Data Mining Cup 2016

Iowa State University Team 1

June 28, 2016

Introduction

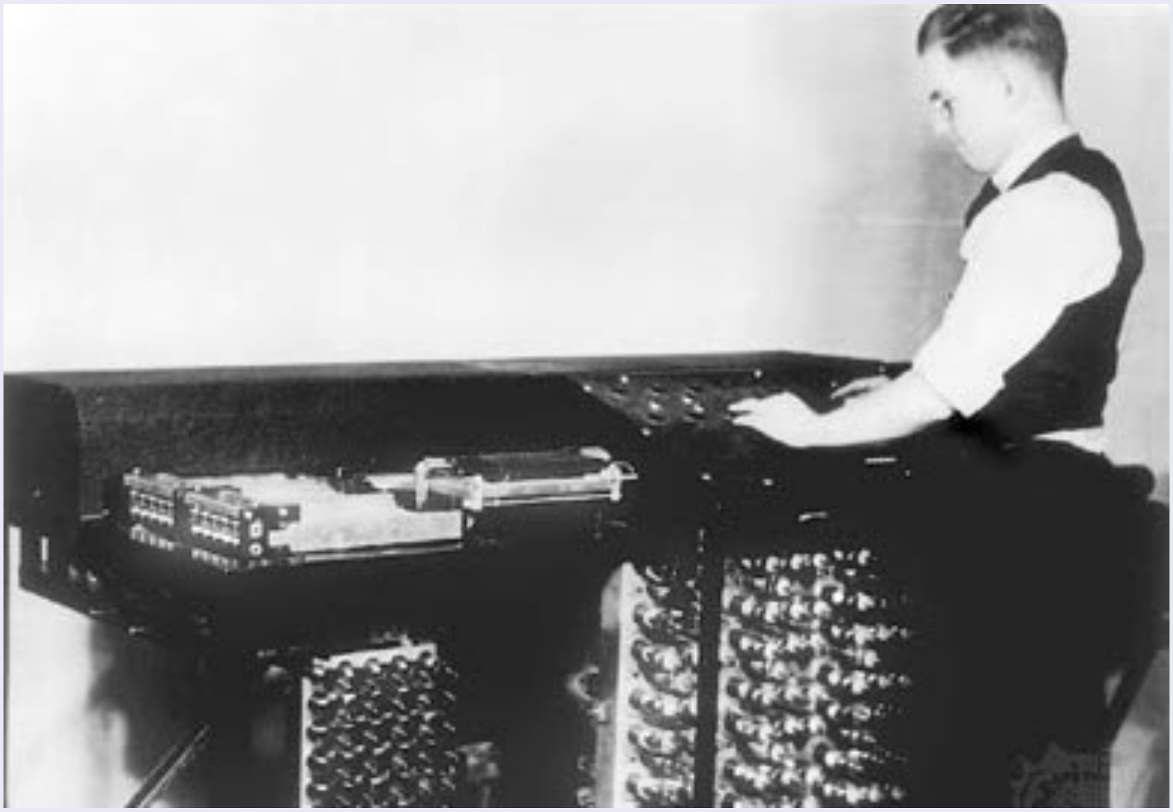
Iowa State University

- Located in Ames, Iowa, USA
- Statistics Department founded by George W. Snedecor in 1947 – First Stats Dept. in USA!
- ISU also developed first automatic electronic digital computer in 1937: Atanasoff–Berry computer (ABC)

Introduction

Iowa State University

Clifford Berry with the Atanasoff–Berry computer (1941)



