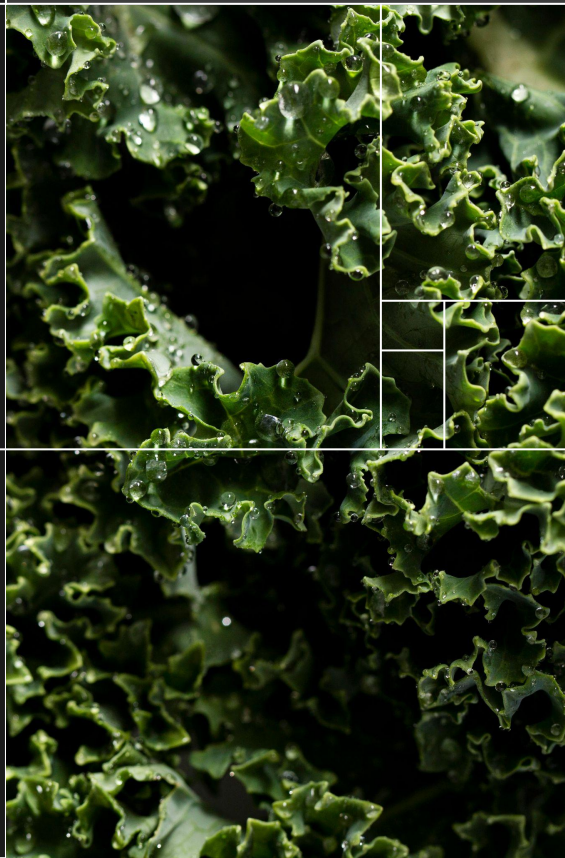# Instacart Predictions

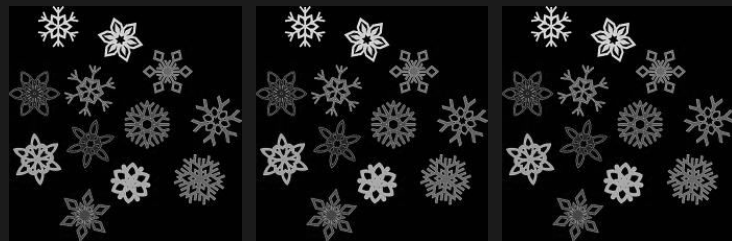Next time you log in to instacart, which items will they recommend you reorder?

Why Predict Reorders?

- Shopping is quick & easy when items we want most appear immediately when we log on.
- Instacart profits when we keep coming back for the convenient experience.

Shoppers are Fickle

Shouldn't this be a simple task?
I *feel* like I buy extra-creamy lemon yogurt every-other day. Just show me that.

Nope.
There are tens of thousands of products, and our purchasing patterns are less consistent than you might think.

3%

People reorder from the Dairy & Eggs department more often than from any other category. . . .

. . . But if you guess I'll buy that yogurt next time I log in, without considering any other factors, you'll only be correct about 3% of the time.

Modeling Works

If you randomly guess at whether or not each item somebody has bought in the past will be reordered on their next visit, here's how well your recommendations will land:

True Negatives: 83%	False Negatives: 8%
False Positives: 8%	True Positives: 1%

Making predictions with a Random Forest Machine Learning Classifier produced recommendations with the following accuracy:

True Negatives: 90%	False Negatives: 2%
False Positives: 5%	True Positives: 3%

Digging into Model Performance

Random Guessing:

False Positives:	True Positives =
8%	1%

If somebody has bought 100 items in the past, you'll recommend they reorder 9 and be correct just once.

11%

of recommendations will feel right to them.

Predictive Modeling:

False Positives:	True Positives:
5%	3%

If somebody has bought 100 items in the past, you'll recommend they reorder 8 and be correct 3 times.

38%

of recommendations will feel right to them.

