Capgemini

User Recommendation Engine & Market Basket Analysis

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Link: https://github.com/XuechunWang/Cap_Recommendation

User Recommendation Engine & Market Basket Analysis

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01 Description of the Problem and Data Sets

02 Insights and Exploratory Analysis

03 Feature Engineering and Clustering Analysis

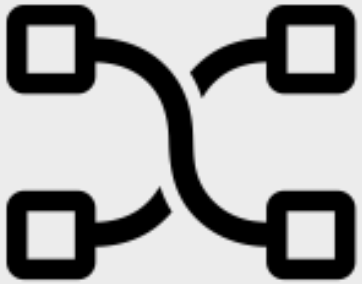
04 Recommendation Engine Modeling and Diagnostics

05 Technology Used and Future Work

Description of the **Problem** and Data Sets

Transaction Data

Data Processing



Data Discovery

Prediction Model
on which product a user will buy again

Description of the Problem and **Data Sets**

Orders

Order Products
(prior, train, test)

30+m rows

- order_id
- product_id
- add_to_cart_order
- reordered

User Orders

3.4m rows

206K users

- order_id
- user_id
- Eval_set
- order_number
- order_dow
- order_hour_of_day
- days_since_prior

Products

50km rows

- product_id
- product_name
- aisle_id
- department_id

aisles

134 rows

- aisle_id
- aisle

departments

21 rows

- department
- department_id

Insights

and Exploratory Analysis

Insights and Exploratory Analysis - Understanding the Products

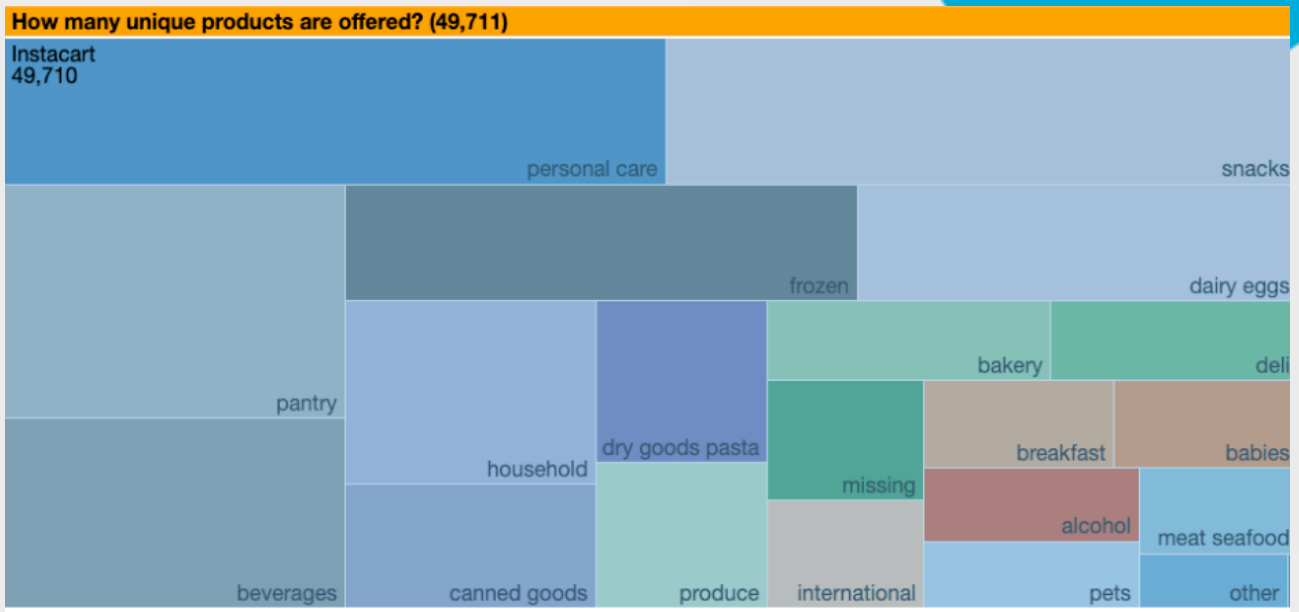
Top 3 Departments

How many unique products:

Personal care

Snacks

Pantry

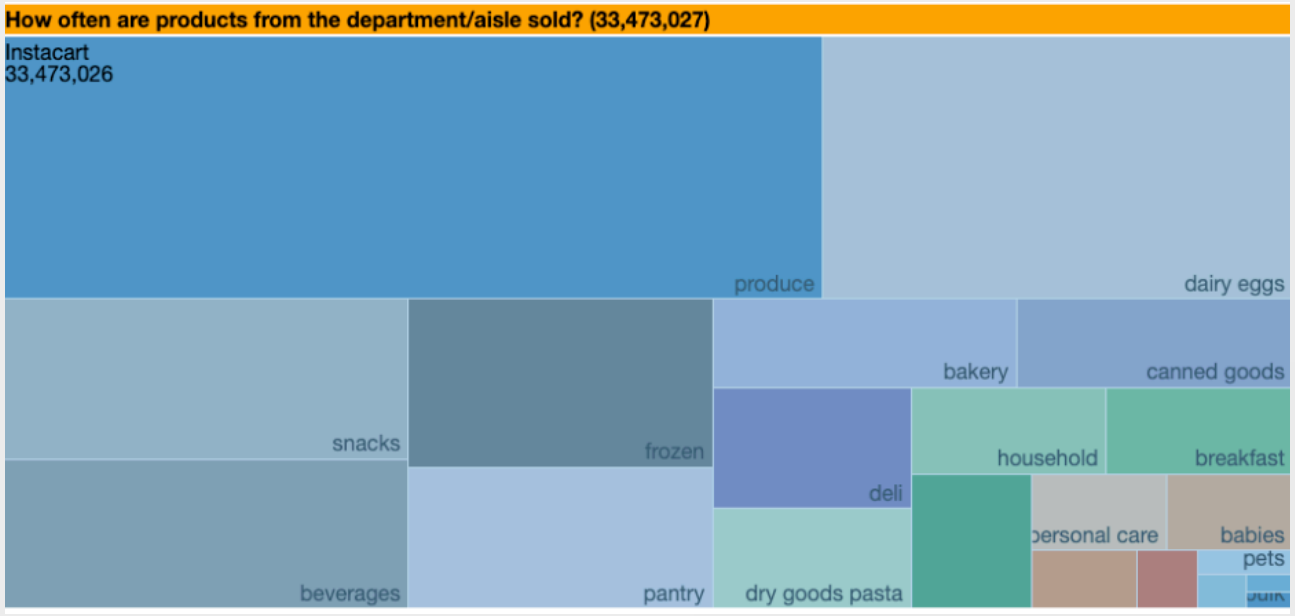


How often purchased:

