Business Type Identification and Churn Prediction

Key Takeaways

- RFM Based Clustering Model
  - Focus more on high value merchants
  - Reach out to users without freshness recently

- Churn Prediction with XGBoost
  - XGBoost out-performed in evaluation metrics when data have missing value
  - With churn probability prediction model, business partners could:
    - Target merchants with higher probability of churn
    - Make wiser decision in promotion activities
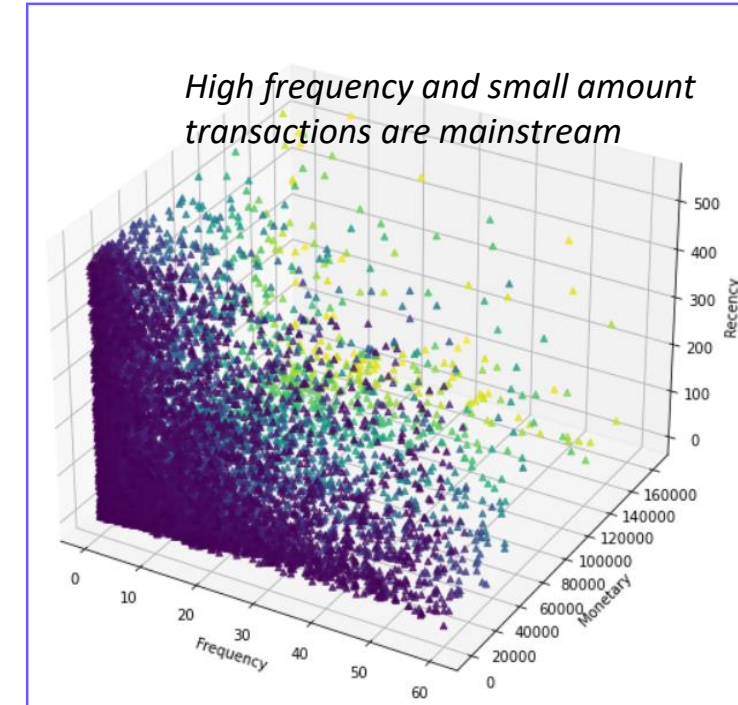
Type Identification: Model Setting

High frequency and small amount transactions are mainstream

Last Transaction: number of days from Merchant's last purchase to 12/31/34

Datediff(12/31/34, last_transaction_day)

Average Transaction Amount: average amount of monetary by this merchant per transaction
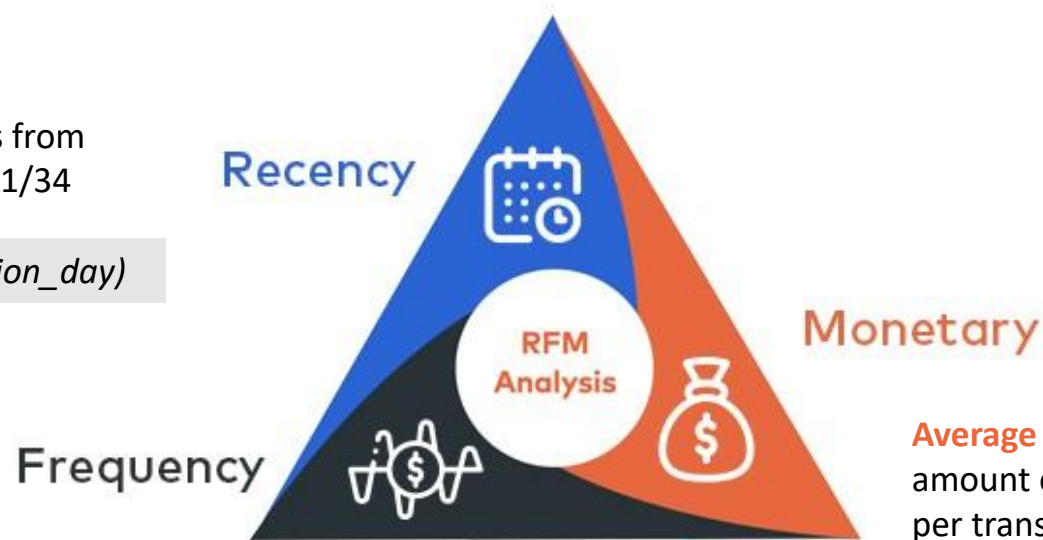
Average Transaction Interval: average number of days between each transaction of this merchant

