



Case Study:

## Yokohama Rubber & dotData Revolutionize Tire Performance and Manufacturing by Scaling AI

How Yokohama Rubber, one of the world's leading tire manufacturers, implemented dotData to advance its tire manufacturing technology.



ENHANCED TIRE  
PERFORMANCE

IMPROVED TIRE  
QUALITY

IMPROVED ICE-BRAKING  
PERFORMANCE

For over 50 years, Yokohama Rubber has been committed to innovating tire design and production. They are utilizing dotData's Feature Factory platform to analyze data sourced from product design and manufacturing processes, resulting in enhanced tire performance and design workflows. Through interpretation of "features" extracted by dotData from sourced prototype evaluation data, the company has identified the correlation between the finished tire's characteristics and the features discovered, leading to further improvements in tire performance. The incorporation of dotData is extensive, spanning throughout Yokohama Rubber's tire development and manufacturing processes, including valuable insights gained from analyzing the "rubber mixing process" that is fundamental to the manufacture of tires.

"dotData has extracted many novel and creative feature variables that we would not have been able to arrive at on our own, driving innovation in tire development."

The Yokohama Rubber Co., Ltd.'s Executive Fellow, Head of AI Laboratory, Dr. Masataka Koishi

Executive Fellow, Head of AI Laboratory, Research & Advanced Development Division, The Yokohama Rubber Co., Ltd. Dr. Masataka Koishi

Senior Manager, AI Laboratory, Research & Advanced Development Division, The Yokohama Rubber Co.,Ltd. Dr. Hirotaro Tada

## ABOUT THE CLIENT

Industry: Manufacturing

Annual Revenue: \$5B+

Reach: Global

## CHALLENGES

- Improving product development and manufacturing processes through data-driven analysis
- Move from a 100% designer-dependent development approach to one that is supported by data.
- They needed to create a system that could generate new ideas that cannot be derived from experience alone.

## SOLUTION

- dotData's proprietary Feature Engineering technology evaluated billions of data points across multiple categories - simultaneously.
- dotData's unique transparency provided the business with explainable insights that business users could understand.

## BUSINESS BACKGROUND AND CHALLENGES

Yokohama Rubber is a well-known global tire manufacturer, producing a wide range of tire products, including passenger car, motorsports, and studless tires, among others. The company has also ventured into other businesses, such as golf-related products, tire wheels, and industrial and aerospace components. One of their key initiatives is their early adoption of data analysis and AI technology in their R&D, design, and manufacturing processes, with a focus on material development using multiscale simulation and Materials Informatics (MI) AI technology. In 2020, they launched "HAICoLab" an AI utilization concept to further develop their AI and data analysis capabilities.

Dr. Masataka Koishi, the head of Yokohama Rubber's AI Laboratory, says that their goal is not just to automate operations with AI but to solve problems through "collaboration between humans and AI." They aim to utilize AI and data analysis to promote technological innovation that spans incremental and radical innovation. They built a forecasting model using deep learning and devised ways to derive the relationship between data and predicted values, making it understandable to humans. By combining insights and inspiration from human interpretation and making good use of both, they hope to achieve their goal of solving problems collaboratively between AI and humans.

"Data marts need to be updated continuously, for data changes, new data additions, new product trends, etc. While we need to do targeted marketing on more products, outsourcing it to an external data scientist was challenging in terms of flexibility and cost "says Mr. Kobayashi. The solution came from dotData, which automatically generates data marts and automates feature discovery and extraction with its own technology.

