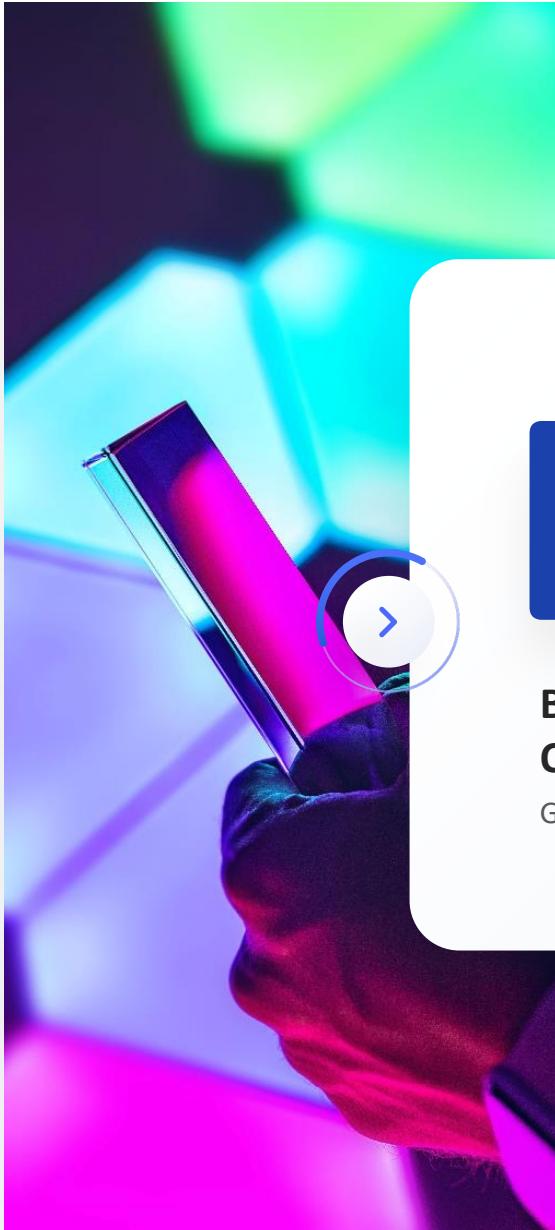


20
21



BNPL

BNPL Merchant On-boarding Model

Group 8

<

1



THE UNIVERSITY OF
MELBOURNE

20
22

Lang (Ron) Chen

Un Leng (Anderson) Kam

Haiyang (Henry) Huang

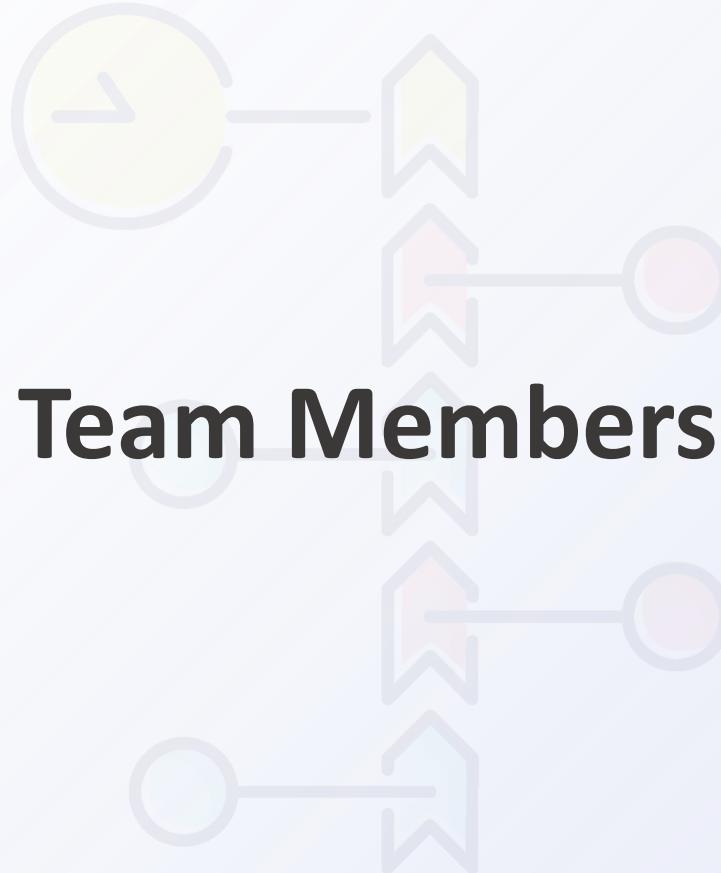
Qirui (Cindy) Li

Yujie Li

2

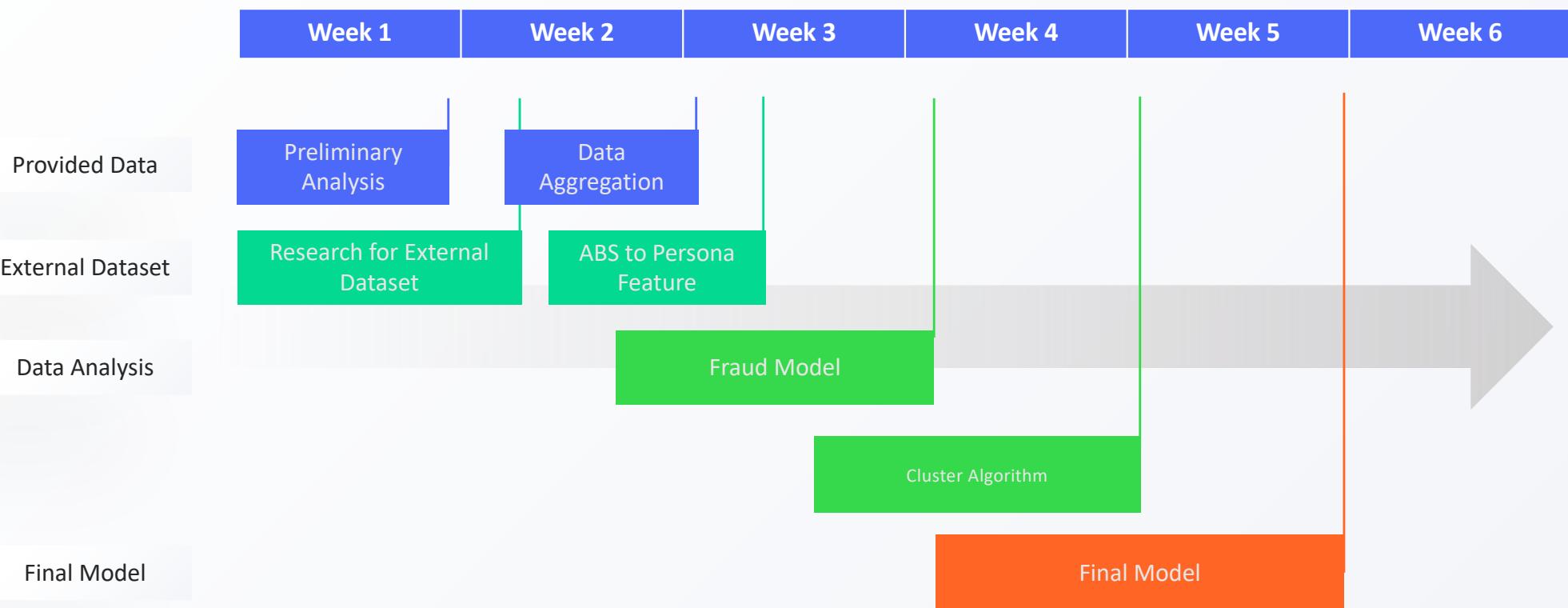


Team Members



Academic Calendar Week 7 – Week 11

Timeline

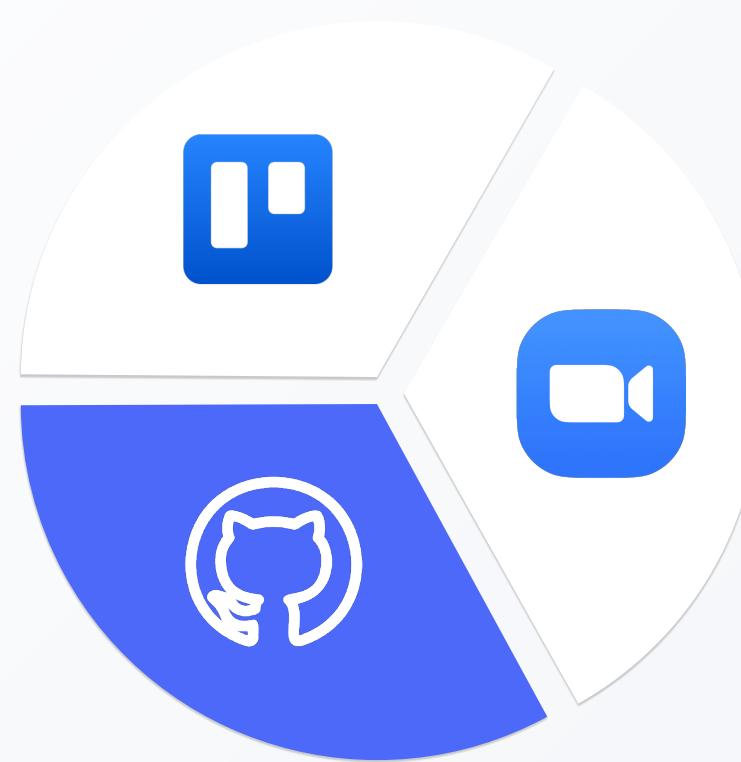


An average of 15-20 hours per week each into this task



Collaboration Tools

Trello
GitHub