Produce

Dairy eggs

Snacks



Insights and Exploratory Analysis – Never buy items

Products that are never sold:

	product_id	product_name	aisle_id	department_id
3629	3630	Protein Granola Apple Crisp	57	14
3717	3718	Wasabi Cheddar Spreadable Cheese	21	16
7044	7045	Unpeeled Apricot Halves in Heavy Syrup	88	13
37702	37703	Ultra Sun Blossom Liquid 90 loads Fabric Enhan...	75	17
43724	43725	Sweetart Jelly Beans	100	21
45970	45971	12 Inch Taper Candle White	101	17
46624	46625	Single Barrel Kentucky Straight Bourbon Whiskey	31	

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Insights and Exploratory Analysis - Most frequently buy items

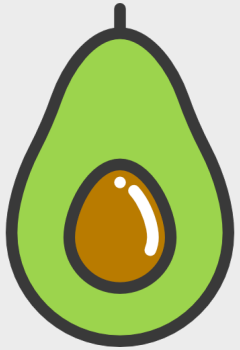
Top List:

1. 
Banana

2. 
Strawberry

3. 
Lemon


spinach

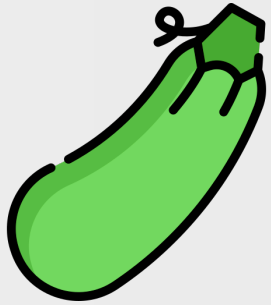

avocado

milk


raspberry


onion

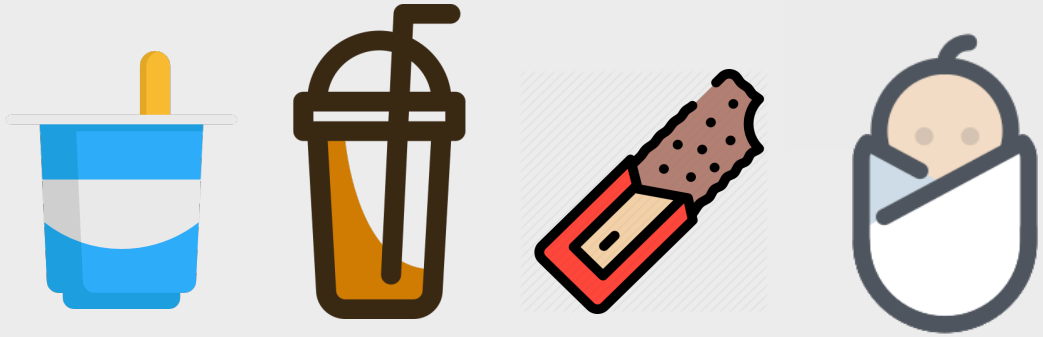

garlic


zucchini

Insights and Exploratory Analysis - Most frequently buy items

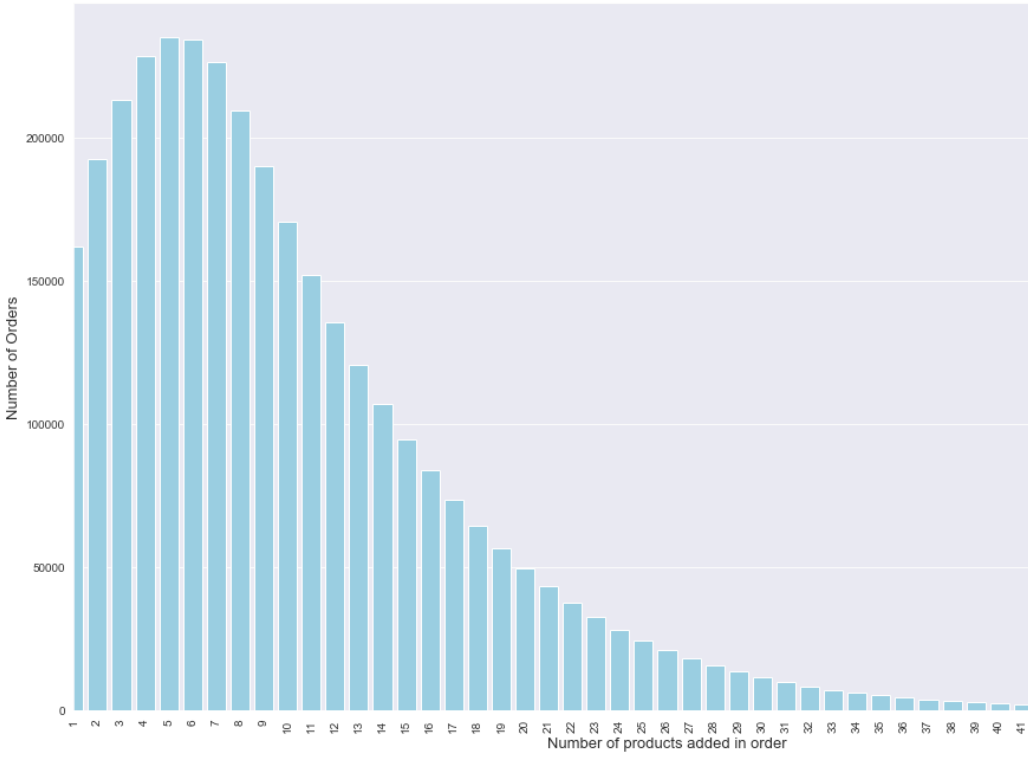
From Association role Analysis - **Apriori Algorithm**

