Predicting a User's Next Instacart Order

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Objective and Problem Setup

Algorithms

- XGBoost
- RandomForest

Techniques

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

Python Libraries

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

Tools

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

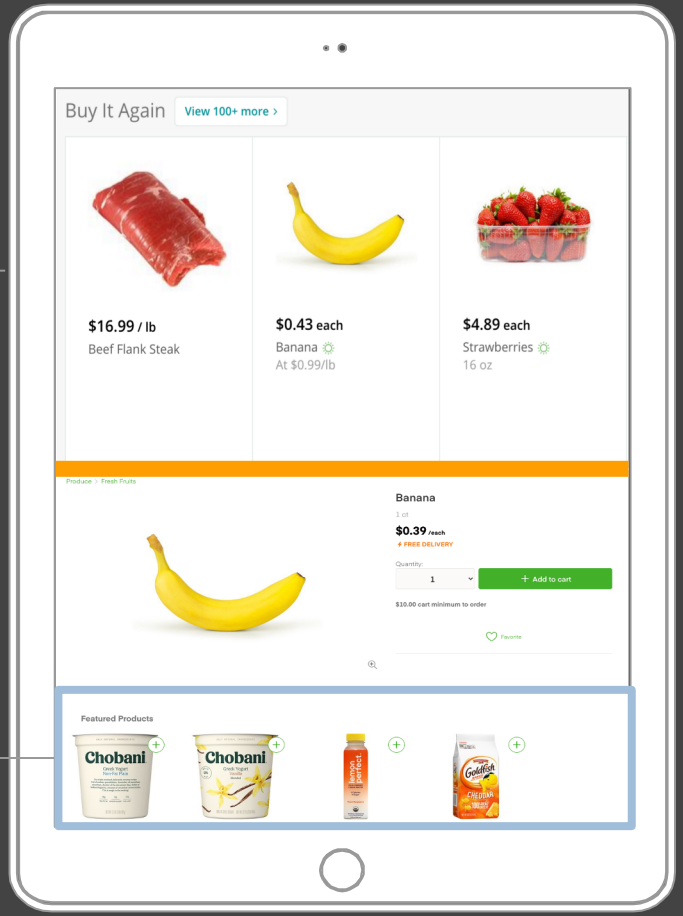
Objective: To predict all of the reorders in a user's next cart

But first… why?

Use Cases:

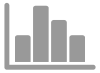
1) Buy-it-again recommendations

2) Frequently bought with...



2

Dataset & Feature Engineering



33,819,106

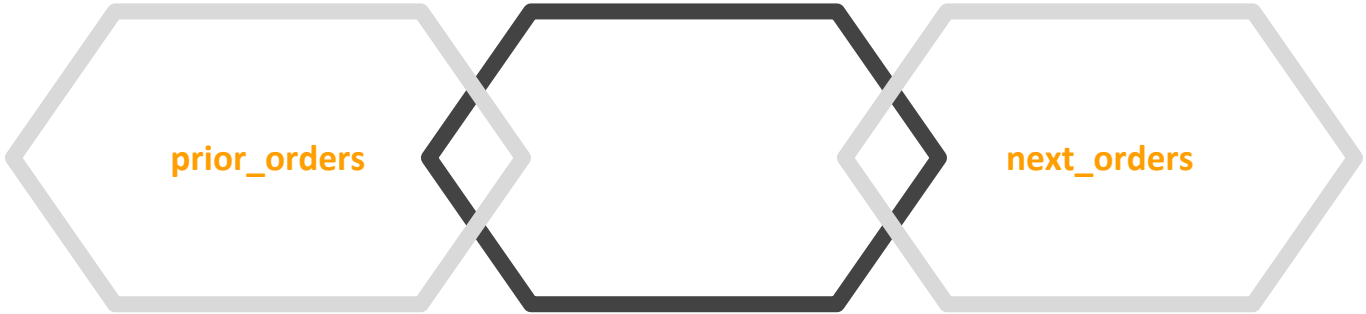
Total rows (1 per product per order)