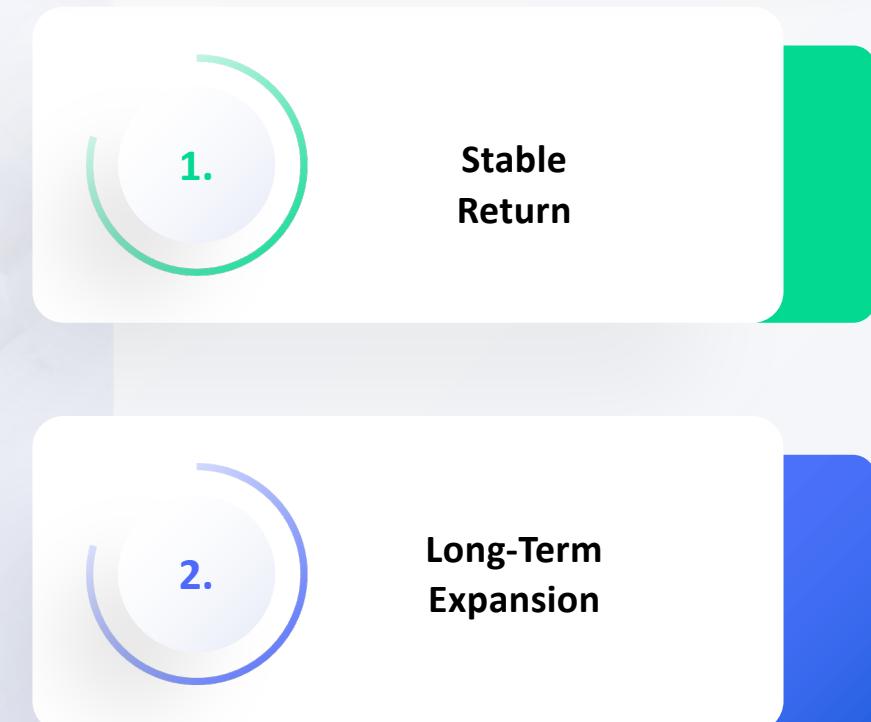
Zoom



What is the Problem?

- **Selecting Merchants for a BNPL Firm Under Limited Resources**

Our Business Goal





$$\begin{aligned} \text{loss per fraud order} &> [\text{take rate} - (1 - \text{first instalment percent})] * \text{transaction amount} \\ &= [\text{take rate} - \left(1 - \frac{1}{5}\right)] * \text{transaction amount} \end{aligned}$$

Features

> Fraudulent Probability

Features	F scores
Dollar value per order ratio	44060.56
Dollar value per order	39514.16
Std of Dollar value per order	13292.88