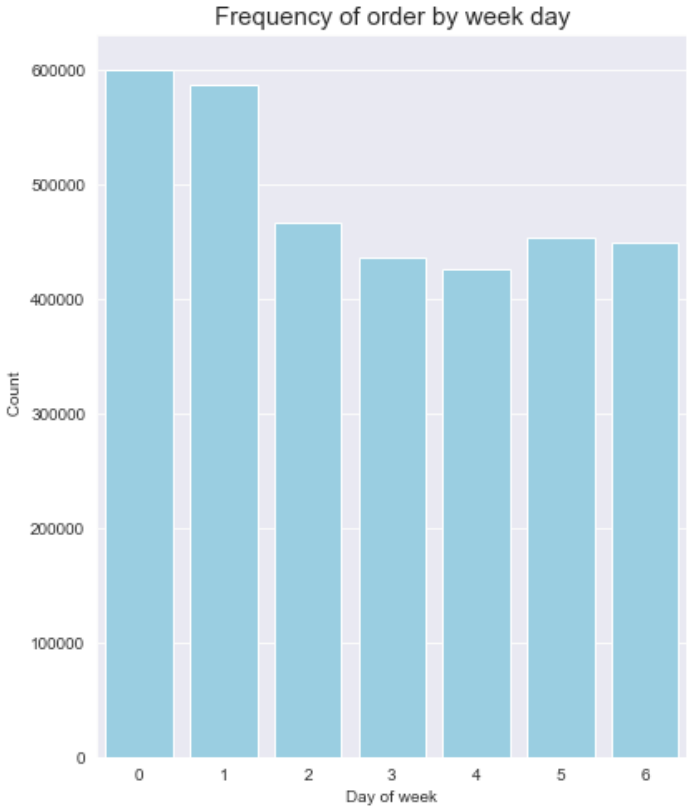
- One flavor of an item being purchased with another flavor from the same family being added to the order
  - Especially on **Yogurt, Beverage, and Food Bar, Baby Food**

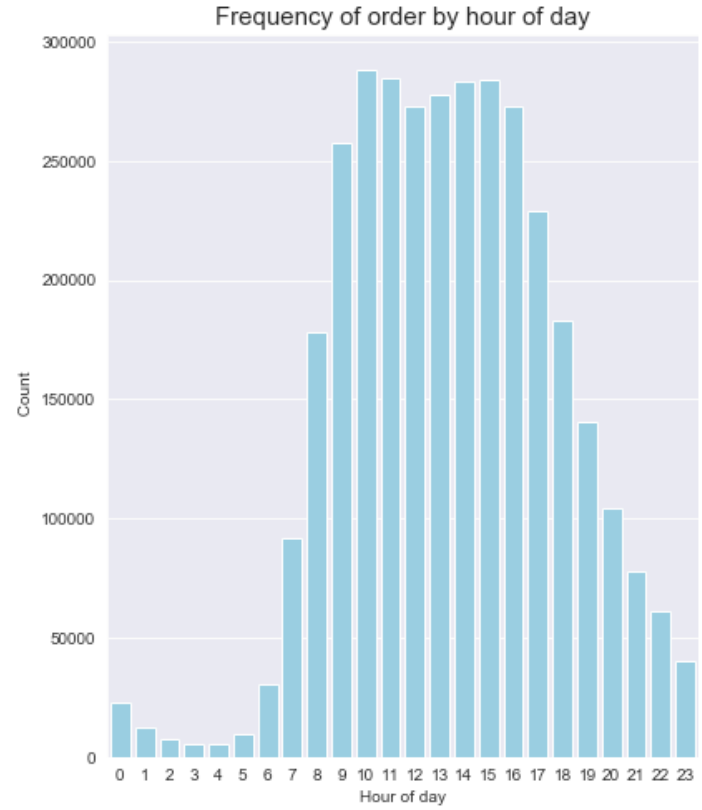


- Recognized some common patterns:
  - Ex. **Moisture Conditioner - Hair Shampoos**

Insights and Exploratory Analysis - Understanding the orders







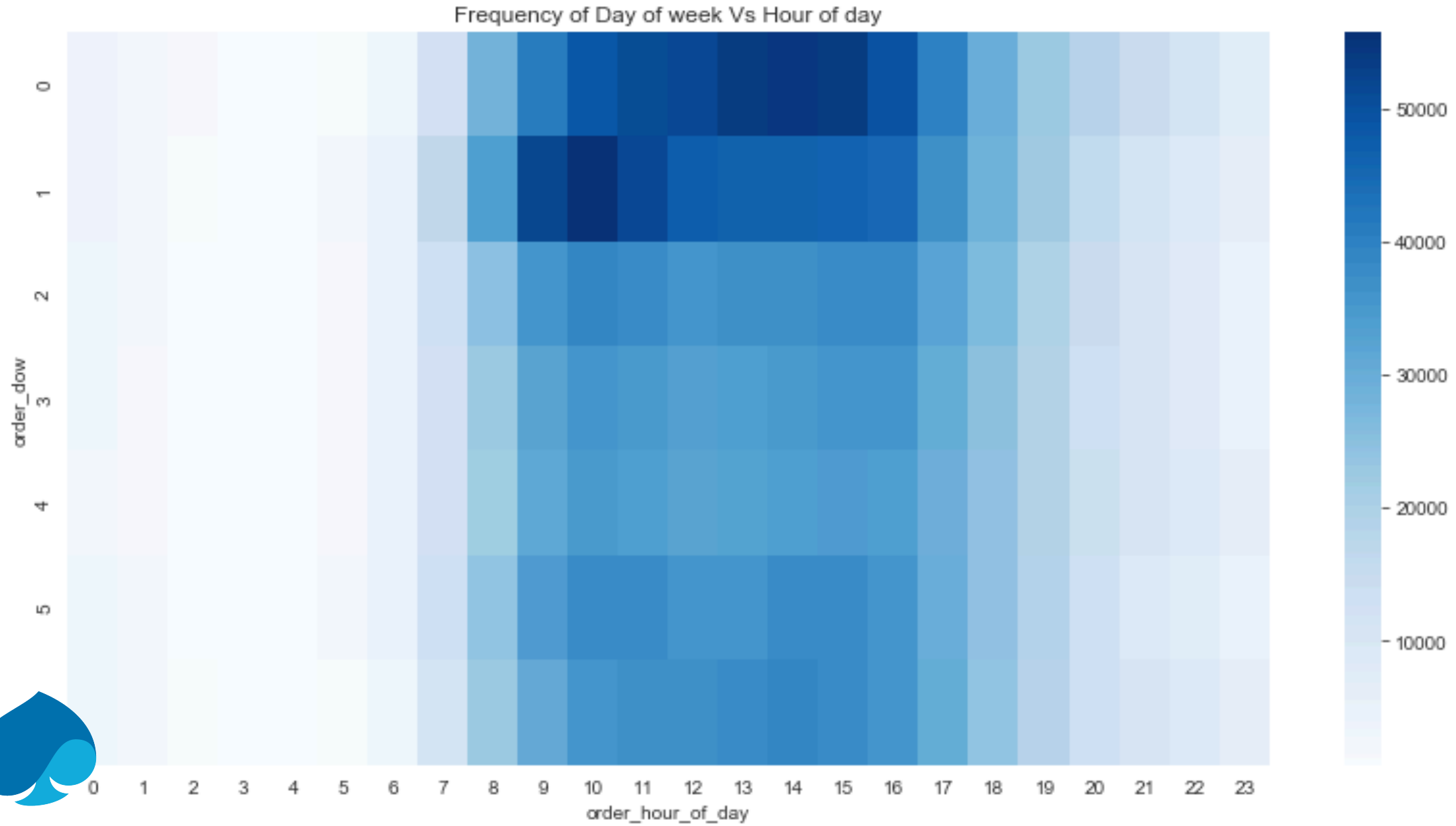
Distribution of number of products per order

