PREDICTING A USER'S NEXT INSTACART ORDER

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1

Objective and Problem Setup

Algorithms

- XGBoost
- RandomForest
- Grid Search & K-Fold Cross Validation
- Precision/Recall Curves
- F-1 & F-beta (F-2) scores

Tools

- PostgreSQL
- Tableau
- Google Cloud Deep Learning VMs
- Jupyter Notebook

Python Libraries

- Scikit-learn, StatsModels
- multiprocessing
- pickle
- pandas/numpy

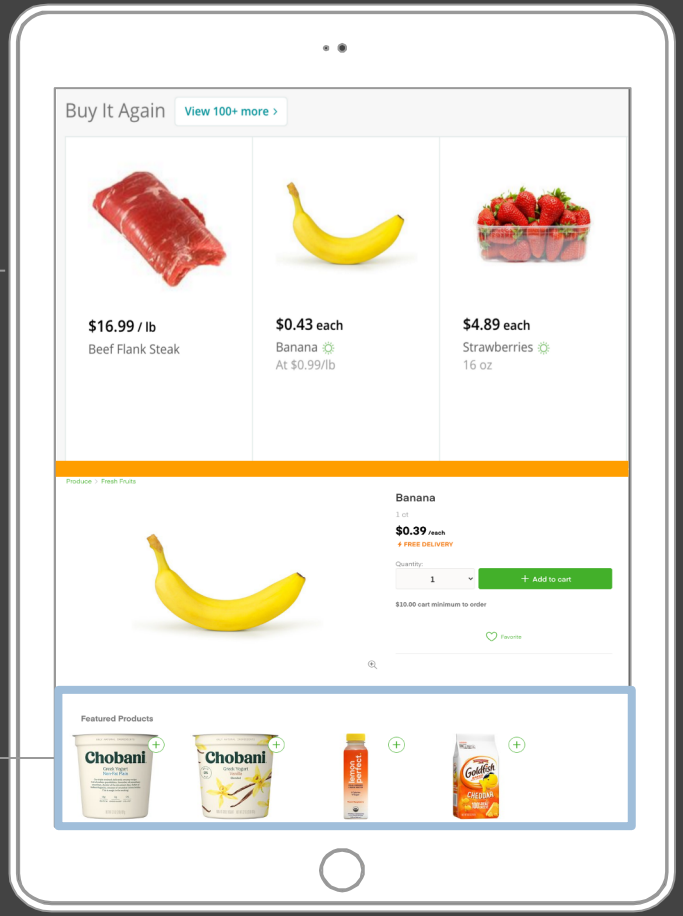
Objective: To predict all of the reorders in a user's next cart

But first… why?

Use Cases:

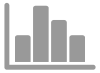
1) Buy-it-again recommendations

2) Frequently bought with...



2

Dataset & Feature Engineering



33,819,106

Total rows (1 per product per order)