Std of Dollar value per order ratio	9811.99
Number of distinct merchant ratio	47.89
Number of distinct merchants	47.05
Number of daily orders ratio	3.97
Number of daily orders	3.68

Fraud Rate Prediction



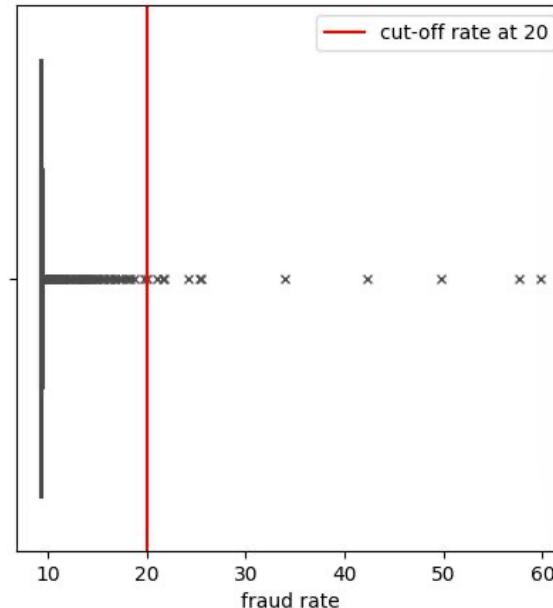
Validation R^2 Score

▲ 0.7908

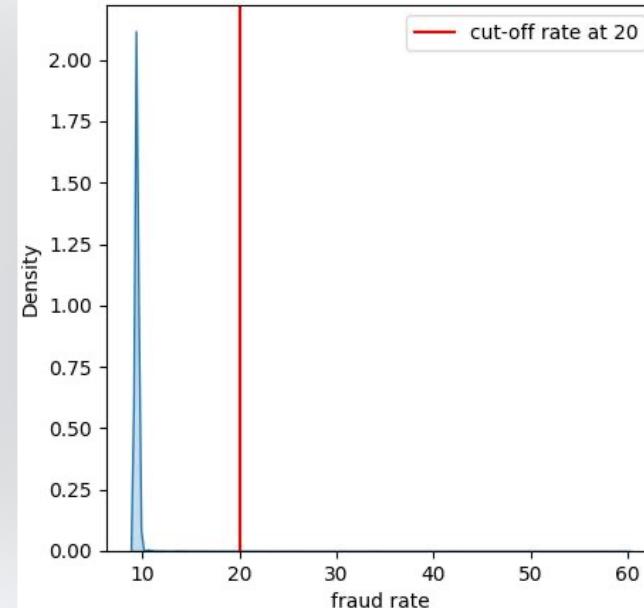
Test R^2 Score

▲ 0.7879

Boxplot of sample fraud rate predictions



KDE plot of sample fraud rate predictions



- We eliminated transactions with top 0.1% of predicted fraud probability, which is about 16,000 transactions.

