

About Lineage



Largest & most innovative cold chain in the world



Accounts for ~30% of the food consumed in US



Operates more than 3 Billion cubic feet across 480+ warehouses

Project Overview

Motivation:

For 2023, Lineage has up to **\$287 Million** of potential EBITDA unrealized

What makes each pallet more profitable than the other?

Objectives:



Determine key factors that impact customer profitability

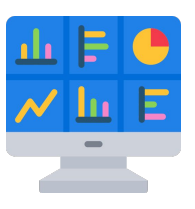


Help Lineage make analytically driven pricing and operational decisions

Impact:

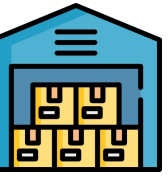


Top 10 features explain up to **\$215M** of EBITDA



Data visualization to help inform pricing decisions

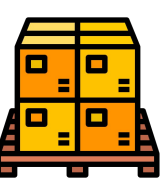
Data Scope



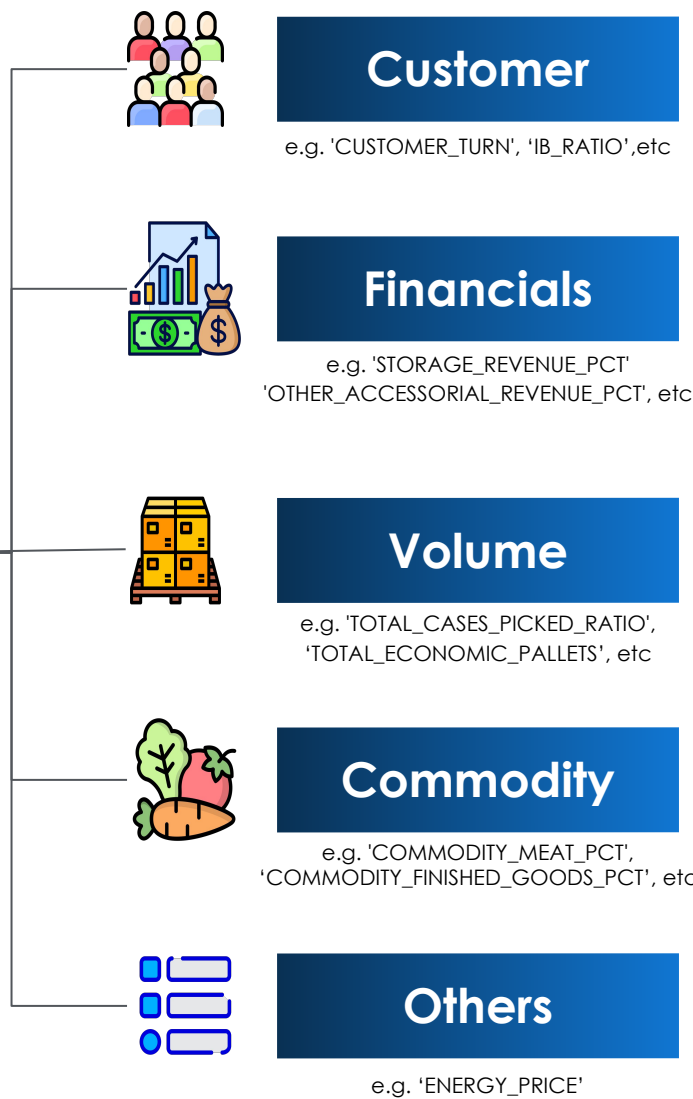
44 facilities



1201 customers



16m+ pallets



Feature Engineering

Standardization

Normalize data across diverse customer profiles

Imputation

Recovered missing data using KNN imputation

Data Grouping

To remove legacy accounting errors

Correlation analysis

Removed all features with pairwise absolute correlation ≥ 0.85

Feature Interpretability

Remove & rework features to be understood by decision makers

Defining Profitability

Deciding on a **single profitability measure** was a key challenge to the project, which involved several iterations.

We **considered EBITDAR and EBITDA**, with the respective measures **scaled by on-hand pallets**.

In the end, the chosen target variable was:

Contribution Margin / Economic Pallet (CM/EP)

Contribution Margin = Revenue - Variable Costs*
Economic Pallet = Customer Pallet Space that is occupied or reserved

With this, Lineage can better decide to **optimize their finite warehouse space** to drive value.