3,346,083

Total orders

337,418

Total users



Contains prior order details for all users

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

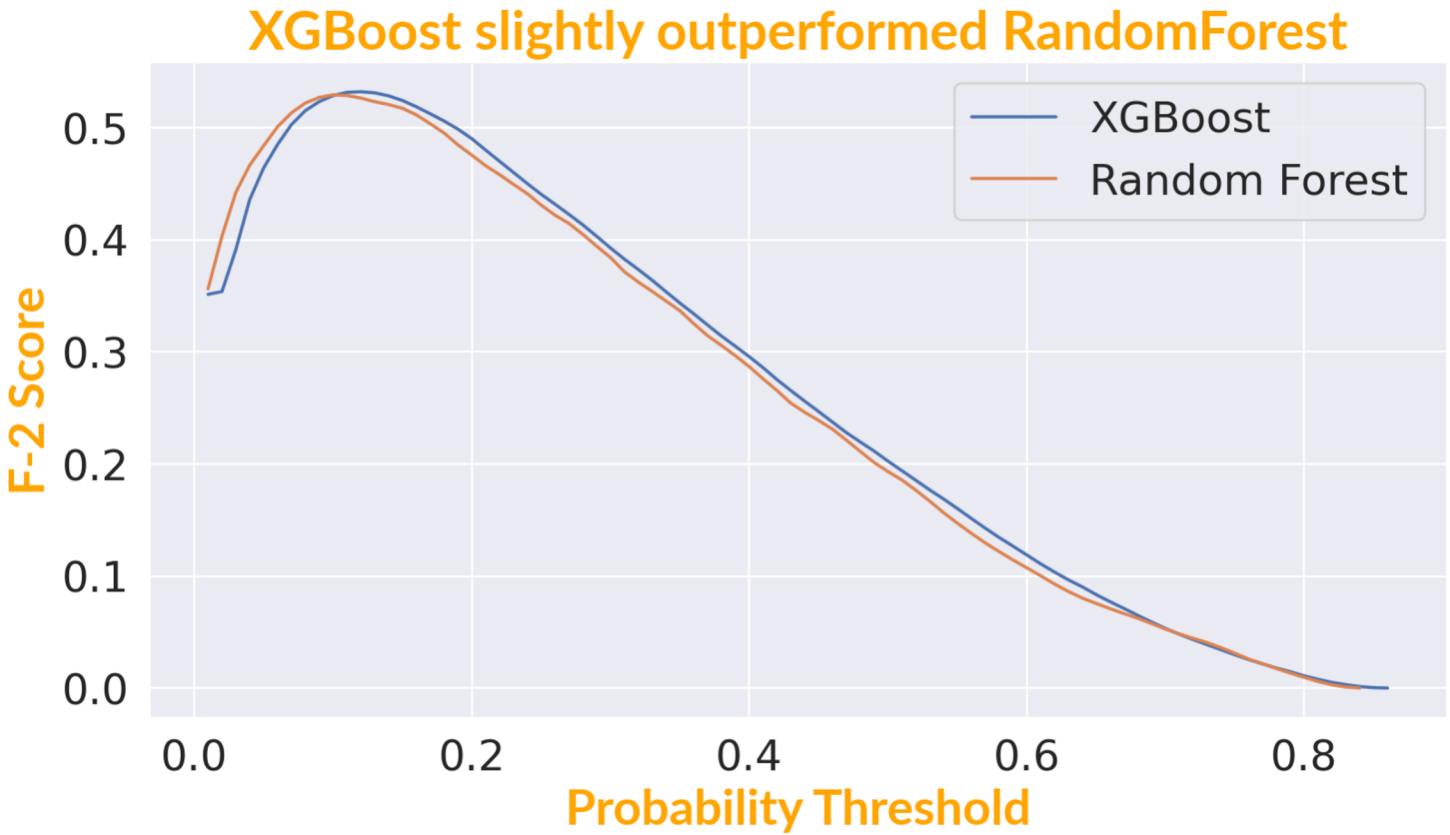
- Contains user & product statistics from prior_orders
- Contains next_order details
- Modeling done on these inputs

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)

3

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 XGBoost parameters:

Took over 28 hours using 16 vCPUs and just 25% of the dataset!