Introduction

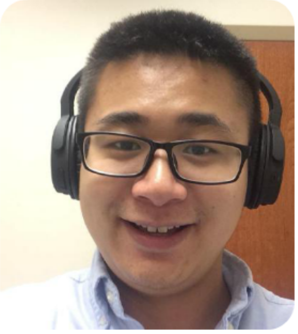
Team Members

Xiaojun Mao

Ye Han

Manju Johny

Abhishek Chakraborty



Haozhe Zhang

Xinyi Li

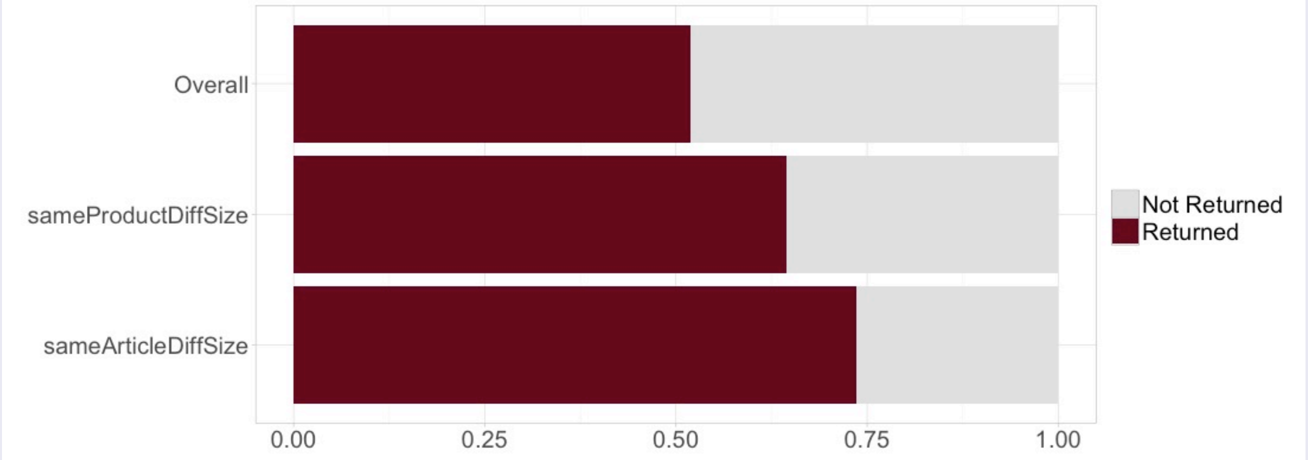
Approach

- Objective: Use data over 21 month period to predict return quantities for the following 3 months
- Treated return quantity as binary since only 0.17% of return quantities were greater than 1
- Split available 21 month data into 3 disjoint sets: historical set, training set, and test set
- Searched for patterns in the historical set
  - patterns will help map known return behaviour to unknown return behaviour
- Created features (or variables) according to these patterns for the feature matrix

Feature Generation - Order Type

- Created features based on order type
- Classified order type by defining properties: discount, voucher amount, variability, quantity, price, date of purchase, etc of order

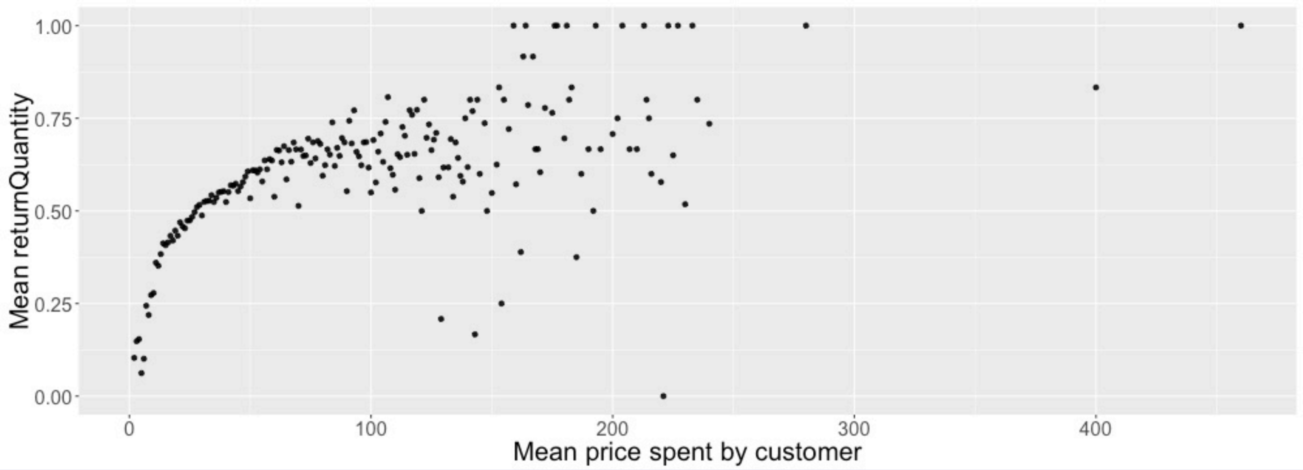
Notable features related to order type



Feature Generation - Customer Type

- Created features based on customer behaviour
- Classified customer behaviour by defining properties: frequency of visit, time between visits, amount spent, quantity purchased, etc