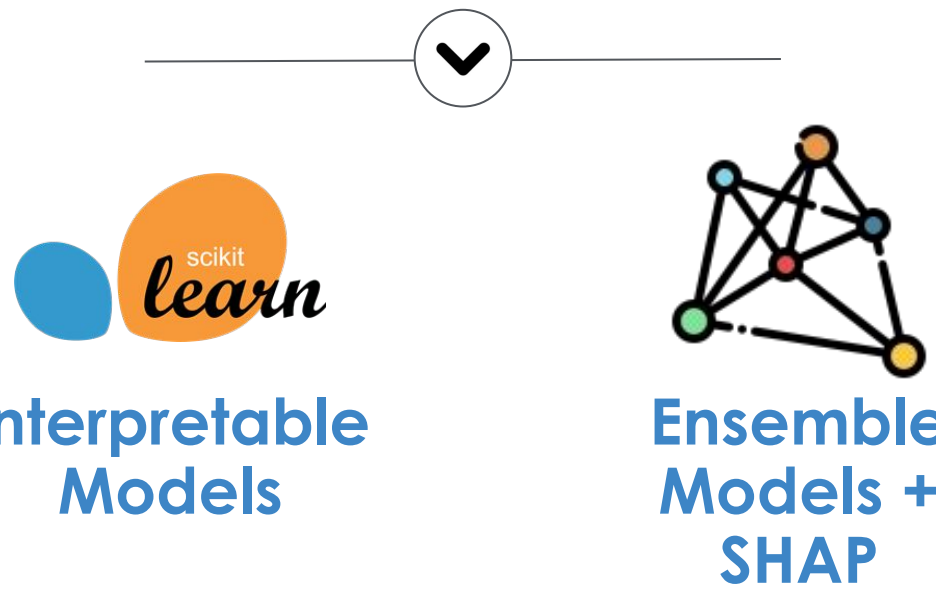
This granular insight allows Lineage to identify the **shadow cost of replacing a customer with a different customer occupying the same amount of space**.