Model Evaluation Metrics

Random Forest Classifier

F1 Score: 0.4
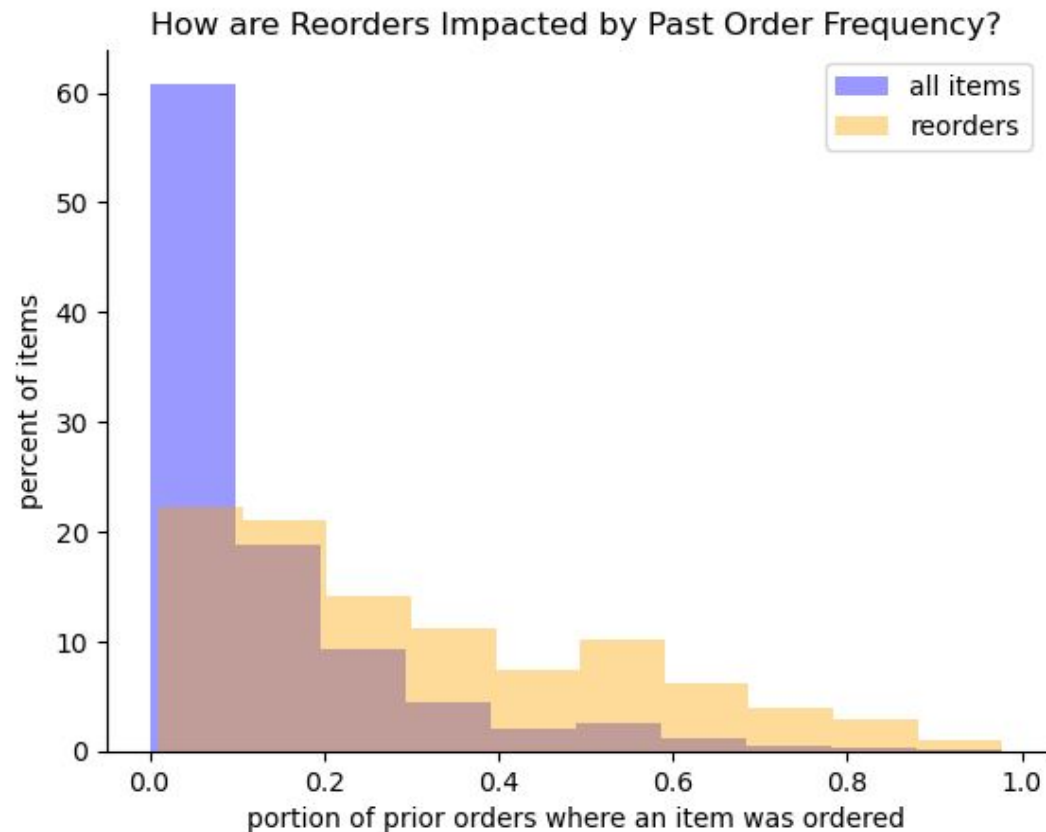
ROC AUC: 0.71

Log Loss: 2.55

How?

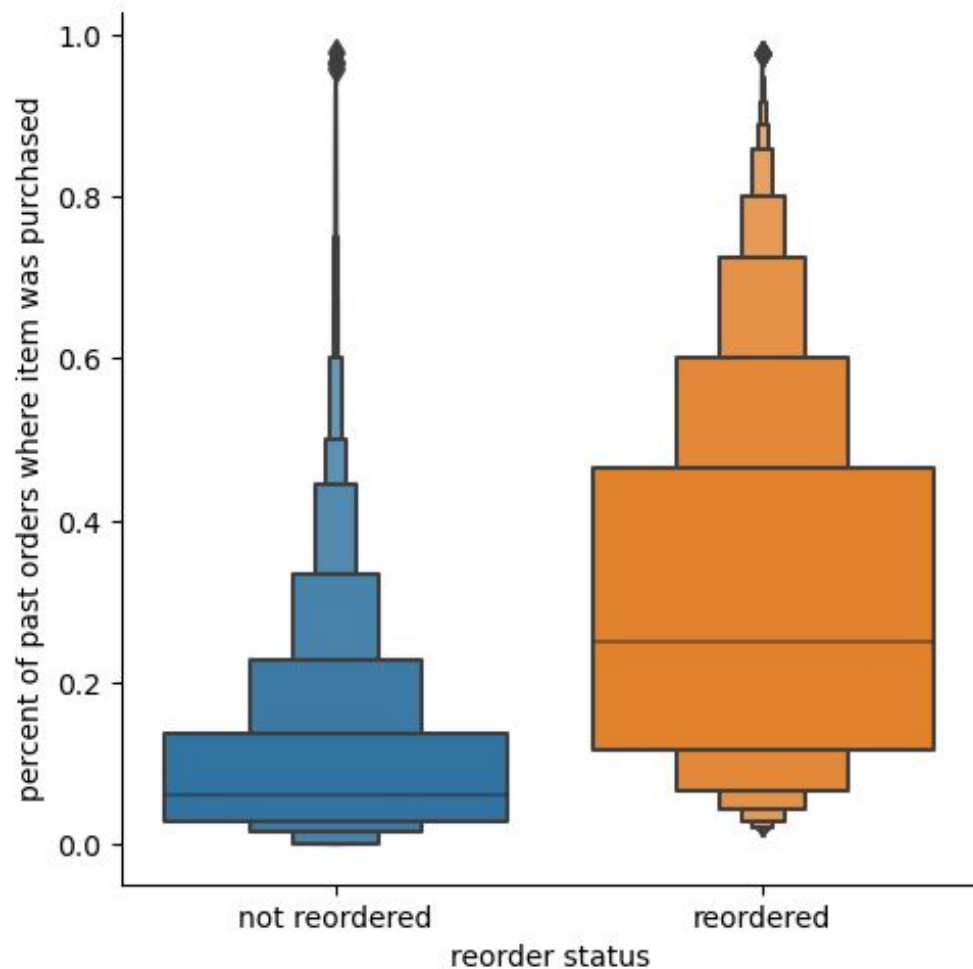## What variables are most helpful in making predictions?