3,346,083

Total orders

337,418

Total users

THE DATASET

Contains prior order details for all users in next_orders

Contains order details for each user's 'next' order

THE DATASET

Contains prior order details for all users in next_orders

Contains order details for each user's 'next' order

df_features

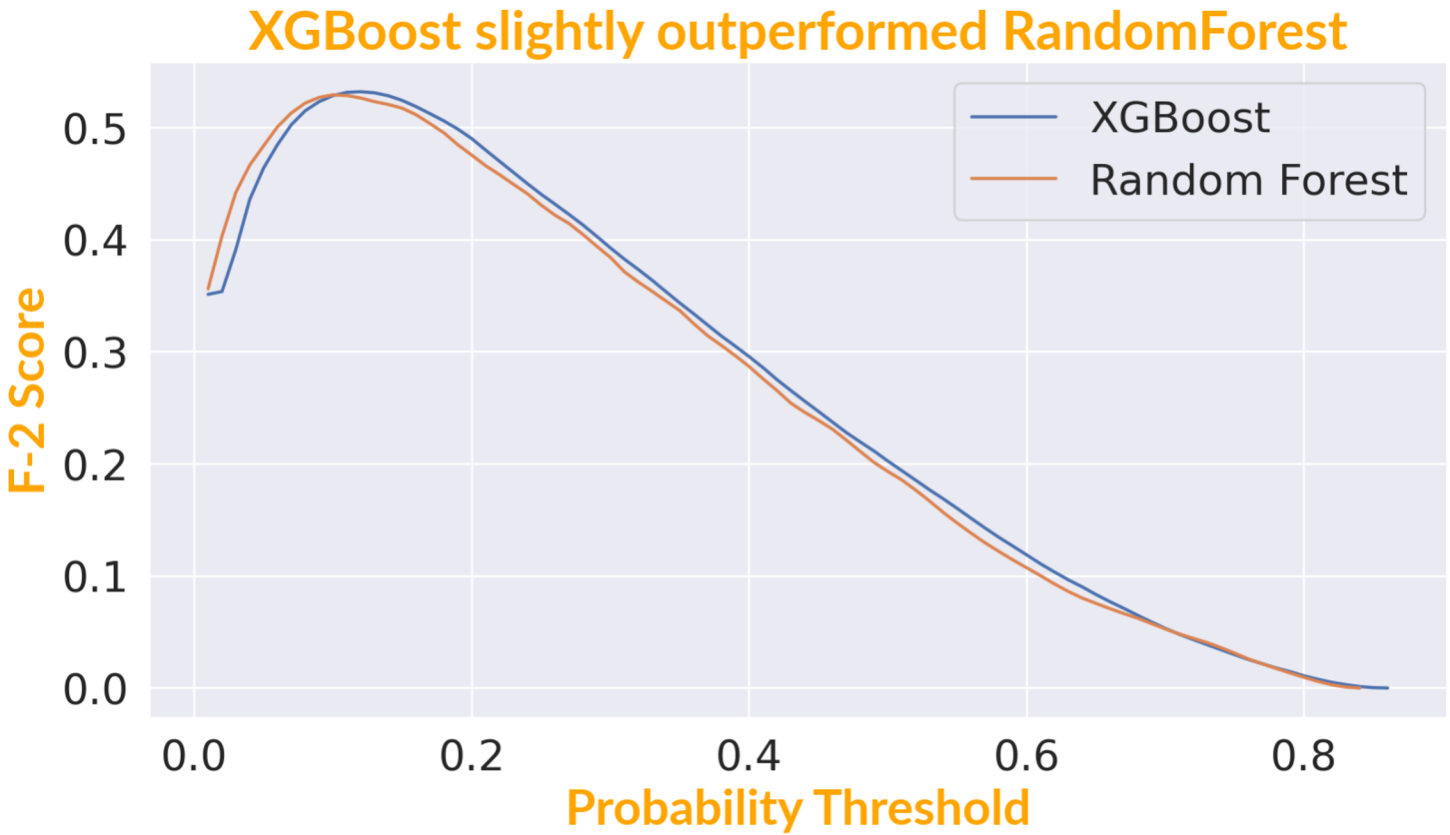
- Contains user & product statistics from prior_orders
- Contains next_order details
- Modeling done on these inputs

Some key features (32 total):

User Features	Product Features	User/Product Features
avg_cart_size	percent_reorders	**order_streak**
days_since_prior_order	qty_sold	last_five_buys
avg_time_between_orders	qty_reordered	In_last_cart (0/1)

1

Model Selection & Results


XGBoost slightly outperformed RandomForest
XGBoost
Random Forest
F-2 Score
0.0
0.1
0.2
0.3
0.4
0.5
0.0
0.2
0.4
0.6
0.8
Probability Threshold

Used grid search to define the optimal parameters:

learning_rate	**0.009**
n_estimators	**400**
max_depth	**7**
colsample_bytree	**0.8**
min_child_weight	**9**

Scoring

2018 Kaggle competition crowned winner based on resulting F-1 scores

Do you remember our use case?