Similar to Poisson distribution

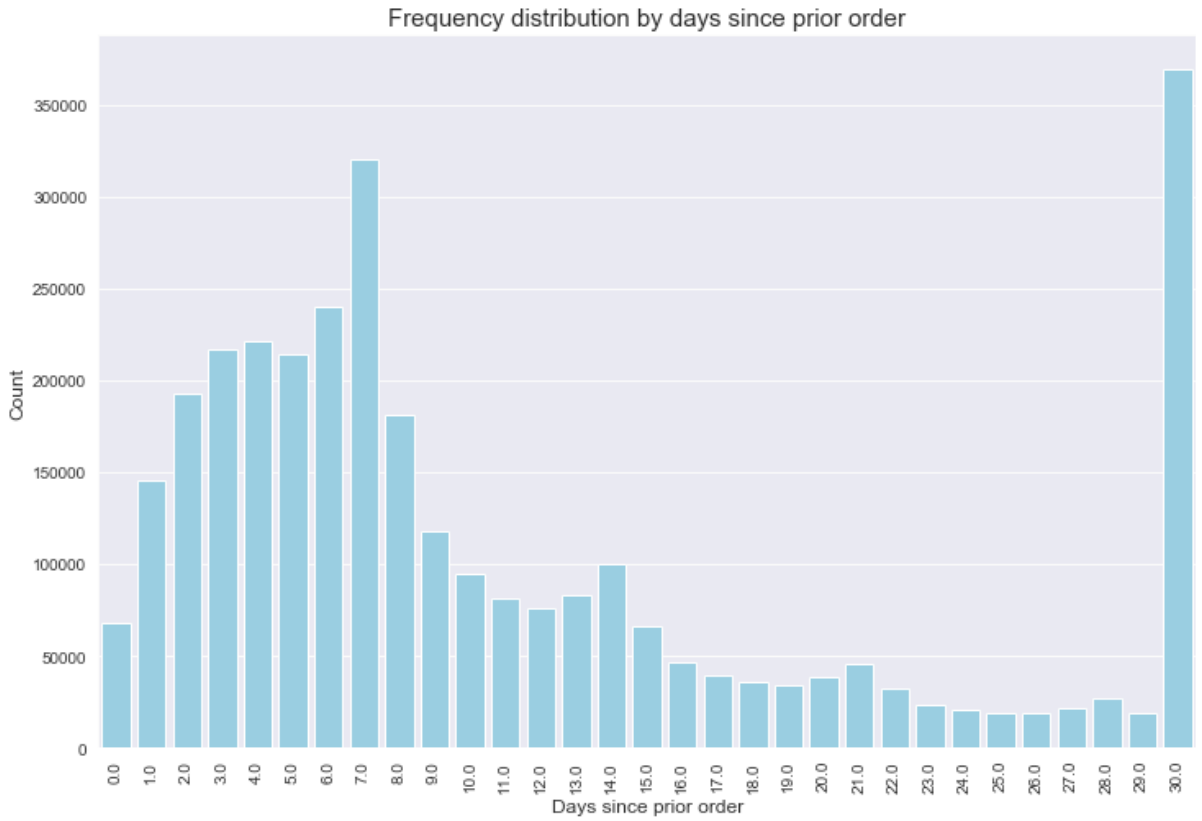
Sunday and **Monday** have relatively more orders during a week