Notable feature related to customer behaviour

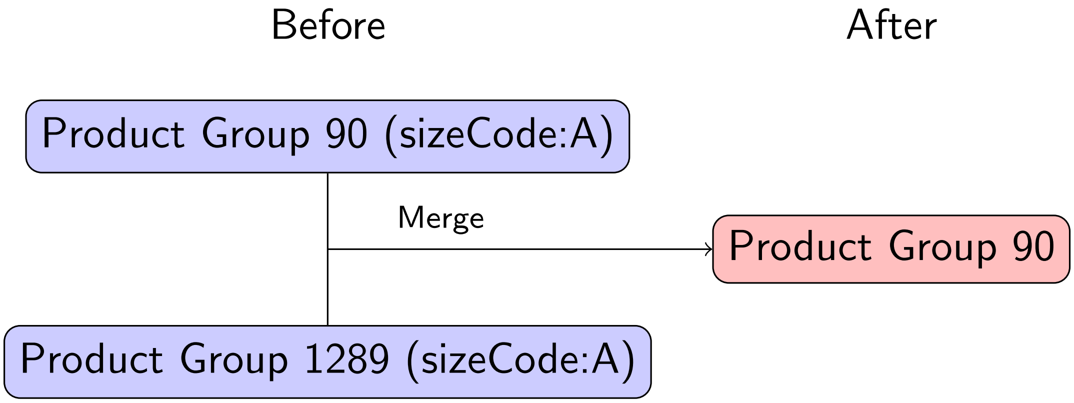


Feature Generation - Item Type

- Created features based on item type
- Issue: new items introduced in classification set
  - 20% new color codes
  - 18.4% new product groups
  - 75.5% new voucherIDs
- Solution:
  - classified item type by defining properties
  - standardized sizes
  - mapped new products to existing products
  - mapped new colors to existing colors

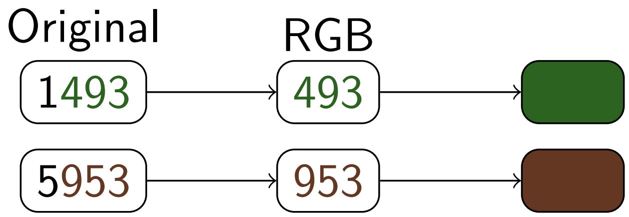
Product Group Conversion

- 13 new product groups introduced in classification set
- No information about these new products in historical set
- Merged new product groups with existing groups based on similarities


Before
After
Product Group 90 (sizeCode:A)
Merge
Product Group 90
Product Group 1289 (sizeCode:A)

Color Code Conversion

- Historical set contained only 4-digit color codes
- Classification set contained both 4-digit and 5-digit color codes
- 86 new color codes in classification set have no overlap with historical set
- Possible that last 3 digits of color code represent 3-digit RGB color code
- Extracted last 3 digits of color code to create new color feature