## DOTDATA FEATURES ACCELERATE THE TIRE DESIGN PROCESS

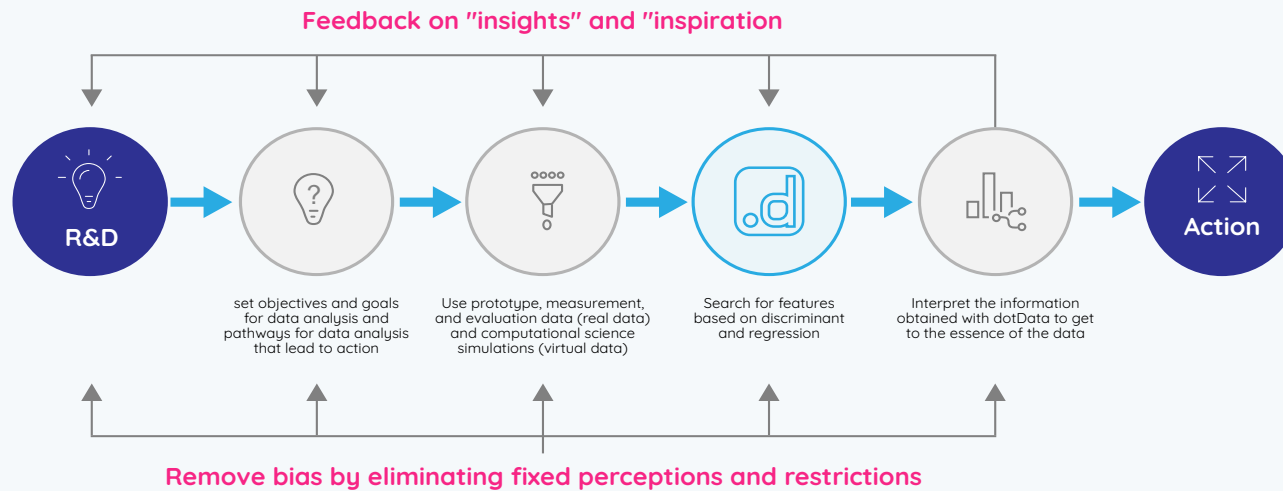
Yokohama rubber has been working to explore the relationship between input and output data in the design process for some time. However, Dr. Koishi says that there were limitations to the number of factors that could be handled and that the number of factors themselves could not be analyzed in detail.

"We have been working to explore the relationship between input and output data for some time, but there were various issues, such as the limited number of factors that could be handled and the

fact that the factors themselves had to be set by people familiar with both the subject of analysis and data analysis,” says Dr. Koishi.

Their interest in dotData was largely due to its great advantage of automatically finding and extracting important features by entering outputs (objective variables to be predicted) and inputs (various explanatory variables related to design and processes). dotData’s ability to automatically extracts features in a form that is understandable to humans is a key point for “human-AI collaboration”. This was exactly in line with the company’s AI utilization policy of “collaboration between humans and AI.

## How dotData is used in the HAICoLab



After conducting a proof of concept using dotData on a trial basis, the effectiveness of the system was confirmed, and the decision was made to formally introduce it into the process. The first application of dotData was in the design of high-performance tires. High-performance tires mounted on sports cars require exceptional driving performance and stability. “We were working on a project to review the conditions of the manufacturing process, which involves mixing rubber materials, molding the tire, and vulcanizing it, along with the design specifications for high-performance tires,” says Dr. Koishi.

## RESULTS

- Enhanced tire performance by establishing the correlation between tire design/manufacturing factors and the characteristics of the final product.
- Analyzed manufacturing process data to identify factors affecting rubber properties resulting in improved quality.
- Identified and formulated design and environmental factors that significantly impact the ice braking performance of winter tires.

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<https://dotdata.com>

<https://dotdata.com/products>



The data obtained from each process in the prototype evaluation was compiled and fed into dotData, which automatically designed “feature values” that were thought to contribute to the improvement of the prototype’s characteristics. The project members repeated the process of automatically designing and interpreting the “feature values” and incorporating them into the next prototype, and “performance and stability improved step by step. Although development work continues, there are many findings that were only realized after being confronted with data patterns discovered in the process of utilizing dotData,

“We call such discoveries secondary effects, and we consider them to be the results of utilizing dotData,” says Dr. Koishi.

The data obtained from all manufacturing processes from design, mixing, extrusion, rolling, molding, vulcanization, and inspection, and the relationship between them and tire measurement and evaluation data are analyzed by dotData to further improve product performance, stabilize quality, and increase productivity. The company is promoting a “manufacturing revolution” to further improve product performance, stabilize quality, and increase productivity by analyzing the relationship between these data and tire measurement/evaluation data.

## **OPTIMIZING THE RUBBER MIXING PROCESS**

In addition to the tire design and development process, dotData analyzed data in the tire manufacturing process. For example, dotData optimized the “rubber mixing process,” which involves mixing raw materials and compounding agents.