Model Selection

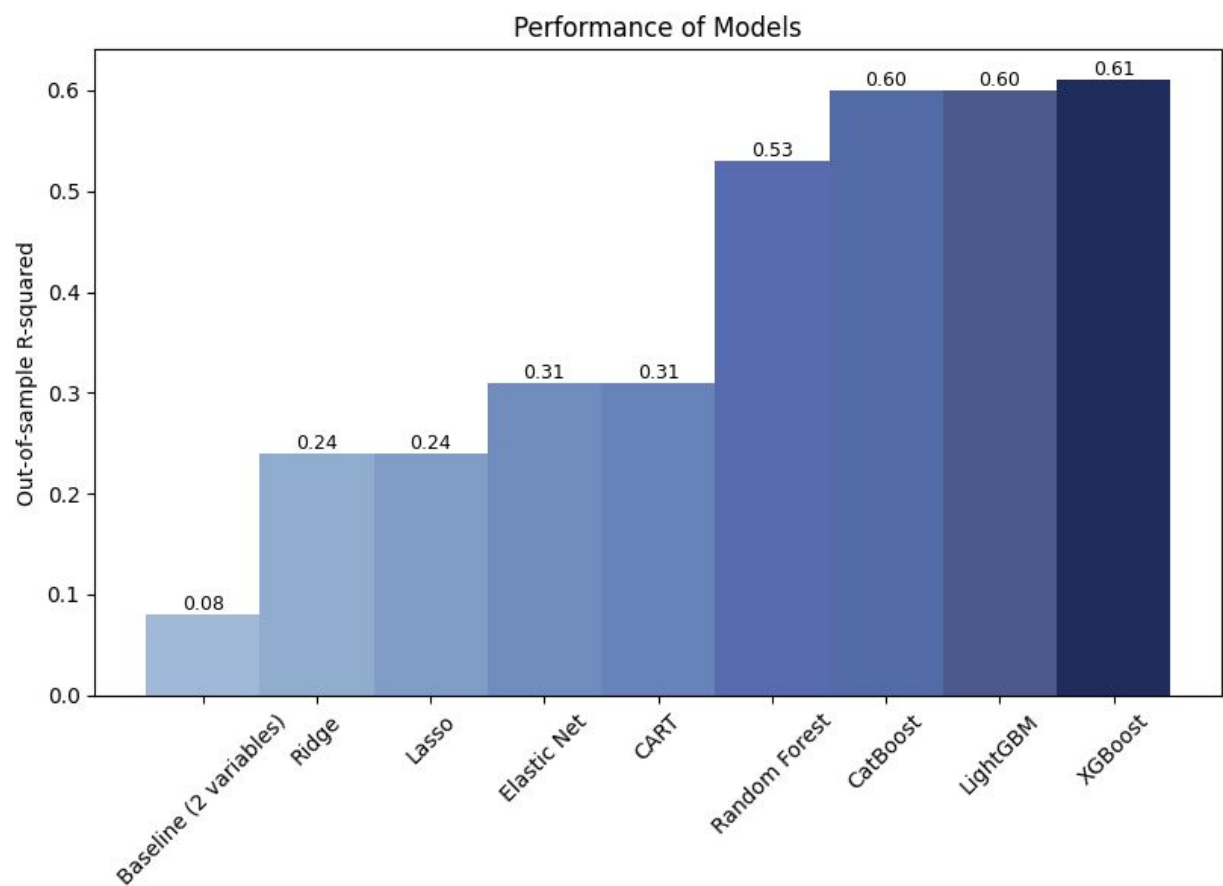


A **primary consideration** of modeling is for **our business users to understand the underlying feature contributions**

Our **secondary consideration** is that our value predictions reach a **satisfactory range within actual values**



Model Performance



Ensembled models **significantly outperform** the interpretable models, with **XGBoost** topping the performance

This highlights the **highly non-linear** relationship of our data

Challenges



Interpretability Focus

We had to decide on critical tradeoffs to the performance of the model by maintaining only features that are meaningful to a financial audience



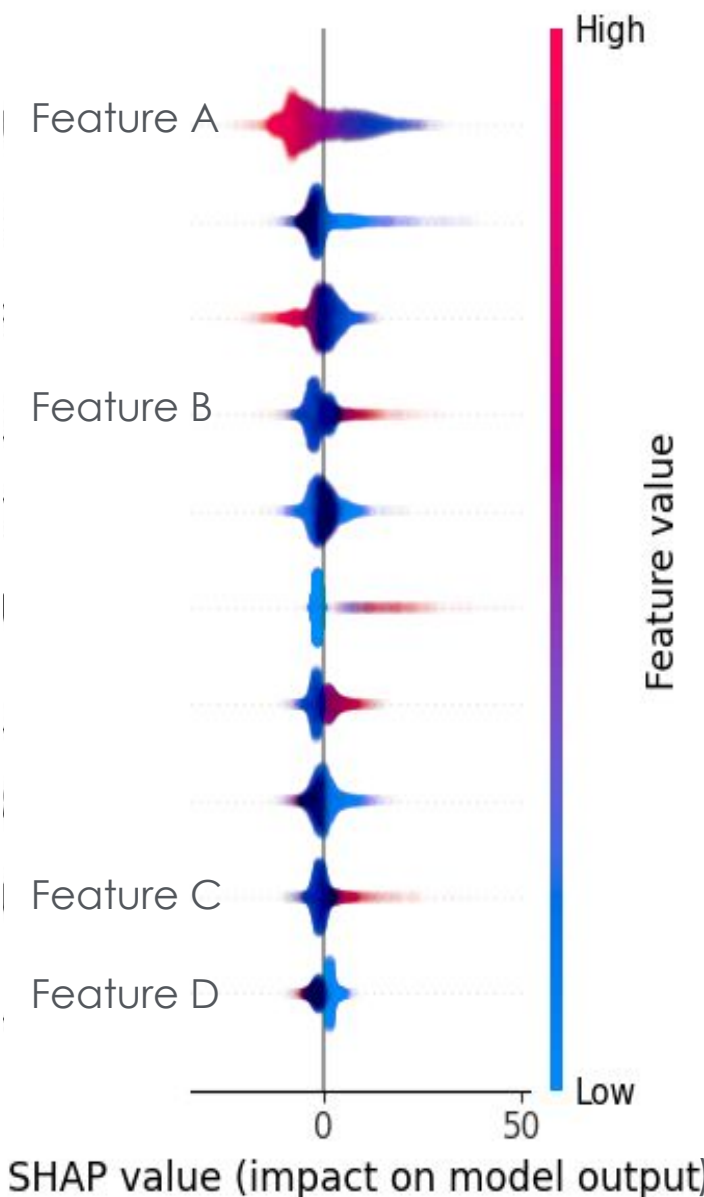
Data Complexities

Lineage has an immense amount of warehousing data available, with data housed at different pools. These data pools are also updated continuously, which made data validation a critical challenge.