Clustering Merchants

Background Info

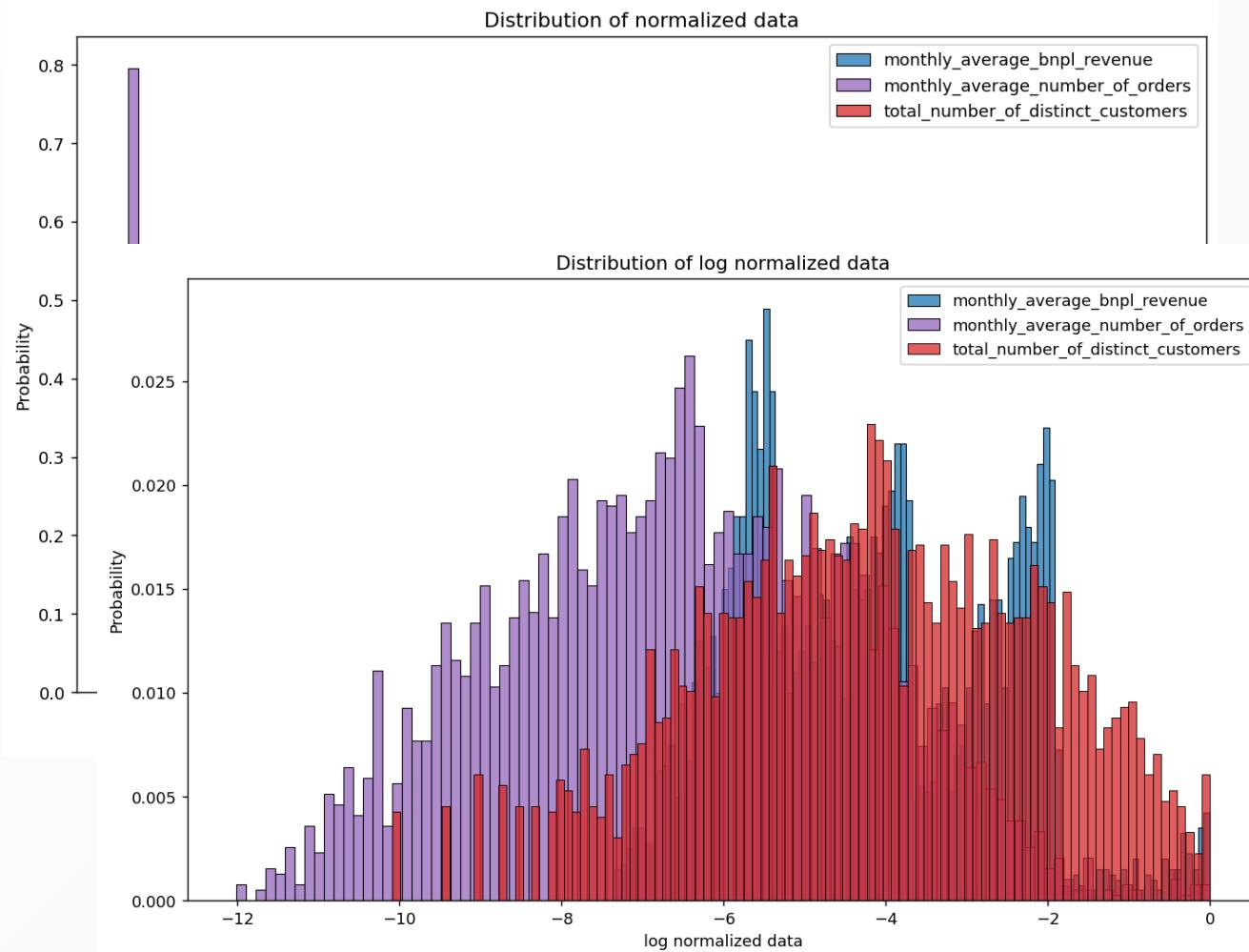
"Despite the wide variety of techniques available for grouping individuals into market segments on the basis of multivariate survey information, **clustering remains the most popular and most widely applied method.**" - Australasian Journal of Market Research

Missing merchant information

381 out of 4380 are unknown merchants!!!

3 ~ 5 Market Segmentations

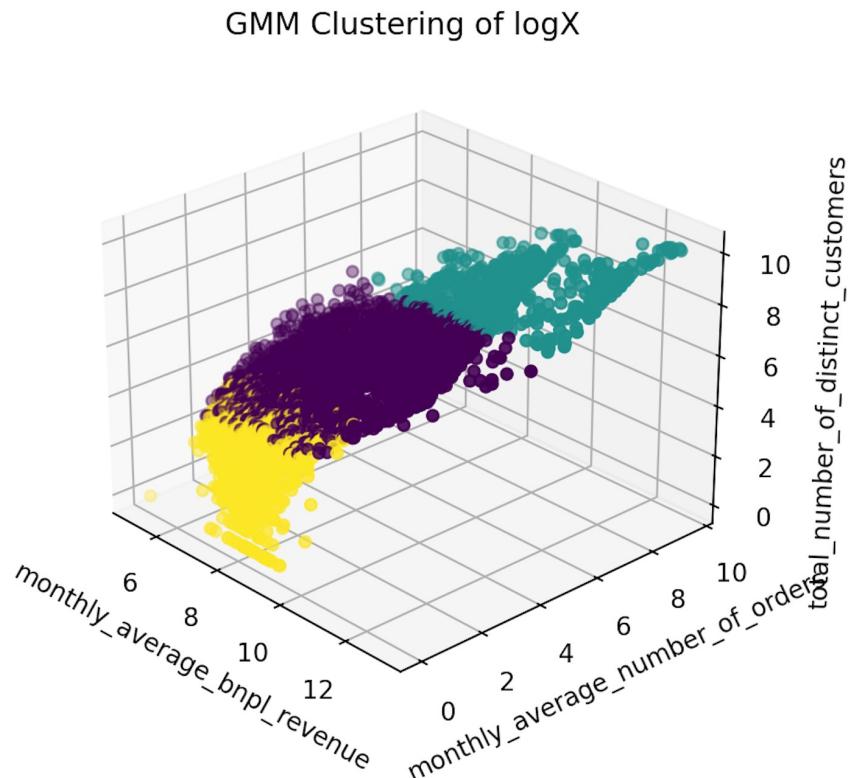




Features

- log monthly revenue
- log monthly number of orders
- log total distinct customers