Use Cases:

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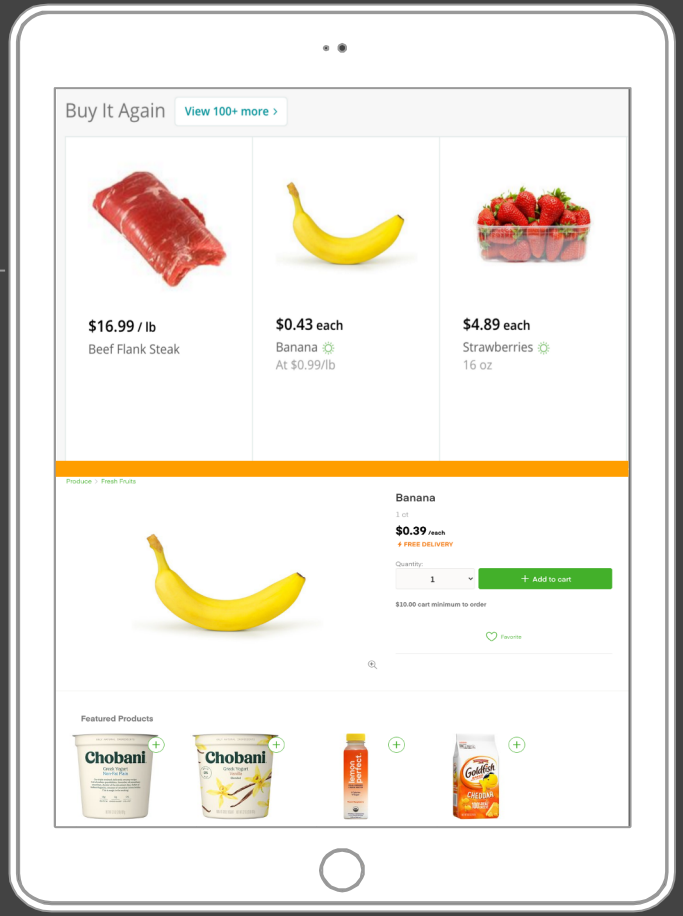
2) Frequently bought with...



Use Cases:

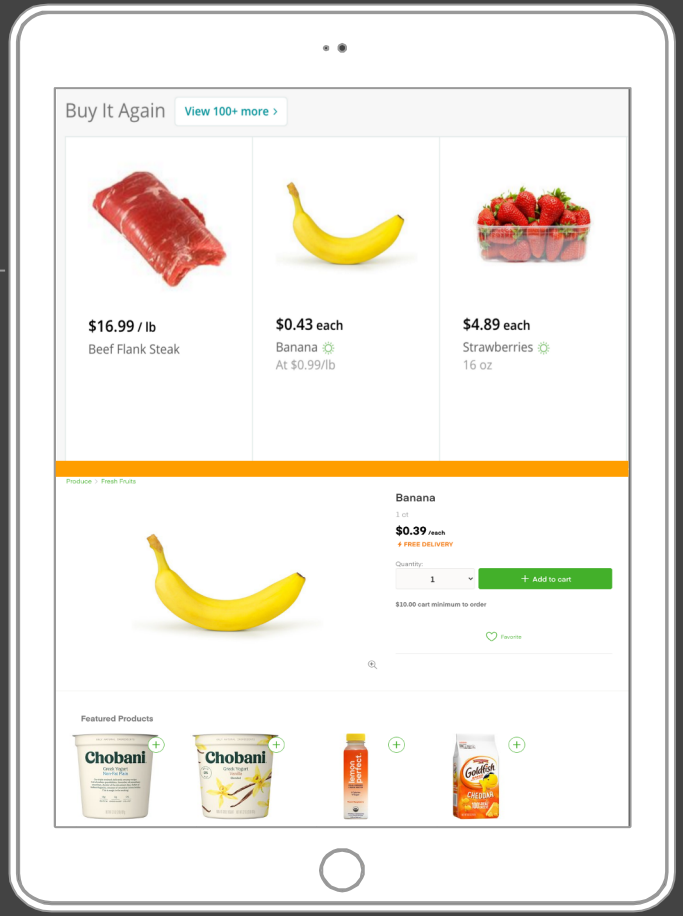
1) Buy-it-again recommendations

2) Frequently bought with...

But how does this help Instacart?