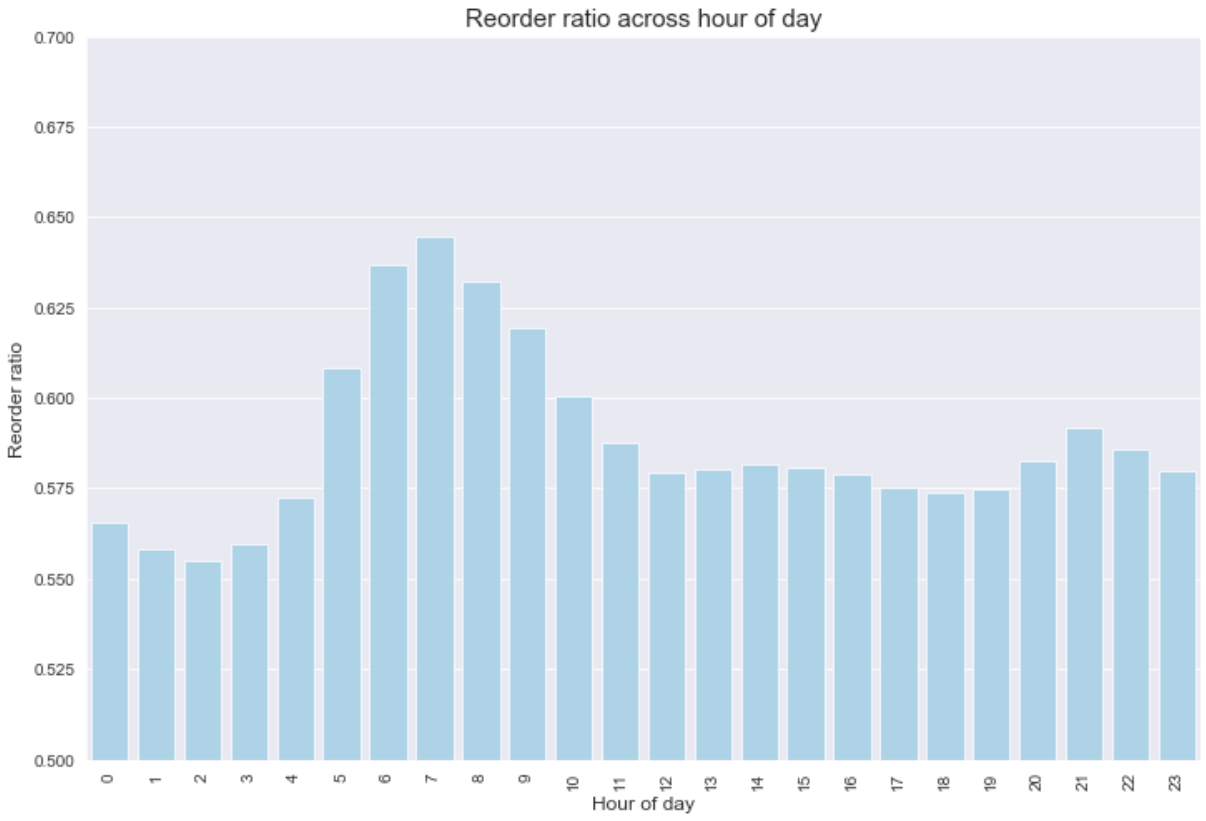
Most of orders occur during the time range 9-17 of a day

Insights and Exploratory Analysis - Understanding the orders



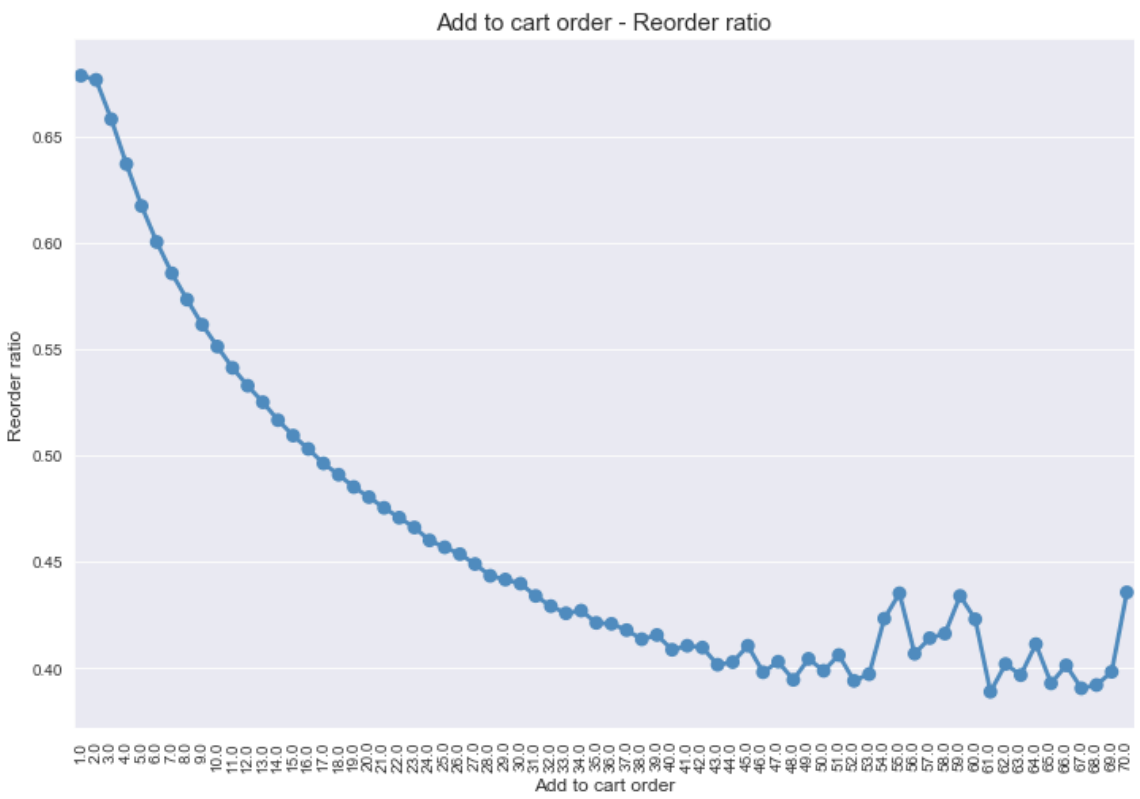
Insights and Exploratory Analysis - Understanding the reorders