Purchase History is Key

Whether somebody has purchased an item many times before is the best predictor that they'll buy it again.
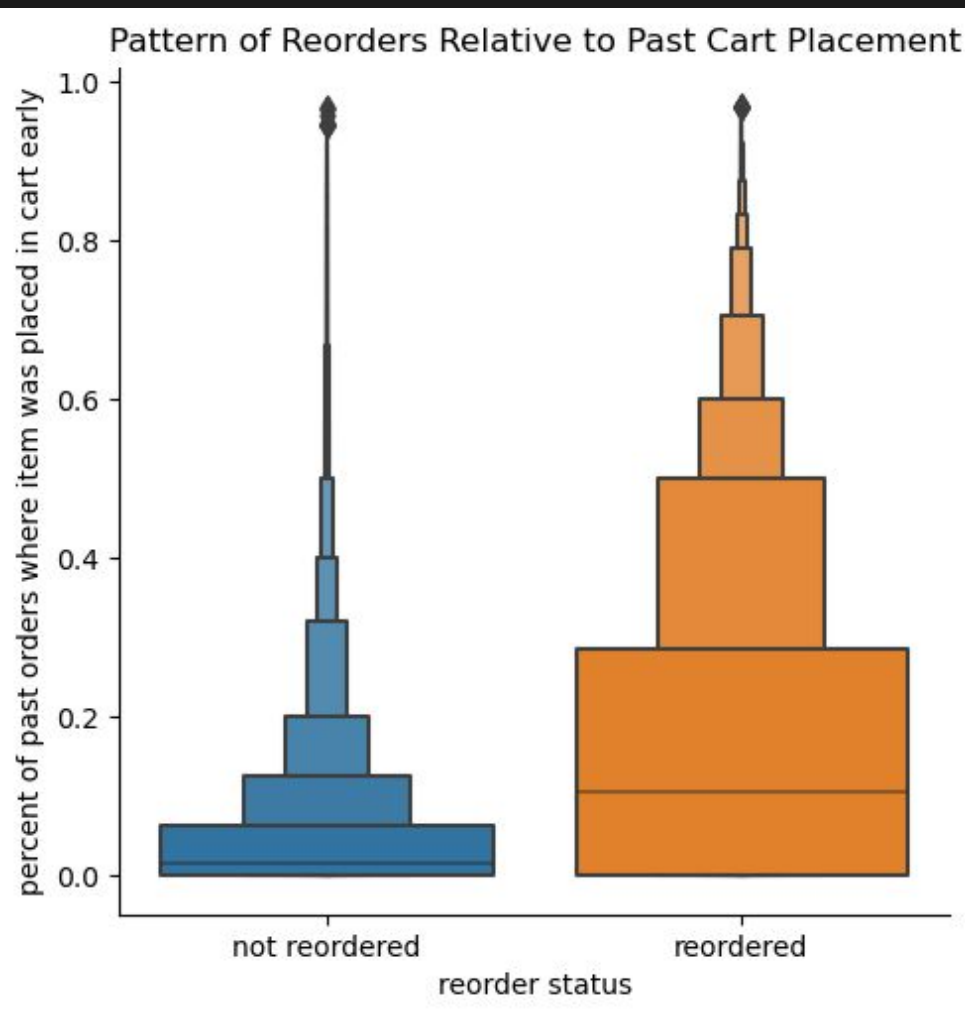
Pattern of Reorders Relative to Past Order Rate

See it another way.