Original

RGB

1493 → 493 → 🟩

5953 → 953 → 🟫

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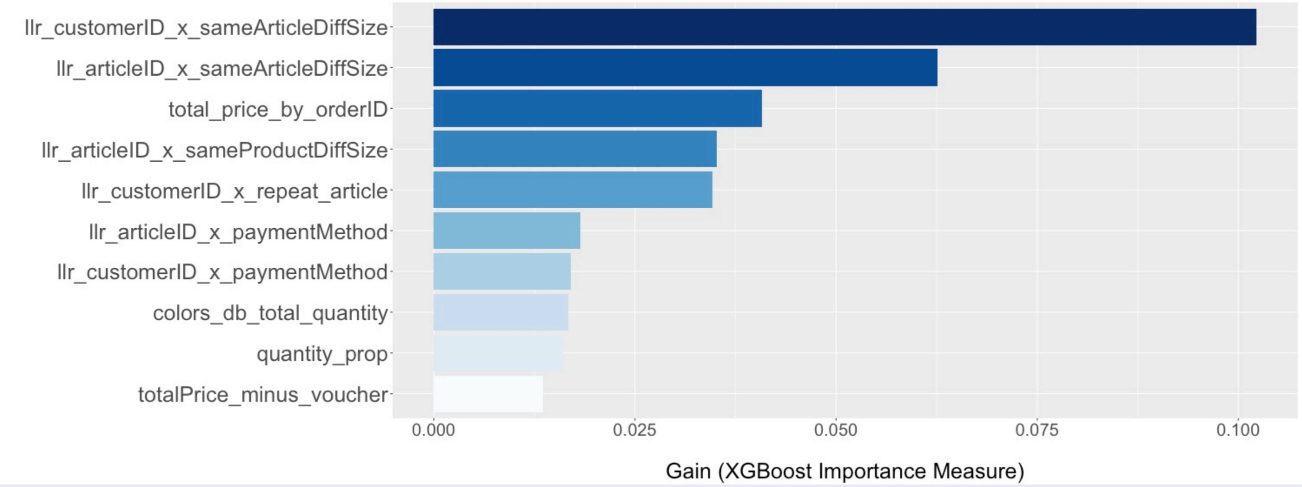
Feature Matrix

- Including interaction terms between variables, complete feature matrix had 1,539 features
- Used feature selection to reduce size to 500 of the most important features

Top 10 most important features for XGBoost



Models

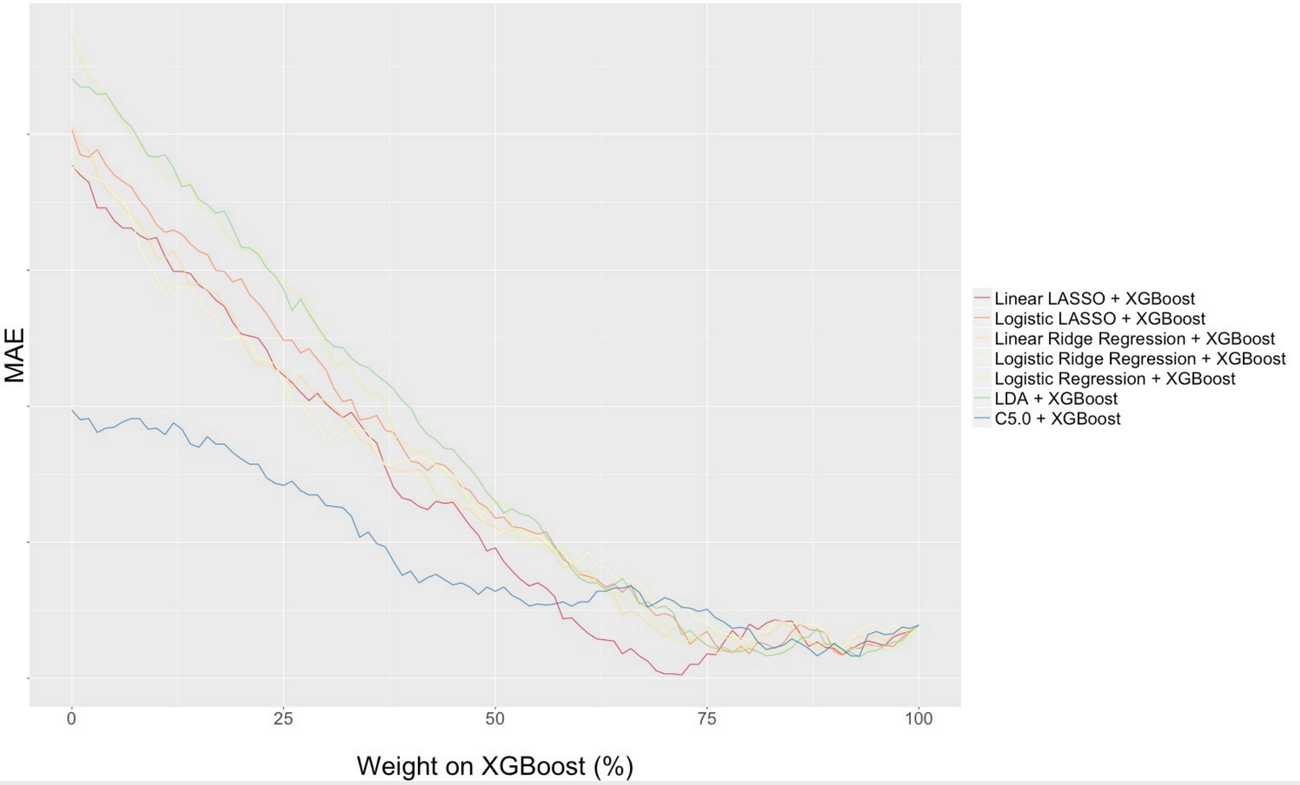
- Tried various modeling techniques
- Minimum MAE between return quantity and predicted return quantity in test set dictated best model.
- XGBoost (tree-based model) performed the best among all models
- Combining XGBoost with another model can further improve predictions by adding information that XGBoost may have missed.