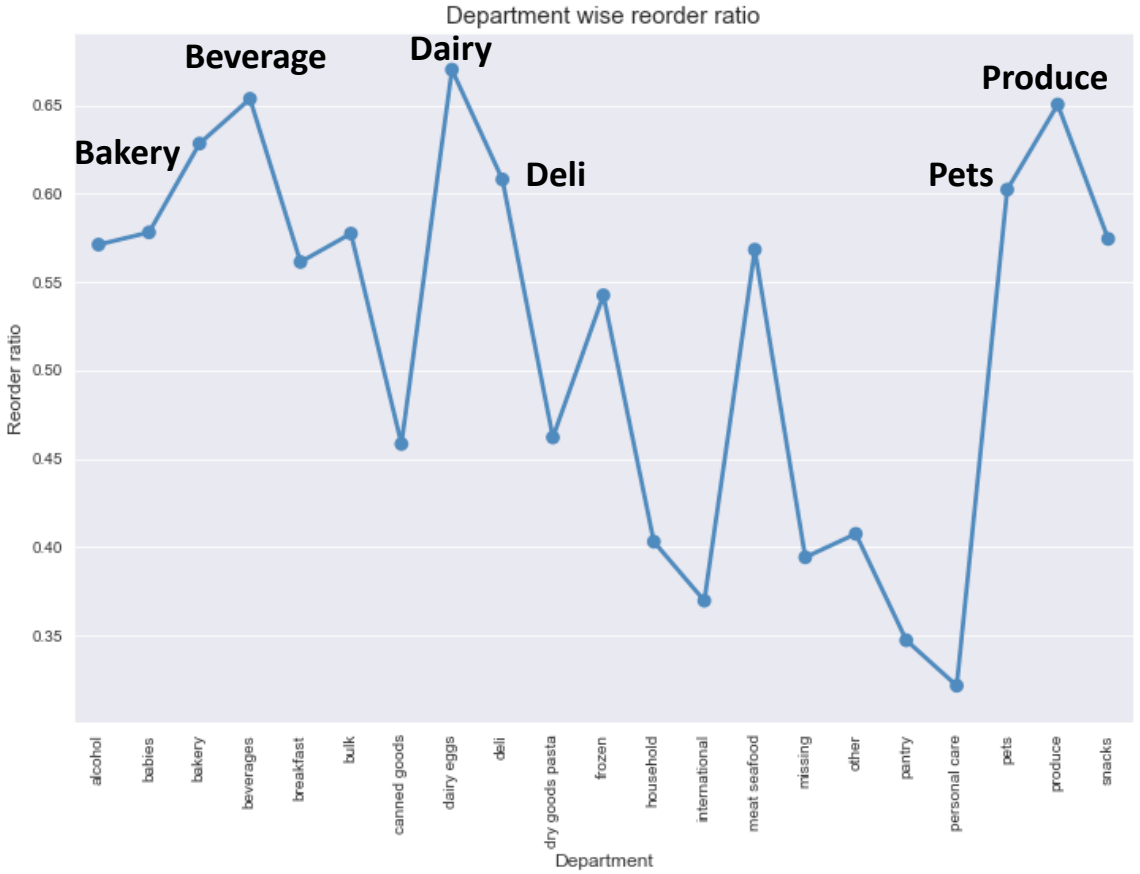




The average times user buy a product is 3.31
The maximum times product is 98

Insights and Exploratory Analysis - Understanding the reorders





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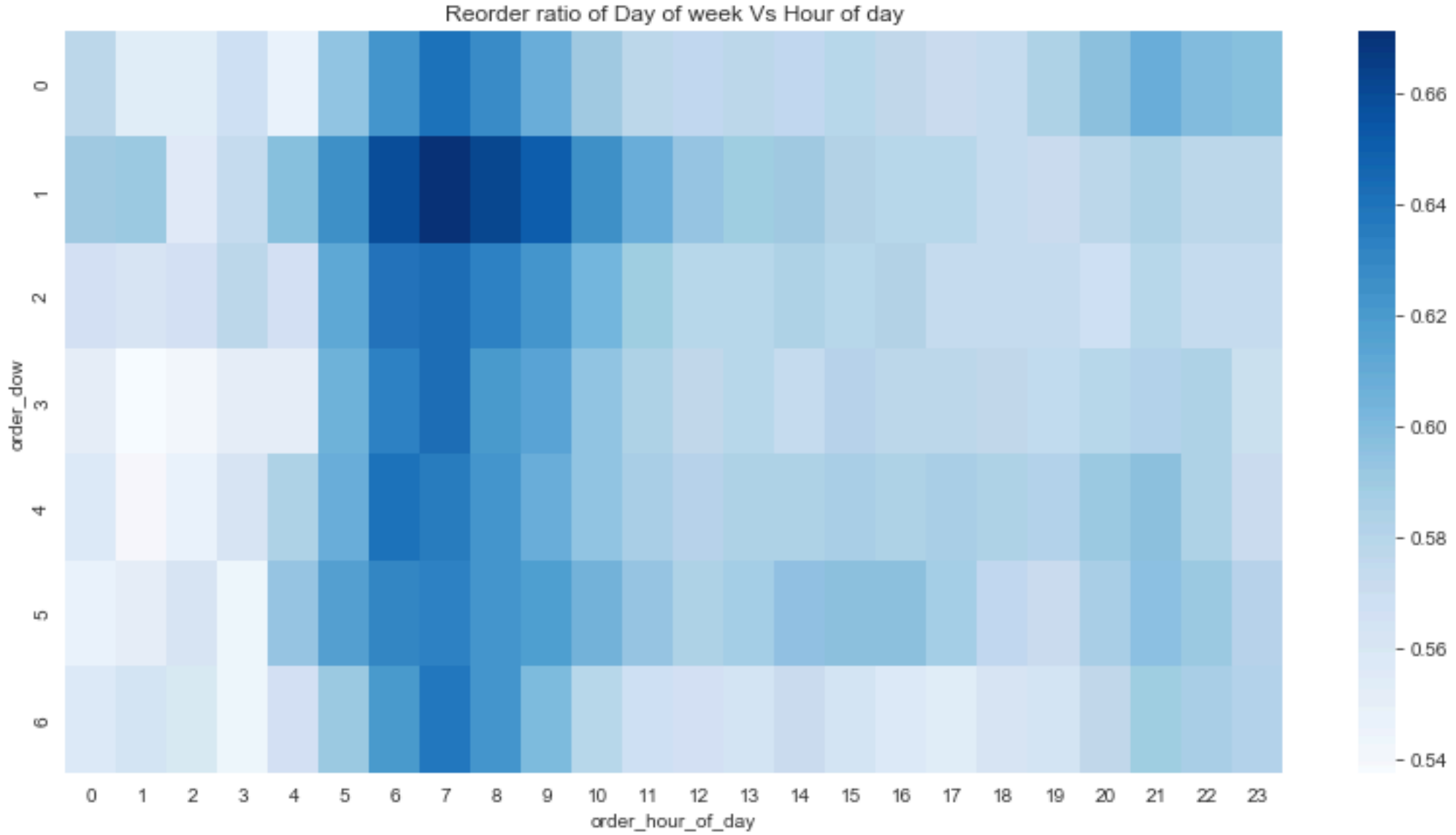