“The rubber resulting from the mixing of raw materials and compounding agents must meet several predefined physical property requirements. However, because of the influence of a variety of external factors, the properties may not always be consistent. To obtain more stable results, we decided to analyze data to clarify the relationship between various factors such as mixer rotor speed, power consumption, mixing time, timing of material loading, ambient temperature, and the physical property values.” says Dr. Tada, who is the head of the company’s AI research laboratory.

They have successfully identified the factors that cause desired changes in physical property values through the use of dotData in the rubber mixing process. They are also working on applying the same approach to improve accuracy in the mixing process for high-performance

tires, which have more demanding specifications. In addition, they claim to have gained a better understanding of the underlying mechanics of the mixing process using dotData which was an unexpected result.

dotData also helps in the design of stud less tires used during the winter season. The most important performance feature of stud less tires is “braking performance on the ice,” which is the ability to decelerate and stop within a short distance on icy road surfaces. To enhance this performance, they used dotData to determine what factors affect braking performance on ice based on past prototype evaluation data, and successfully formulated the relationship between important factors and braking distance using these characteristic quantities. By adding interpretation to the features obtained with dotData, they were able to obtain a highly prospective relationship that is convenient for the design process, i.e., based on design factors that can be determined before the tire is prototyped.

#### **YOKOHAMA RUBBER FUTURE PLANS FOR DOTDATA**

Dr. Koishi says that the company is currently working on measures to improve the accuracy of its stud less tire forecasts.

“We have established a formula for calculating braking distance within the range of currently available data, but we have also discovered that there are design areas where prediction accuracy is poor due to the absence of data. At the moment, we are working with tire developers to obtain new data to supplement this data, and we are repeating prototype verification. “

In addition, by using real-world data accumulated from past prototype evaluations and virtual data obtained from numerical simulations such as Finite Element Method (FEM), the relationship between multidimensional input data (design factors) and multidimensional output data (features) can be clarified, and this complex intertwining information can then be presented to designers in an easy-to-understand format. The goal is to clarify the relationships between multidimensional input data (design factors) and multidimensional output data (features), and to provide designers with this intricate information in an easy-to-understand format.

“One of our goals is to provide information in such a way that people who are not data analysts can gain insight while finding it “interesting,” and we look forward to dotData’s further upgrades so that we can achieve this goal with dotData. We would like to use dotData to solve problems in various fields by eliminating biases and wavering from fixed perceptions and limitations,” Mr. Dr. Koishi concluded.

Since successfully manufacturing Japan’s first cord tire, Yokohama Tire Corporation, known under the brand name “Yokohama Tire,” has been selling unique products globally. Based on the rubber polymer technology, compounding technology, metal processing technology, and design technology developed in tire development, they also operate a multiple business (MB) that produces products that support industry and daily life.

### **LEARN MORE ABOUT DOTDATA:**

dotData was designed exclusively for small and mid-sized organizations looking to leverage AI and Machine Learning to help build predictive analytics models to grow their business. Learn more by visiting our website:

<https://dotdata.com>

<https://dotdata.com/blog>

# About dotData

dotData solves the biggest challenge of organizations of any size: Turning raw business data into valuable and meaningful data marts ready for Machine Learning (ML), Artificial Intelligence (AI), and traditional data analytics deployments and applications. dotData provides solutions tailored to the needs of companies that are just getting started with predictive analytics and companies with more mature data engineering processes. Our core technology allows companies to automatically convert data from data warehouses and data lakes into data marts and feature tables by exploring the relationships between varied data tables with hundreds of columns and millions of rows. Our global customers have used our platforms to accelerate their ML, AI, and Advanced Analytics adoption, achieving rapid ROI by lowering their dependence on scarce, costly expert resources.

Forrester recognized dotData as a leader in ML and AI in 2019, and CRN named dotData to its emerging vendors' list in for four years running and was named a CB Insights Top 100 AI Startups for 2020. The AI breakthrough awards recognized dotData as the "best machine learning platform" for 2019, and Fortune 50 clients around the Globe rely on dotData to help them accelerate their ML, AI, and Advanced Analytics projects. For more information, visit [www.dotdata.com](http://www.dotdata.com), and join the conversation on Twitter and LinkedIn.