine retail and supply chain operations. These leaders can automate their decision-making and replenish stores with the right products at the right times, so customers can get what they want, when they want, and how they want it.

Optimization can even support marketing campaigns by using machine learning to make the best possible targeting decisions, with the flexibility to adapt to new constraints as they arise.

By applying Gurobi mathematical optimization, Vodafone has configured its retail shop network to optimize its support of sales and strategically open as many shops as possible after pandemic lockdowns in the safest way possible. This has allowed them to maximize their ROI while giving their customers optimal service.

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“The nice thing about [Gurobi] is that you can play through many different scenarios, where you can optimize for different aspects, [such as] revenue, contribution margin, costs for different products, and so on, and input any type of constraints that you can think of.”

ROLF BARDELI, PHD
LEAD DATA SCIENTIST AT
VODAFONE GMBH

Solve your most complex challenges with the power of prescriptive analytics.

For more information

www.gurobi.com