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

Scoring

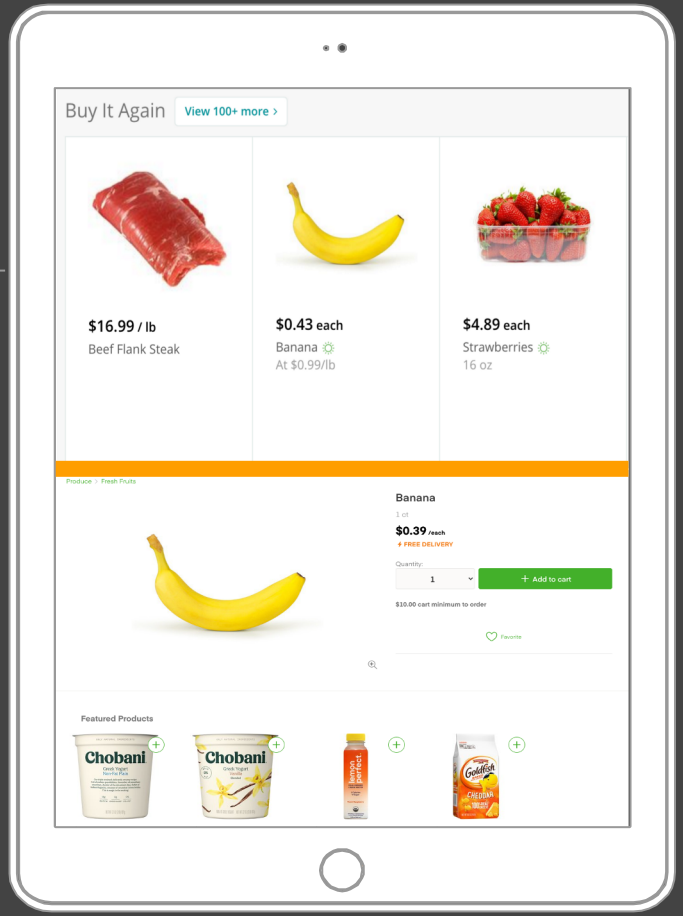
2018 Kaggle competition crowned winner based on resulting F-1 scores

Do you remember our use case?

Use Cases:

1) Buy-it-again recommendations

2) Frequently bought with...



Use Cases:

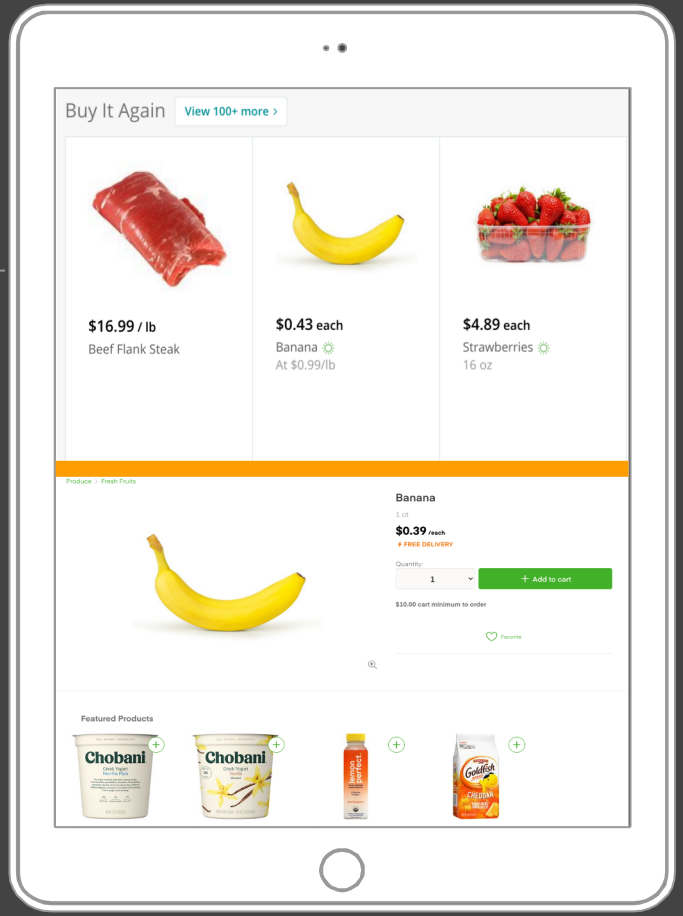
1) Buy-it-again recommendations

2) Frequently bought with...

But how do these features help Instacart?