1. User ease of use

1. **Increase product conversion rates**



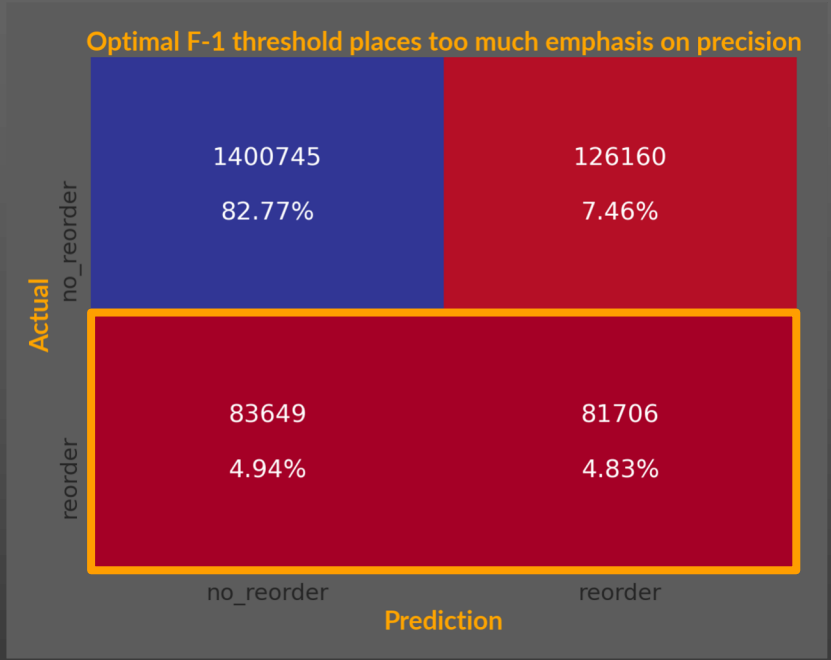
What's the risk of incorrectly classifying an input as positive?

Not Much.

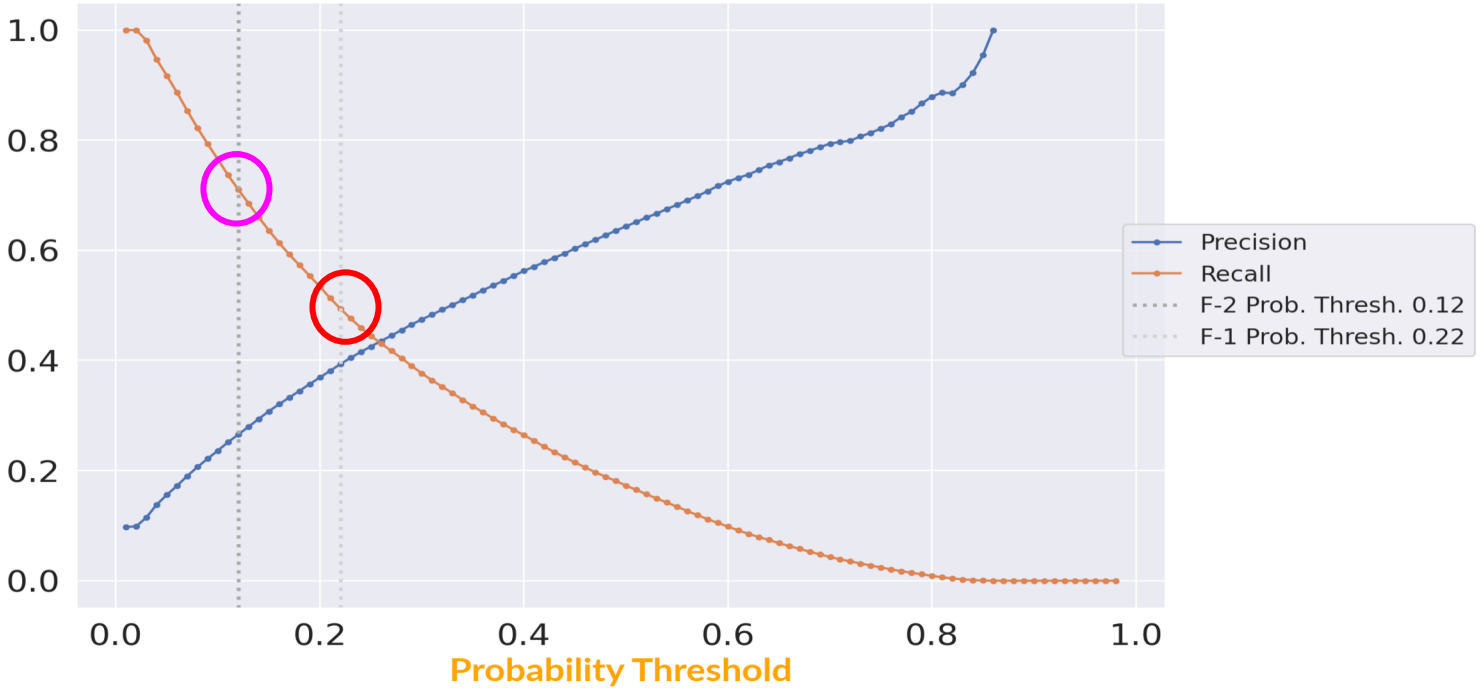
In fact, we may be better off including items that the user is *less likely to buy* based on their prior orders. This will help Instacart to **increase conversion**!