XGBoost
Random forest
C5.0
extraTrees

Linear LASSO
Logistic LASSO
Linear Ridge Regression
Logistic Ridge Regression
Logistic Regression
LDA

Combining Models

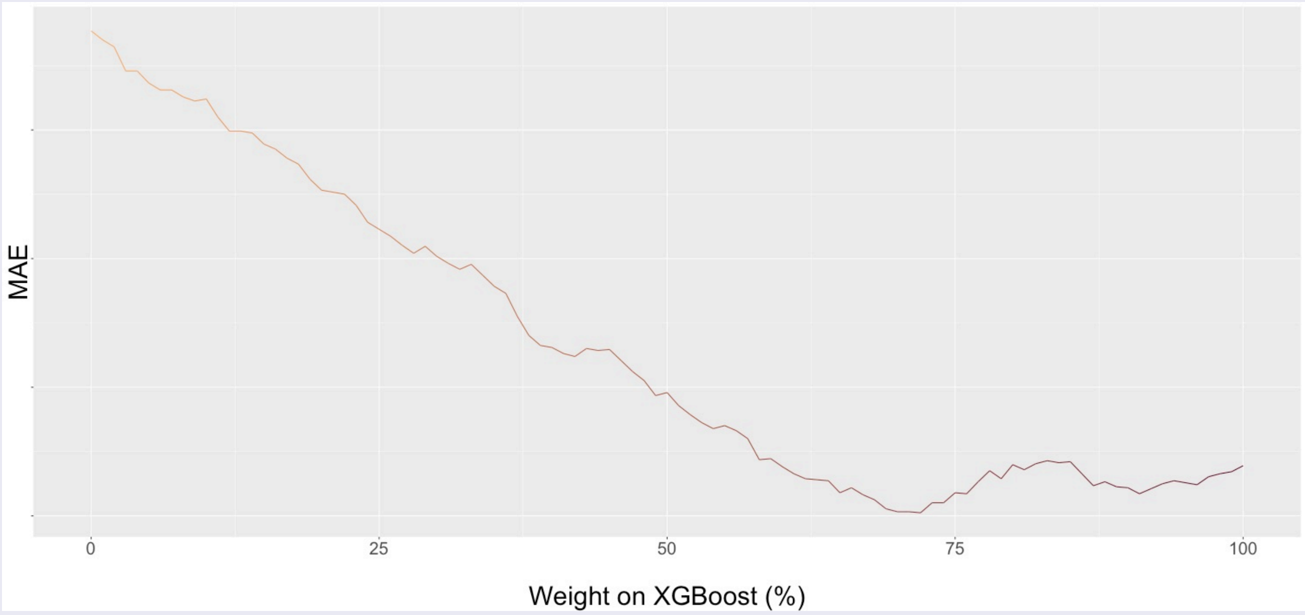
Combinations of xgboost with various models



Final Model

- Final model: 70/30 combination of XGBoost and Linear LASSO trained on the final training set.

Combination of xgboost & linear lasso in test



Acknowledgements

A special thanks to prudsys for this wonderful opportunity and invitation to Berlin, and to Iowa State University for supporting us!