1. User ease of use

1. **Increase product conversion rates**



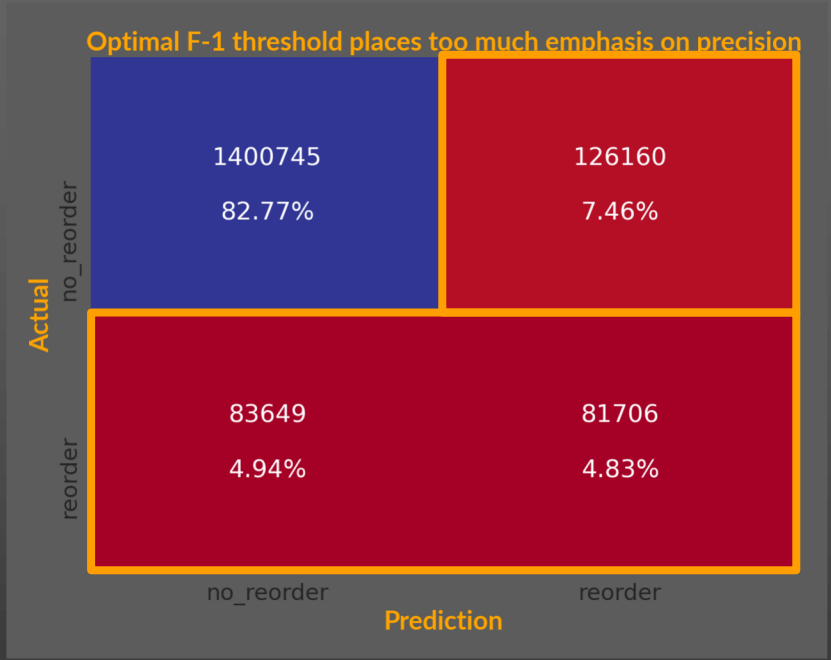
What's Instacart's risk of incorrectly classifying an input as positive (reorder)?

Not Much.

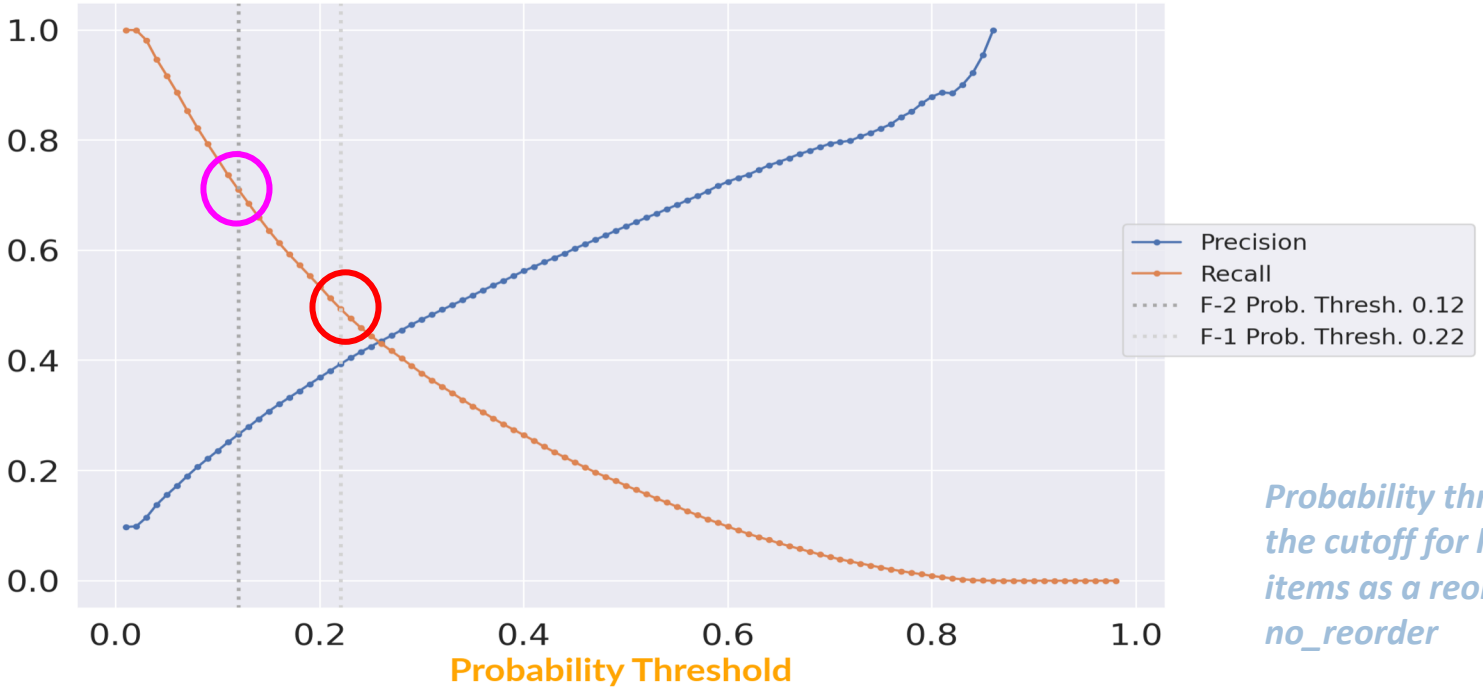
In fact, we may be better off including items that the user is *less likely to buy* based on their prior orders. This will help Instacart to **increase conversion**!