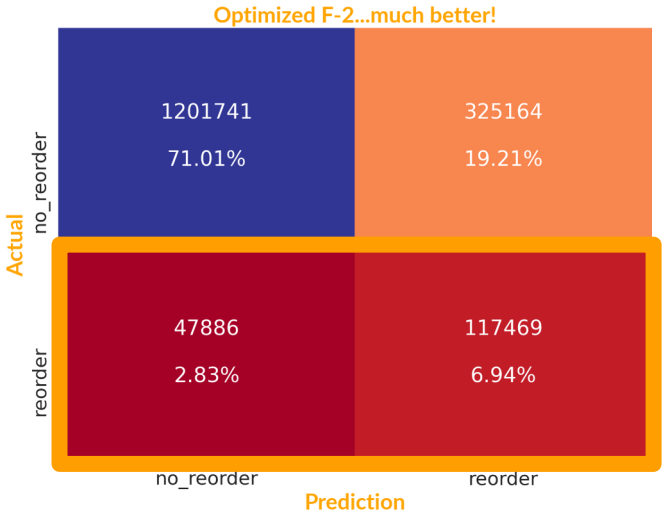
Therefore, we ought to prioritize **recall**!

Recall = True Positives / (True Positives + False Negatives)



Choosing a threshold with an ideal recall/precision balance using F-2 Scores

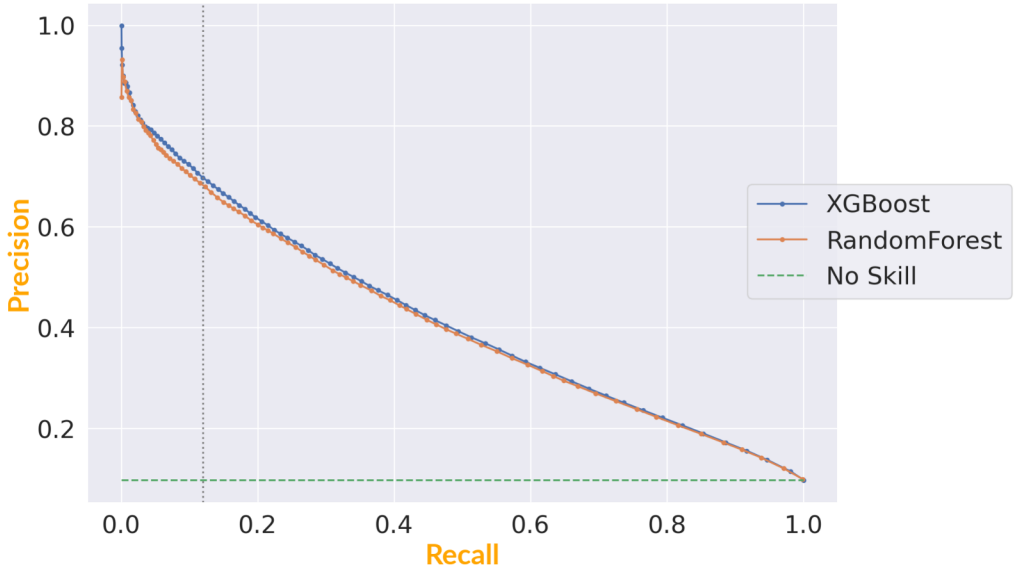




Adjusted F-2 Score

0.53

XGBoost slightly outperformed RF at our chosen recall threshold



Probability Threshold

0.12

THANK YOU!

Any questions?

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