Feature Engineering
& Clustering Analysis

Feature Engineering and Clustering Analysis

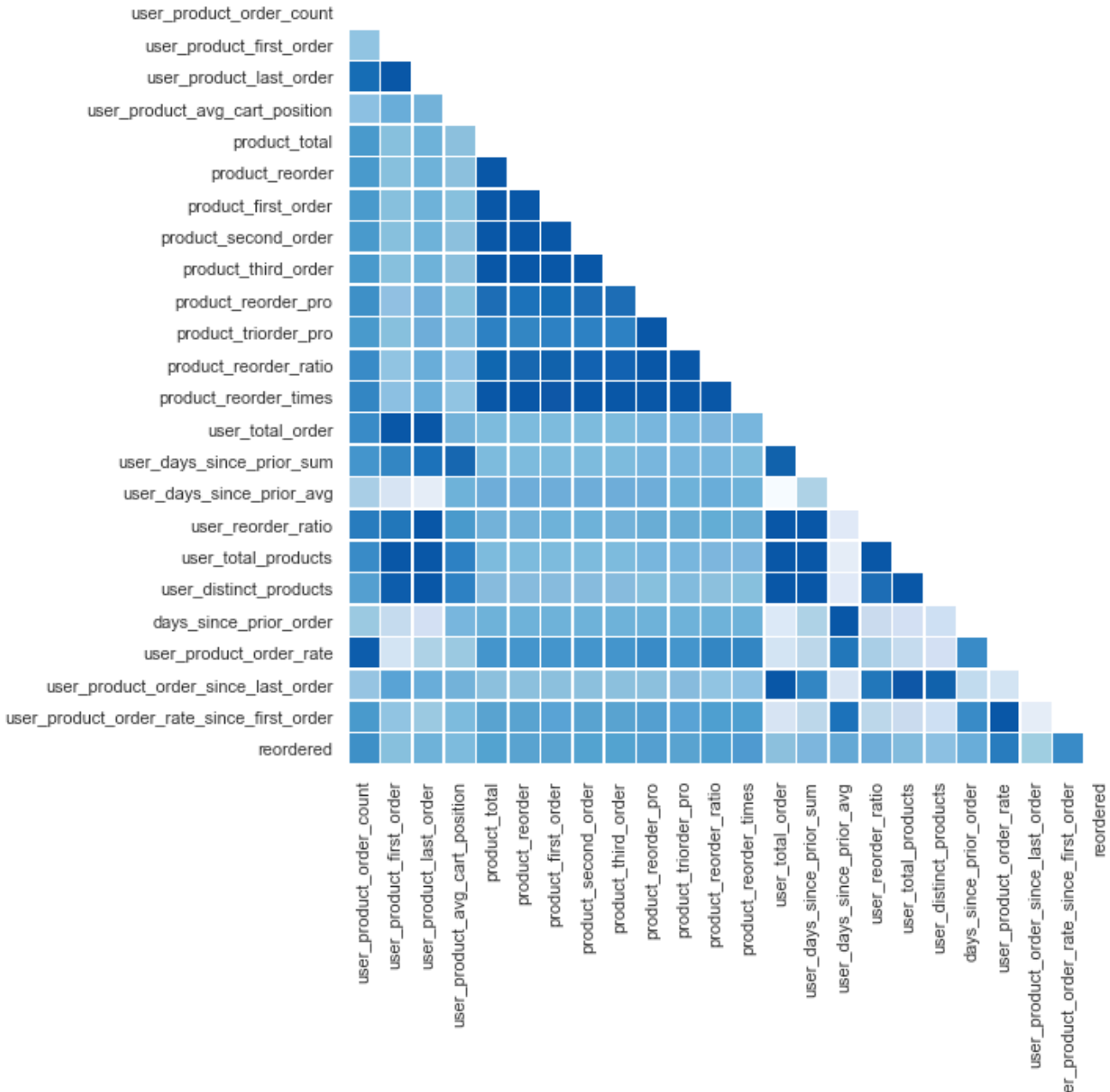
Use Merge and Group by agg function on order_product data to create new features:

- product_total
- product_reorder
- product_first_order
- product_second_order
- product_third_order
- product_reorder_pro
- product_triorder_pro
- product_reorder_ratio
- product_reorder_times

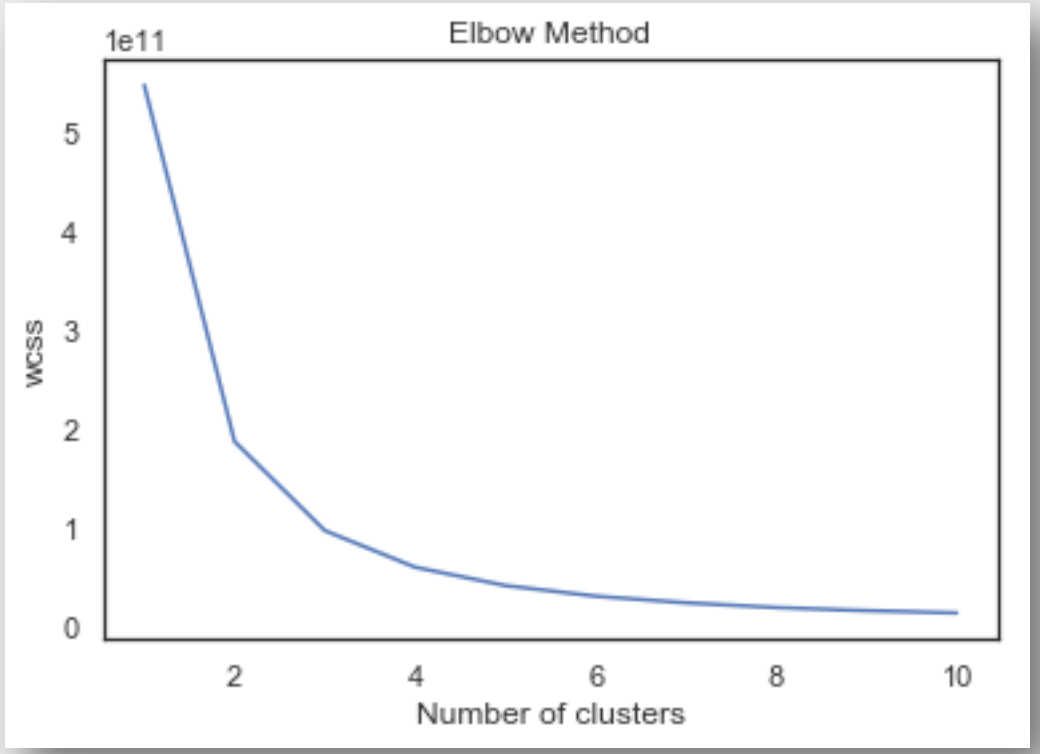
- user_total_order
- user_days_since_prior_sum
- user_days_since_prior_avg
- user_reorder_ratio
- user_total_products
- user_distinct_products