Clustering Analysis



K-means

K-means

Gaussian Mixture model

GMM

Density-based spatial clustering of applications with noise

DBSCAN

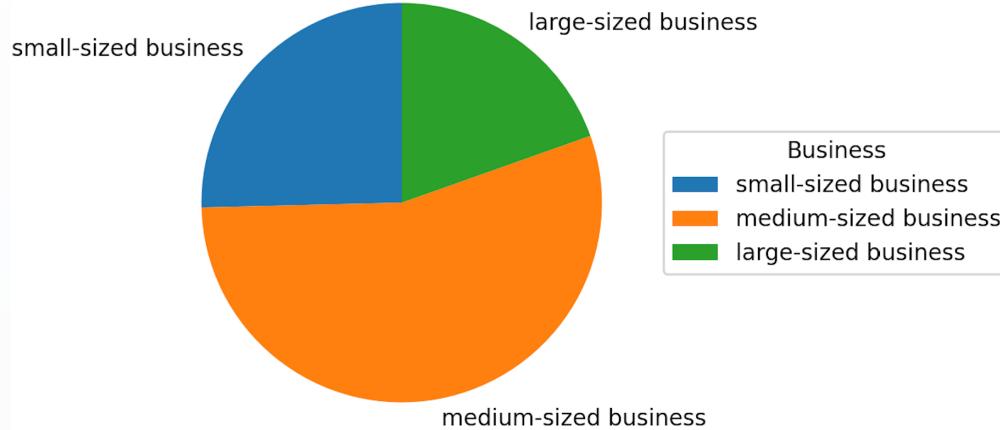
Mean shift

Mean Shift

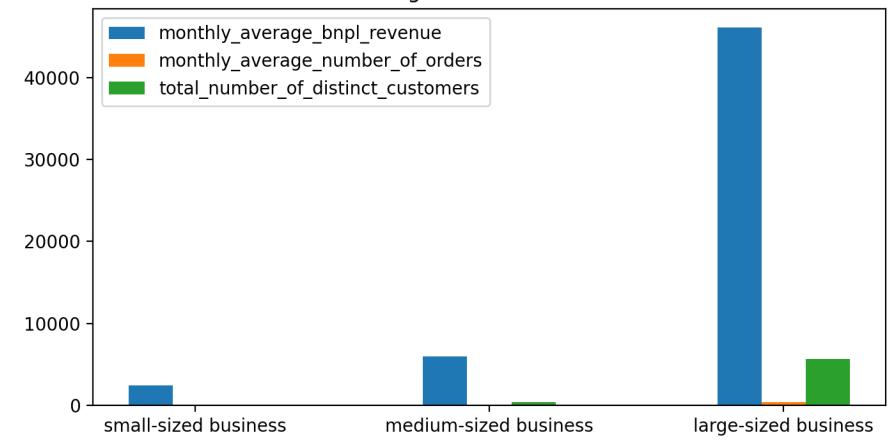
Business Data Chart



Market Segmentations



Segmentation mean



1,112

In a month,

- their revenue: \$2,452
- their number of orders: 2
- their historical total distinct customers: 21

2,414

In a month,

- their revenue: \$5,981
- their number of orders: 21
- their historical total distinct customers: 381

854

In a month,

- their revenue: \$46,079
- their number of orders: 386
- their historical total distinct customers: 854



Final Ranking Algorithm



Computing Top 100 Merchants list

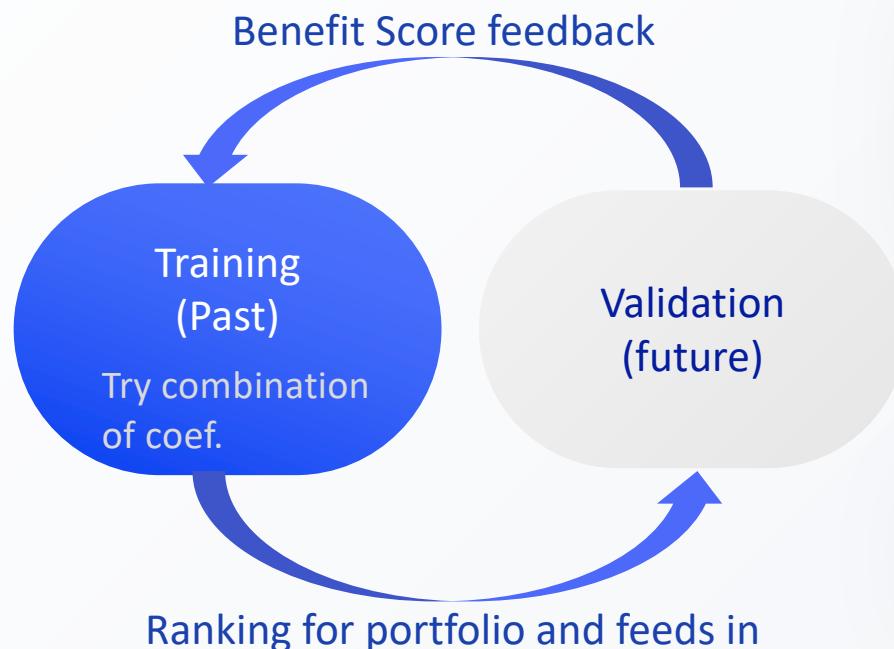
Related Finance Theory and Assumptions

...