"Add to Cart Sequence"

If an item was often one of the first 6 to be placed in a shopper's cart in the past, they're more likely to reorder it in the future.

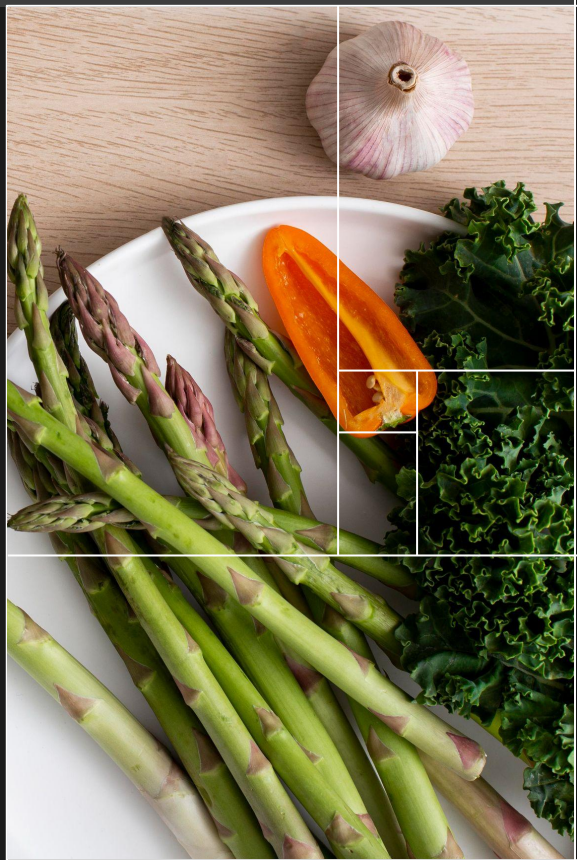Pattern of Reorders Relative to Past Cart Placement

"Days Since Prior Order"

If it has been a while since a user has make an Instacart purchase, they're *slightly* more likely to make more reorders next time they visit.

Pattern of Reorders Relative to Days Since Prior Order
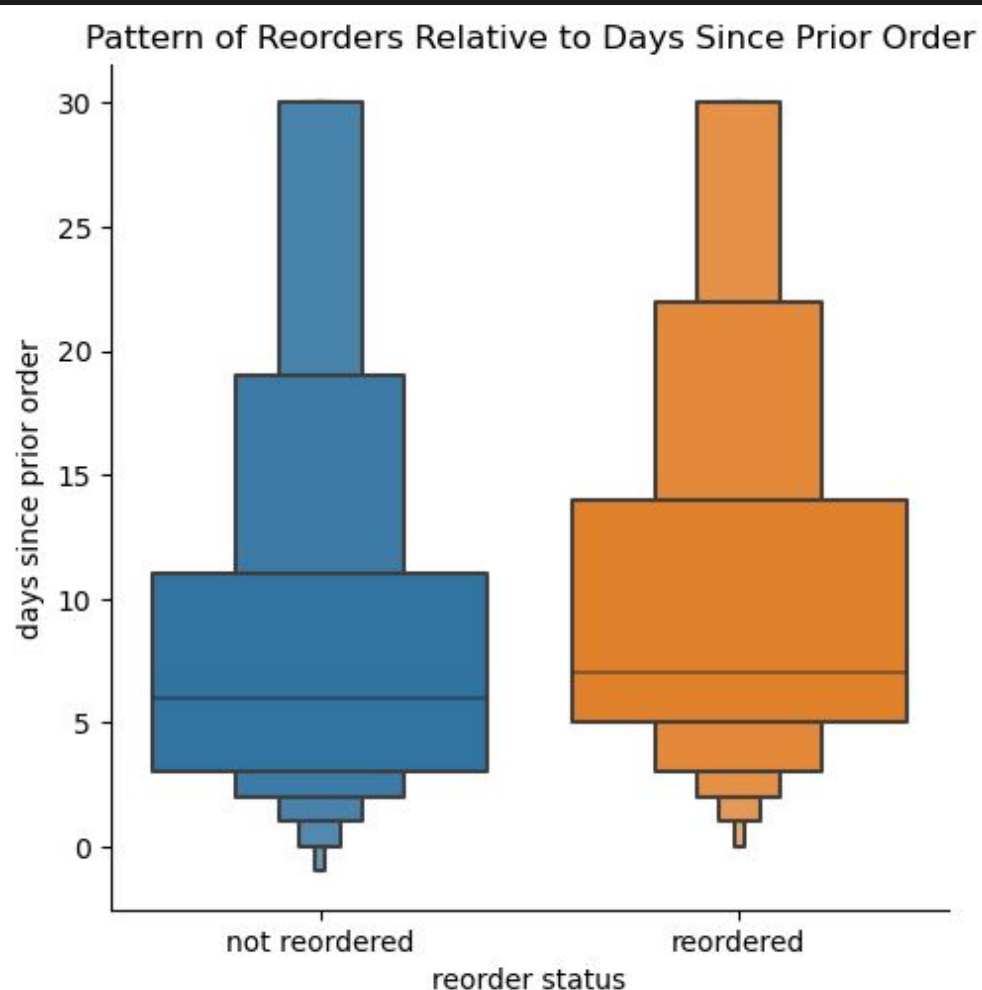
How?