- user_product_order_count
- user_product_first_order
- user_product_last_order
- user_product_avg_cart_position
- user_product_order_rate
- user_product_order_since_last_order
- user_product_order_rate_since_first_order

Feature Engineering and Clustering Analysis



Feature Engineering and **Clustering Analysis**



- **user_total_order**
- **user_days_since_prior_sum**
- **user_days_since_prior_avg**
- **user_reorder_ratio**
- **user_total_products**
- **user_distinct_products**

Optimal Cluster Number: 4

Cluster	Measure 1	Measure 2	Measure 3	Measure 4	Measure 5
1	8.31	16.42	0.42	52.30	31.24
2	31.05	12.98	0.64	393.18	135.84
3	19.82	15.31	0.53	176.51	79.30
4	37.28	11.44	0.73	759.99	199.17

Recommendation Engine Modeling & Diagnostics

Recommendation Engine Modeling and Diagnostics

01 Logistic Regression

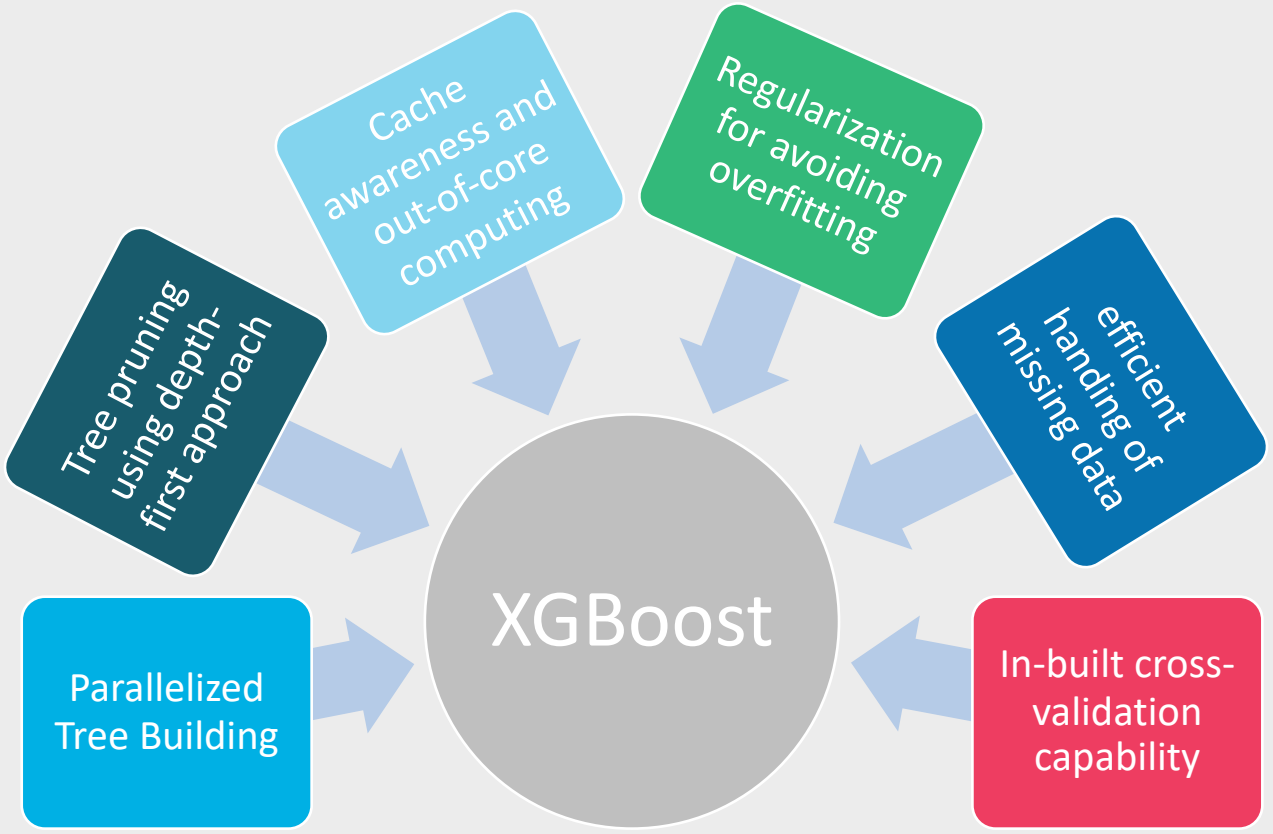
02 Lasso Regression

03 XGBoost Model

04 Optimize threshold

05 Diagnostics

Recommendation Engine Modeling and Diagnostics



Recommendation Engine Modeling and Diagnostics

Optimal Threshold for ROC Curve: Best Threshold=0.073372

Optimal Threshold for Precision-Recall Curve: Best Threshold=0.184227

Optimal Threshold Tuning on F-1 Score: Best Threshold= 0.190

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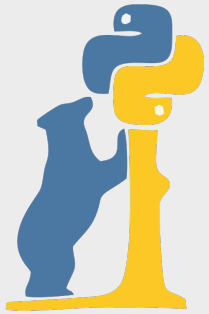
Technology Used & Future Work

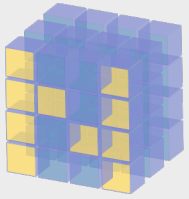
Technology Used & Future Work

Seaborn

Pandas



matplotlib



NumPy

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Technology Used & **Future Work**

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1
2
3
4
5


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