Concept	Stock Market Definition	Our Definition
Sharpe Ratio	$S = \frac{E(r) - rf}{sd(r)}$	$S = \frac{BNPL \text{ cashflow}}{sd(BNPL \text{ cashflow})}$
Risk	Quantified by inter-period standard deviation of cashflow	<
Portfolio	A combination of stocks that is more risk-efficient than any single stock	Our top 100 ranked firms
Market Portfolio ('The Market')	Most efficient portfolio using all possible stocks in the market	The portfolio of all 4380 firms together

Our Ranking System

To find the 100 merchants that from the portfolio giving the highest Future Benefit



Methodology

- a) Find the optimal coefficients using the “Sharpe Ratio”

- b) Use a Linear Heuristic Function

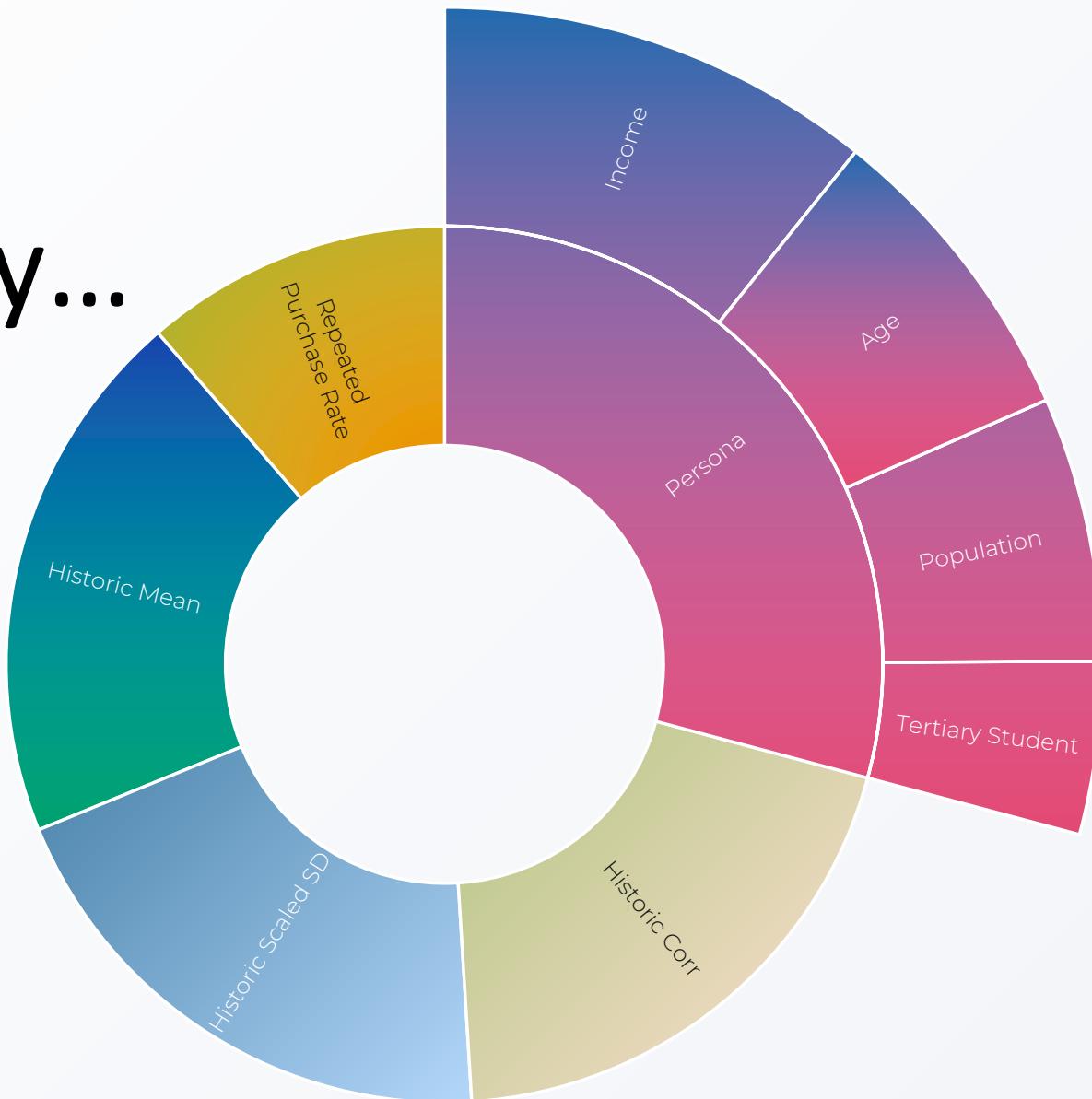
$$\text{Merchant's Score} = \sum(\text{coef}_i * \text{variable}_i)$$

*we will soon discuss variables

- c) Rank the merchants based on scores

- d) Form portfolio of top 100 scoring merchants

Features We Employ...