What process gets that data prediction-ready?

Wrangling Data:

1. Add rows for non-orders, so every order contains a trace of every product ever ordered.
2. Create columns for "percent prior orders where this item was purchased" & "percent prior orders where this item was added to the cart early."
3. Create columns that extract keywords from product names, i.e. "Organic."
4. Remove the "Missing" department.
5. Encode categorical data, i.e. product names get their own unique numbers.

From…

User	Order	Product	Add to Cart	Reorder
A	1	banana	1	0
A	1	milk	2	0
A	2	cereal	1	0
A	2	eggs	2	0
A	2	milk	3	1
A	3	milk	1	1
A	3	banana	2	1
B	1	milk	1	0
…	…			
…	…			

To...

User	Order	Product	Add to Cart	% Past	Reorder
A	1	banana	1	ø	ø
A	1	milk	2	ø	ø
A	2	cereal	1	ø	ø
A	2	eggs	2	ø	ø
A	2	milk	3	1	1
A	2	banana	ø	1	ø
A	3	milk	1	1	1
A	3	banana	2	0.5	1
A	3	cereal	ø	0.5	ø
A	3	eggs	ø	0.5	ø
B	1	milk	1	ø	ø
...					
...					

...with thousands of users.
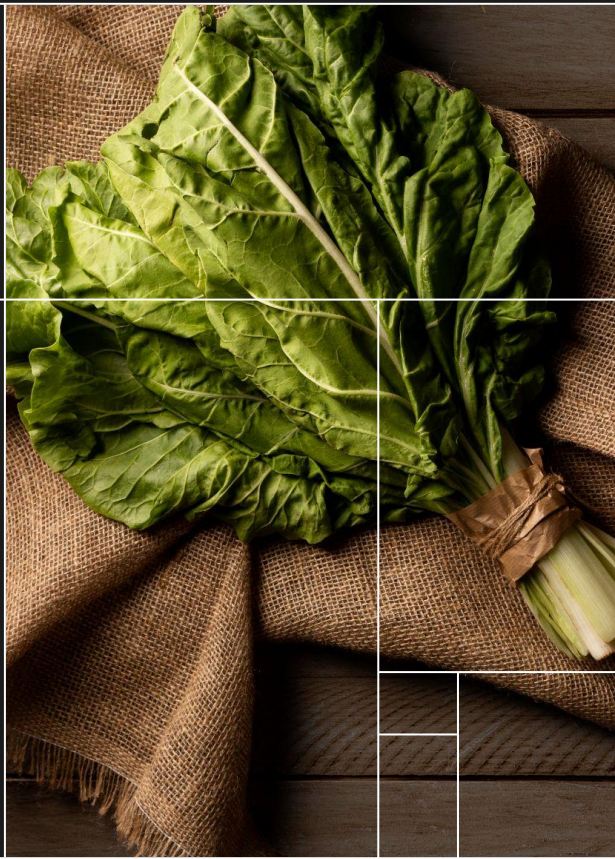
Future Possibilities

