

Creating Best-Fit Customer Experiences

BIRCHBOX ♦

Birchbox makes the world of beauty better by bringing customers to the center. Amid the beauty industry's impossible, exclusive standards and overwhelming choices Birchbox wants to help customers feel like their best selves.

Industry: Consumer Products

Location: Americas

Use Cases: Automation, Operations, Supply Chain

Website: www.birchbox.com

Results

- Birchbox can now create best-fit customer experiences in minutes instead of days.
- New model's average run time is 10 minutes—an improvement of more than 99%.

Birchbox creates optimal customer experiences in minutes instead of days—an improvement of more than 99%.

As subscription e-commerce continues to expand, Birchbox—the trailblazing subscription box service—has stood out with a strong value proposition that engages underserved, overlooked, “casual” beauty and grooming consumers, and meaningfully increases their spend in the category.

Birchbox—which launched in 2010—delivers five to six samples a month, tailored to each subscriber's needs and preferences. A subscription box service's operational success is powered mainly by its “black box”—the custom software solution that groups subscribers into clusters and then creates configurations of available products to send to each group of subscribers. The solution must be formulated to deliver product groupings and box creations deemed “ideal” by the company's proprietary criteria. Additionally, the solution must accommodate meaningful business changes and scale as the service grows.

The Challenge of Scale

By 2015, Birchbox had over a million subscribers and more than 800 brand partners. The company relied

on a mixed-integer programming (MIP) model solved with the Gurobi Optimizer to group products and assign subscribers according to proprietary objectives and constraints tied to subscriber profiles, history, and activity, and product and vendor attributes. This model worked adequately for several years, but as Birchbox's customer base grew further and offerings expanded, solutions to this model were difficult to obtain in a reasonable amount of time—and this limited business flexibility.

Operations executives were forced to painstakingly manage and monitor the model because it too often could not find adequate solutions and, when it could, the average run time of 30-50 hours jeopardized production deadlines.

When Birchbox introduced exciting improvements to its box experience in early 2019, its leaders sought to increase the flexibility of how products were assigned to a box (for example, adding a sixth sample while not compromising the integrity of the assortment). However, testing determined that the model could not adequately handle the additional mathematical complexity.

Partner Spotlight



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“ The increase in speed and flexibility from the new model impacts every piece of our business across multiple teams. With this new model, Birchbox has truly entered a new operating universe.”

David Bendes

Vice President of Global Business Technology, Birchbox



Model Review and Reformulation

Birchbox leaders retained Princeton Consultants' Optimization Practice to improve the performance of the existing mathematical optimization model.

Princeton Consultants' team of Operations Research practitioners interviewed business and technical personnel from Birchbox about the existing model's functionality, and reviewed documentation of the existing formulation. Analysis of the existing model uncovered the causes of the poor performance.

In reformulating the model to meet Birchbox's needs, the team leveraged its deep understanding of the Gurobi Optimizer—the mathematical optimization solver utilized by Birchbox—and advanced linear programming and MIP techniques. The team created the Reciprocating Integer Programming (RIP) technique to address this challenge.

Better Solutions, 99% Faster

The reformulated model generates better results that reduce the required number of box configurations to meet the subscriber needs.

Birchbox executives can create a larger number of clusters in their machine learning approach, resulting in greater customization per subscriber. The new model's average run time is 10 minutes—

which represents an improvement of more than 99%.

David Bendes—Birchbox's Vice President of Global Business Technology, whose team ran, monitored, and adjusted the original model—described this acceleration as “life altering.”

The transformed performance allows the Birchbox team to tweak inputs and re-run the model—and therefore evaluate different parameters, levels of subscriber aggregation, definitions of a “good” box, and even optimize on box value. Previously, such experimentation was impossible.

Furthermore, it is quickly determined if a given set of products can meet the needs of all subscribers (e.g. is it feasible to assign every subscriber a box?)—and this is a key for operations.

Using Princeton Consultants' innovative RIP technique, Birchbox executives are transforming their technology, operations, and service as they further solidify their position as a leading subscription box service.

The Benefits of Gurobi

The RIP technique employed in the Birchbox solution requires a reliable, robust integer programming solver to solve different integer programs that are coordinated to find a solution to the business problem. The Gurobi Optimizer's performance allowed the

concept of RIP to become a reality.

Due to the speed of the Gurobi Optimizer, the flexibility of the Gurobi Python API, and Gurobi features that allowed the performance to be tuned for different problems, combined with the innovative RIP technique, the Birchbox team now reliably solves problems of increasing complexity in minutes instead of days.

Experience Gurobi for Yourself

Our 30-day evaluation license includes:

- Free benchmarking services
- Free model tuning services
- Free access to our world-class technical guidance and support
- Two free hours of one-on-one consulting services

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