Feature 1-3

Cash Flow



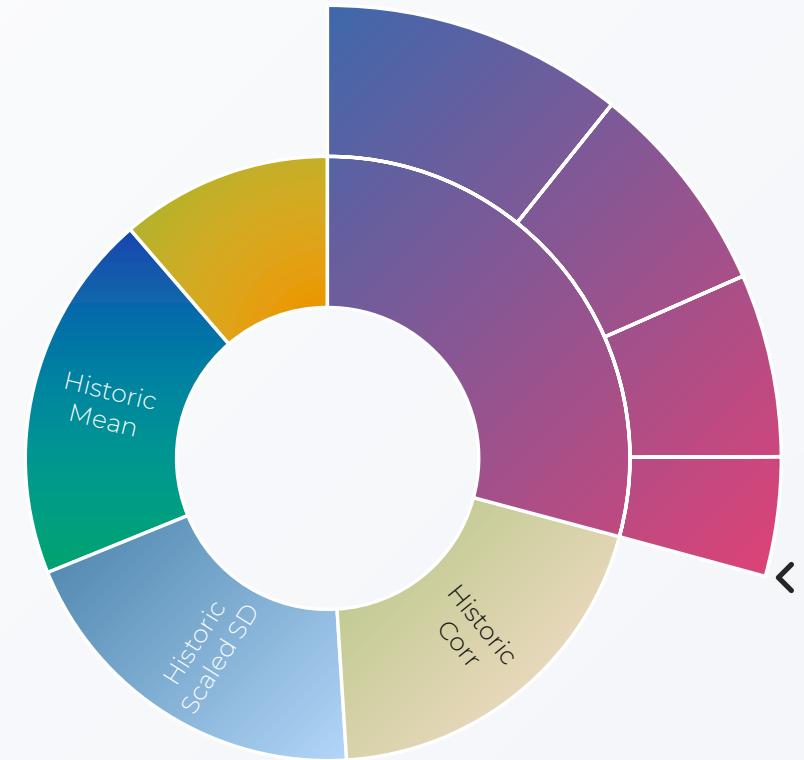
Feature 1: Historic Mean (Fortnightly Cashflow)

Feature 2: Historic Scaled SD (of Fortnightly Cashflow) =

$$\frac{\text{Historic SD of Fortnightly Cash Flow}}{\text{Historic Mean of Fortnightly Cash Flow}}$$

Feature 3: Historic Market Correlation =

$\text{Corr}(\text{Merchant Historic Fortnightly Cash Flow}, \text{Market Historic Fornightly Cash Flow})$



Feature 4

Repeated Purchase Rate

$$\bullet \text{ Repeated Purchase Rate} = \frac{\# \text{ Customers with multiple purchases in the merchant}}{\# \text{ Customers with purchases in the merchant}}$$



- Transactions With Varying Dollar Values Which Would Likely Induce Growth in the Future

- Merchants With Low Repeated Purchase Rates are More Likely to Have Exposure to Distinct Customers

Persona Score

Feature 5

Income

Age
+
Student

Postcode
Population



PERSONA FEATURE 1+2:

Age

Higher Chance of Impulsive Buying

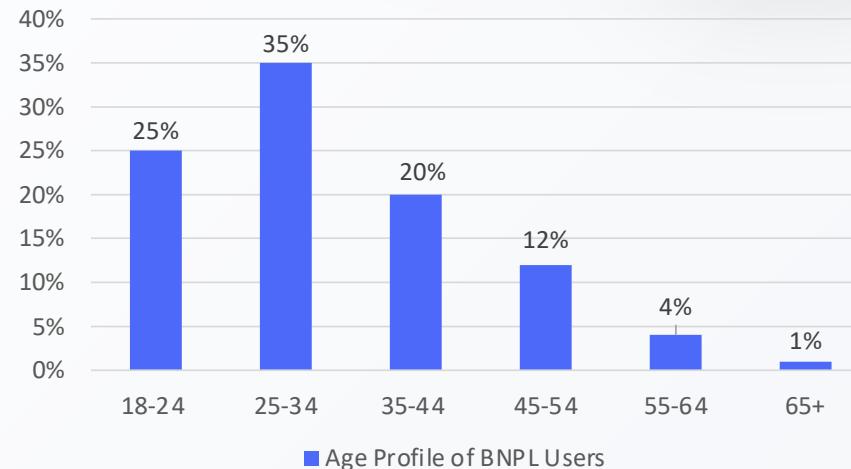
More Open-minded to E-commerce Product

Student

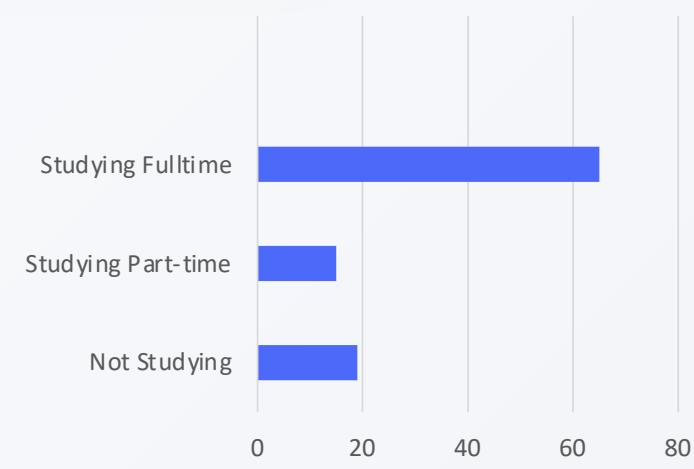
Potential High-income Audience in the Future