Modeling Results

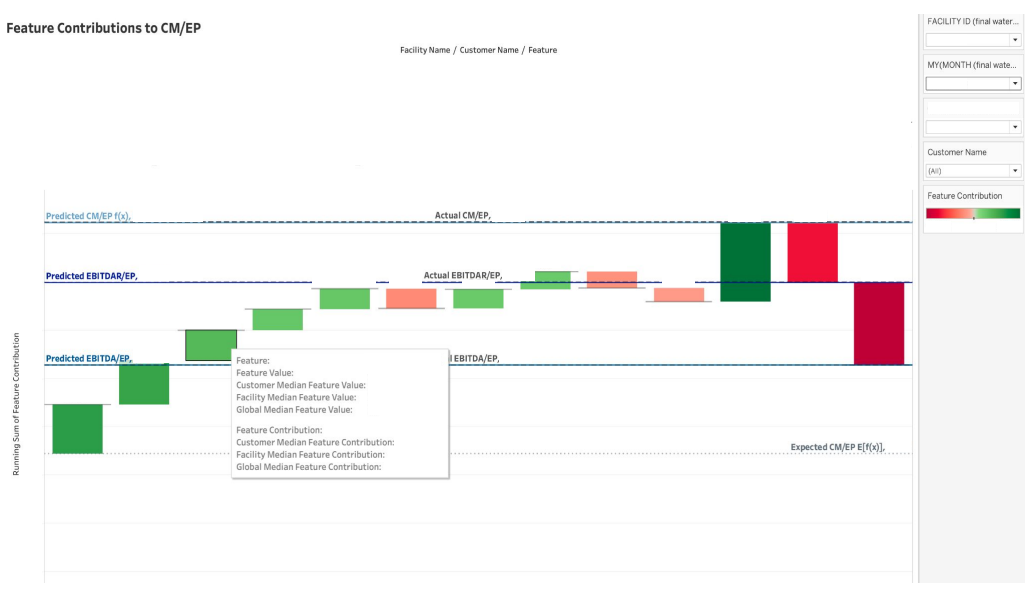
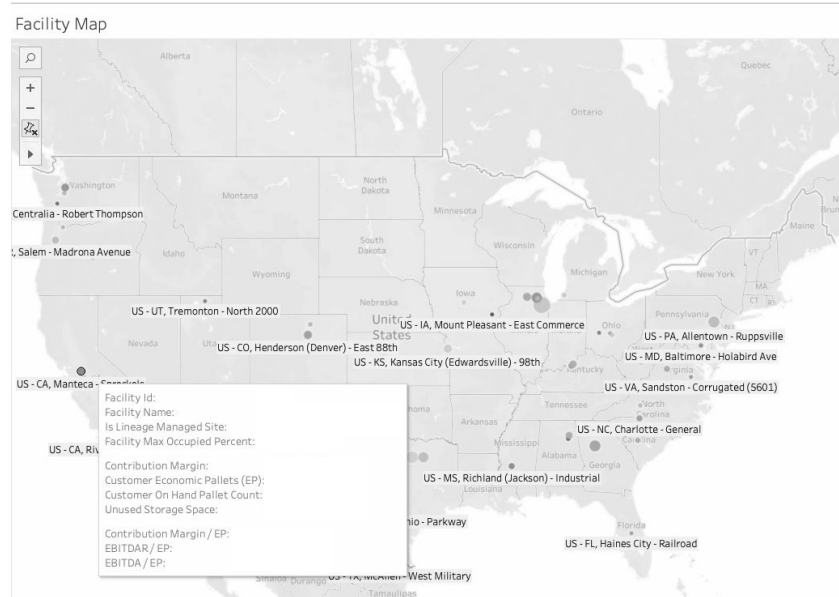
Key Observations:

- High Feature B** is **directly related to higher customer profitability** when scaled by economic pallets, supporting Lineage's current hypothesis
- On a per pallet level, **high Feature A** implies **low Feature C**, hence these have **opposing relationships to profitability**
- While **Feature C** is directly correlated to profitability, **Feature D**, a similar feature, **is not**, implying a need for **pricing changes**



Implementing Insights

Top 10 features explain up to **\$215M** of EBITDA that can be gained.



Visualization of feature contributions to profitability helps translate insights to **inform pricing and operational decisions**

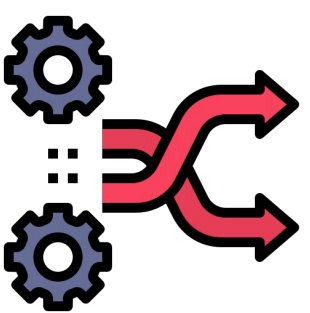
*Information has been redacted to maintain confidentiality

Technical Next Steps

As work on the model continues, these are some key areas of work:



Hierarchical clustering to help understand customer profiles



Sensitivity analysis to understand how changes in each feature can alter customer profitability

Future Use within Lineage

Lineage is excited to implement these results in multiple ways



Integrate into existing internal dashboard to give enhanced insight to Sales/Operations on customer performance



Develop tool to visualize the impact of customer behavior changes; predicting new business value with sensitivity analysis