Total transaction amount/ trans count

Datediff(last_transaction_day, first_trans_day) / transaction count

Type Identification : Clustering Result Overview

K-Means Clustering
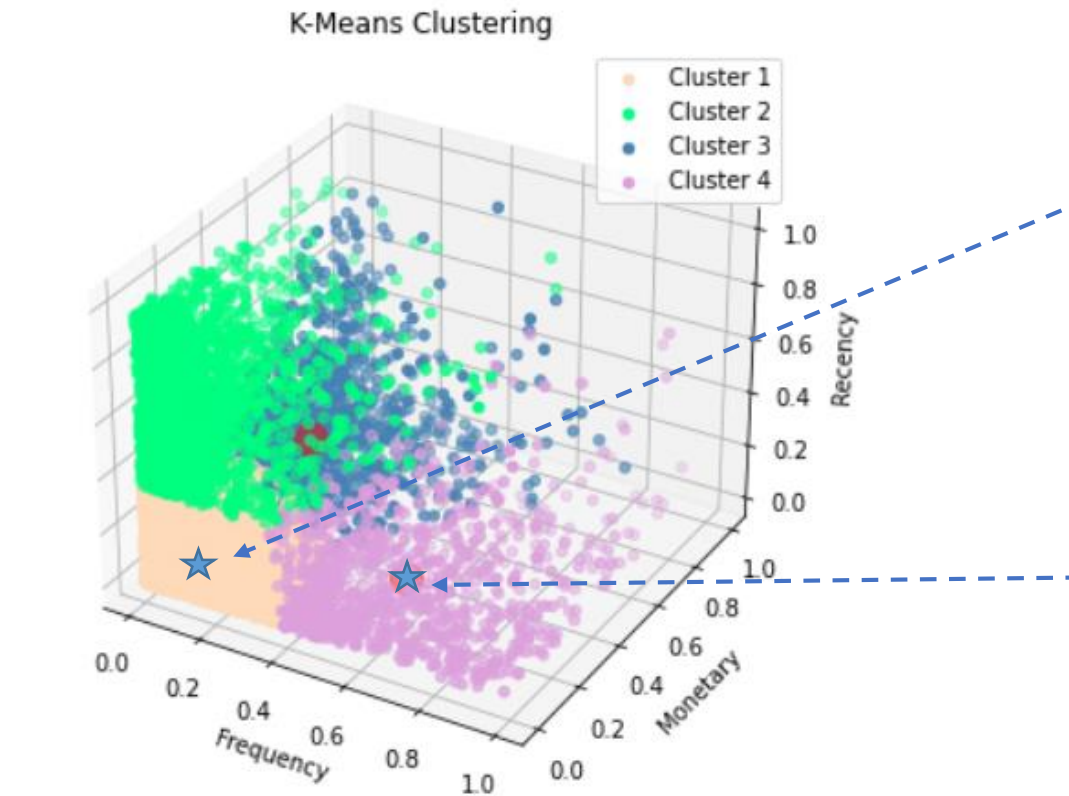
Type 1: short interval, low transaction amount, high freshness

Fundamentals of the payment business merchants who used Stripe for payment in everyday business

Type 4: short interval, high transaction amount, high freshness

These merchants could be active Stripe user of high value payment which were not frequently required.
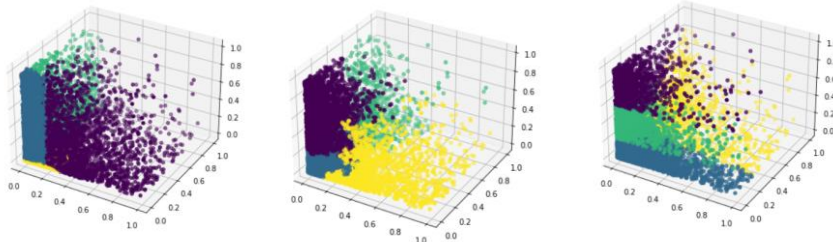
K means performed better than Gaussian Mixture, agglomerative clustering and mini-batch K means (from left to right)

Type Identification : Business Value

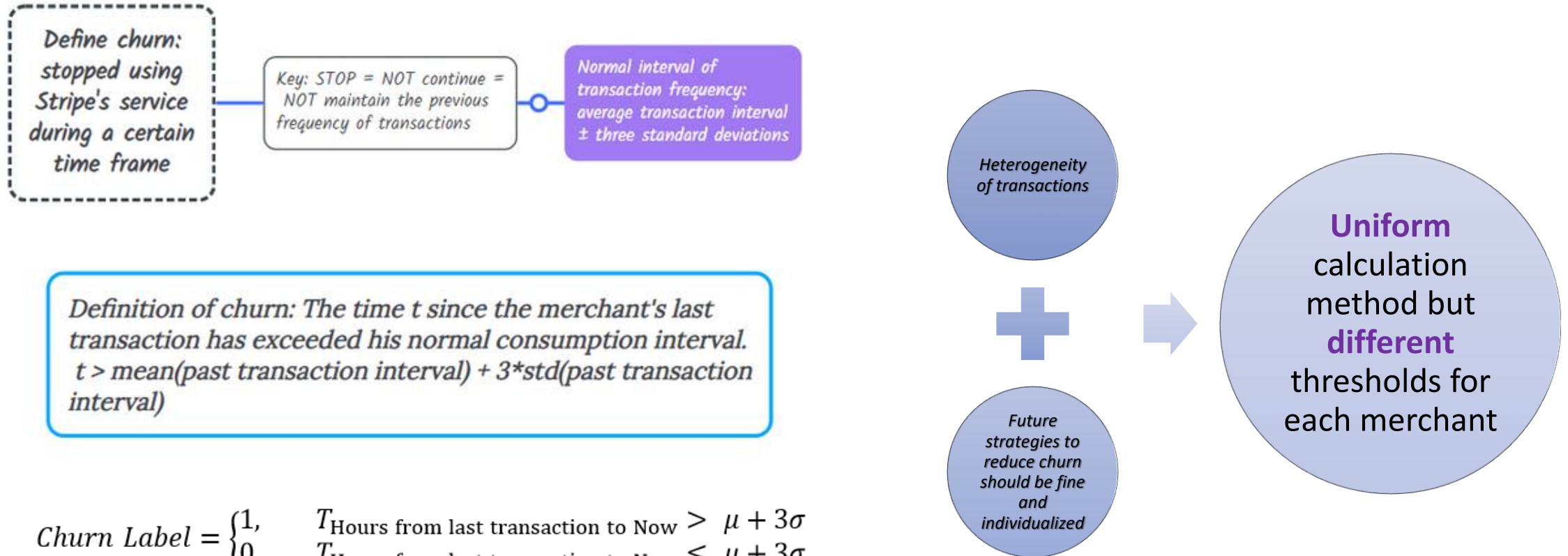Focus:

Put more focus on the behavior and user experience on Type 4 merchants as they were active customer who account for high business value.

Reach Out:

- Type 2 merchants were low value but account for high business value
  - Send email / use small bonus to bring them back
- Type 3 merchants were frequent Stripe user of high value payment previously
  - Incentive like temporary fee reduction

Churn Prediction: Definition and Labeling

Define churn: stopped using Stripe's service during a certain time frame

Key: STOP = NOT continue = NOT maintain the previous frequency of transactions

Normal interval of transaction frequency: average transaction interval ± three standard deviations

Definition of churn: The time t since the merchant's last transaction has exceeded his normal consumption interval.
$t > mean(past\ transaction\ interval) + 3*std(past\ transaction\ interval)$

Heterogeneity of transactions

Future strategies to reduce churn should be fine and individualized

Uniform calculation method but **different** thresholds for each merchant

$$Churn\ Label = \begin{cases} 1, & T_{\text{Hours from last transaction to Now}} > \mu + 3\sigma \\ 0, & T_{\text{Hours from last transaction to Now}} \leq \mu + 3\sigma \end{cases}$$

μ : mean of past transaction interval, σ standard deviation of past transaction

If the number of transaction is so small (< 4) that the hypothesis of a normal distribution of robust cannot be derived, the criterion: no transaction in the last three months

Churn Prediction with Model Comparison

- Target: Predict future (from 12/31/34 -3/31/35) churn for current active merchant.

Still active at 12/31/34, marked remained active (0)

Active Customer at 09/30/34

Churned at 12/31/34, marked churned (1)

Output: List of merchant id with churn probability in descending order

	churn_prob
b583972b34	0.996372
48008cb383	0.996132
7afb593dd0	0.995882
fae77cd687	0.99504
f11205719b	0.994982
3c4ac570a3	0.993502
062dcb31f4	0.993486
07cabcb557	0.990337
ee0e287095	0.989665
1e26f9d71a	0.989486
54c464b410	0.988868
ffb94e1865	0.988679
fe1cb2e840	0.988373
62ceabdaaa	0.987437
df9ec4cb3c	0.987168

Help with strategy formulation in avoiding churn of these customer

Churn Prediction with Model Comparison

	fit_time	score_time	test_accuracy	test_precision_weighted	test_recall_weighted	test_f1_weighted	test_roc_auc	model
0	0.502486	0.013963	0.792862	0.795881	0.792862	0.792342	0.871133	XGB
1	0.493115	0.013963	0.787264	0.789242	0.787264	0.786857	0.865625	XGB
2	0.489817	0.010979	0.801821	0.802534	0.801821	0.801513	0.879998	XGB
3	0.472009	0.013982	0.790616	0.793212	0.790616	0.790562	0.859793	XGB
4	0.497958	0.012986	0.795518	0.796875	0.795518	0.795217	0.868107	XGB

The XGBoost model has been validated by cross validation in terms of model accuracy and prediction speed, and performs better than other models (Logistic, Random Forest, KNN, SVM, GNB).

Comes from ability to cope with missing value, no categorical variable, hyper-parameters can be tuned……

Churn Prediction: Business Value

- Target "Hazard" Merchants:
  - better target our retention efforts:
  - marketing campaign to remind them that they haven't used service from us in a while, or even offering them a benefit.

- Wiser Cost-Benefit Analysis
  - Use the churn model to calculate the maximum benefit price that is still worthwhile.
  - *For example, if we know that the estimated probability of a particular client leaving is 10% and their annual revenue is 100, the expected value of future annual revenue is $90. Therefore, an offer that typically reduces the probability of leaving to 5 percent will be worthwhile for this client.*