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

Recall = True Positives / Actual Positives



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



Probability threshold is the cutoff for labeling items as a reorder/ no_reorder

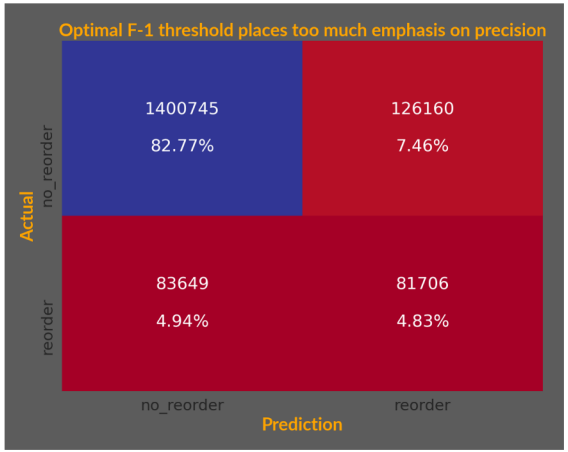
Adjusted F-2 Score

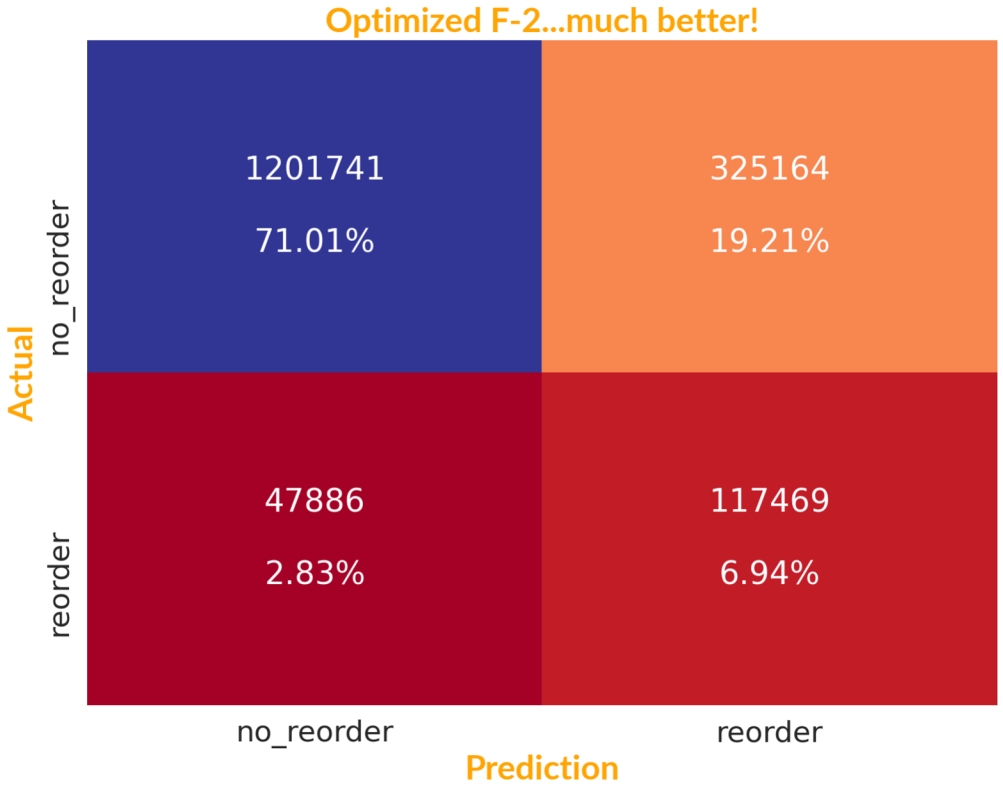
0.53

Probability Threshold

0.12

Previous threshold (0.22)





THANK YOU!

Any questions?

You can find me…

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