Answer a related, but more flexible, prediction question:

From among all items a user has ever ordered, which are they most likely to reorder first on their next order? Can we guess at least 1 of their first 5 reorders?
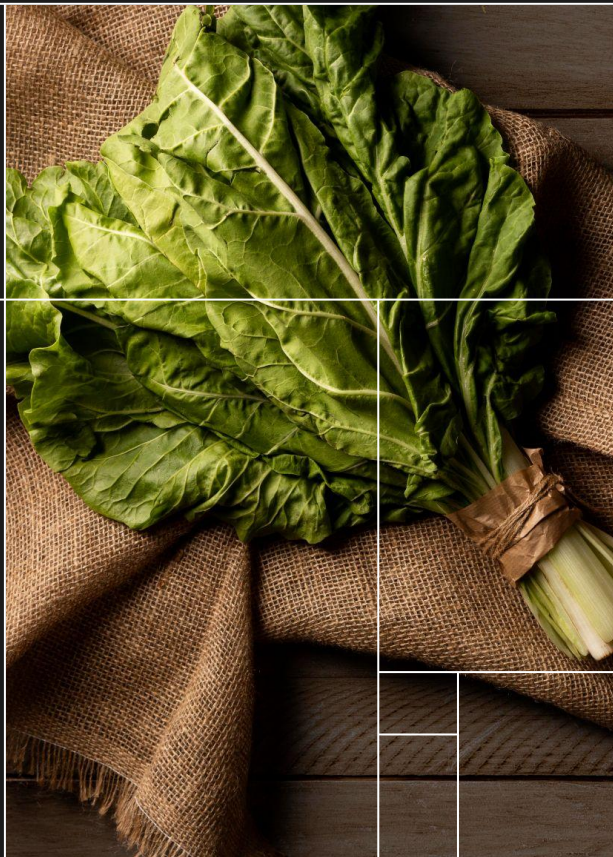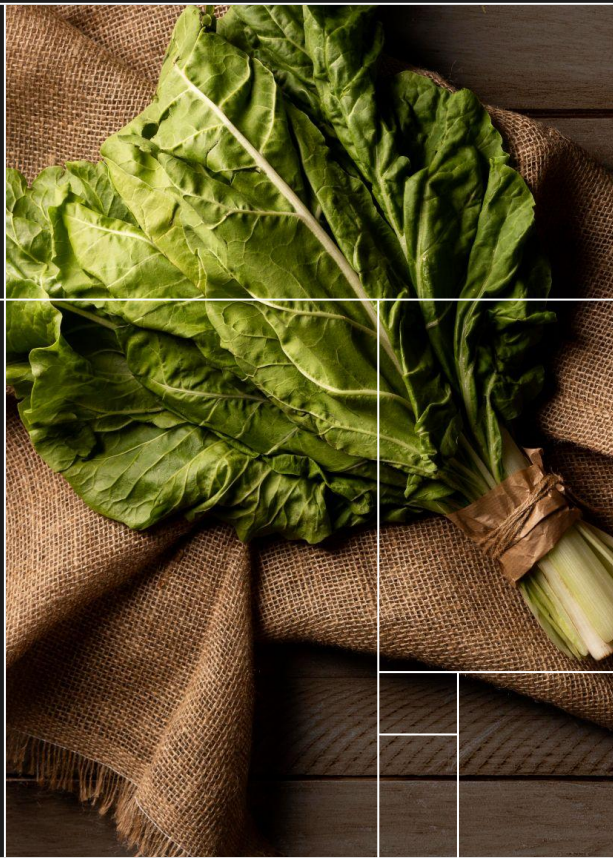
Future Possibilities

Reclassify each product from the 'Missing" department to the department where it logically belongs. This could improve the model's predictive performance.

Future Possibilities

Use the outcomes from this model to improve predictions:

Did the user take our recommendation? What does this tell us about how to change recommendations in the future?

Thanks!

Nutrition workshop

Benefits of kale