Bring More Sustainable Business Opportunities to Our Firm

Age Profile of BNPL Users



Percentage of Using BNPL



PERSONA FEATURE 3:

High Income

"after controlling for age, income is the most important determinant of variations in credit scores"

Credit Growth and the Financial Crisis: A New Narrative

- Able to Repay Regularly
- Bring Stable Cash Flow



PERSONA FEATURE 4:

Postcodes with Large Population

- Encourages Postcodes with More People



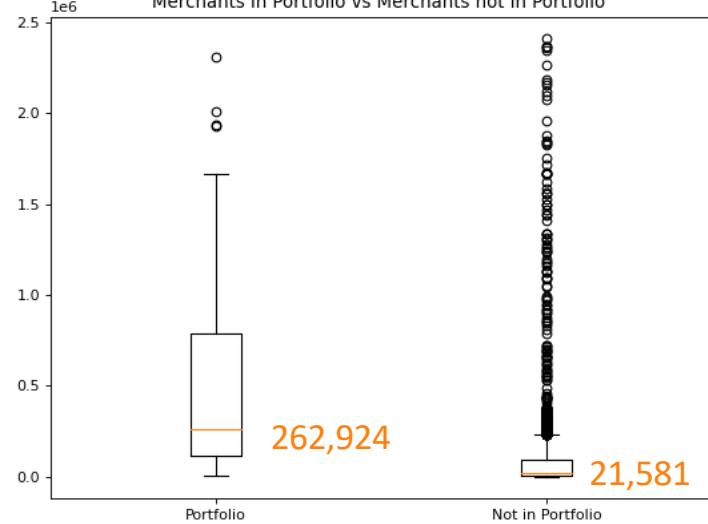
20
21



23

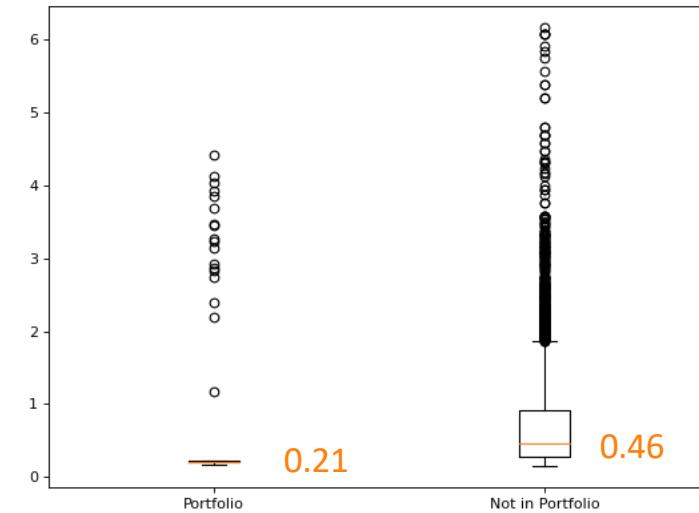
Historic Mean Fortnightly Cash Flow

Merchants in Portfolio vs Merchants not in Portfolio



Historic Scaled SD Fortnightly Cash Flow

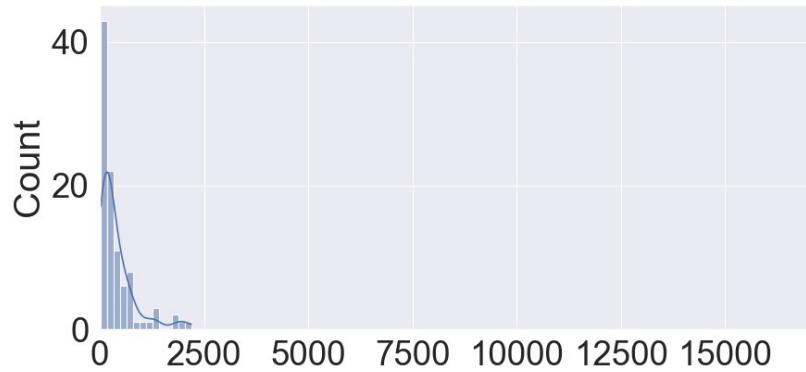
Merchants in Portfolio vs Merchants not in Portfolio



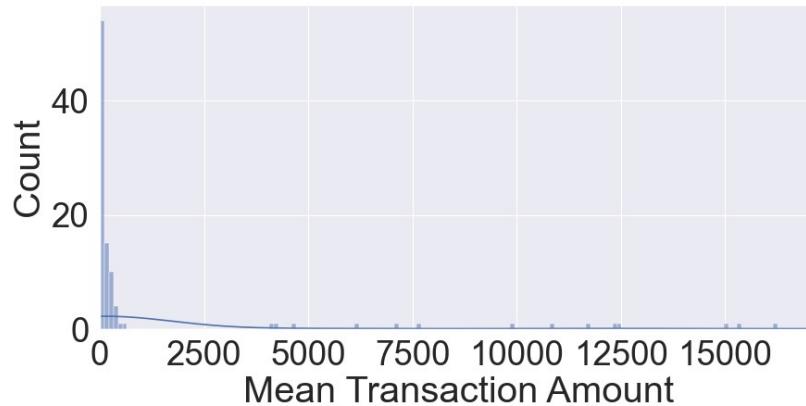
Portfolio Merchants vs Not in Portfolio Merchants

Intuition About BNPL Preferred Merchants

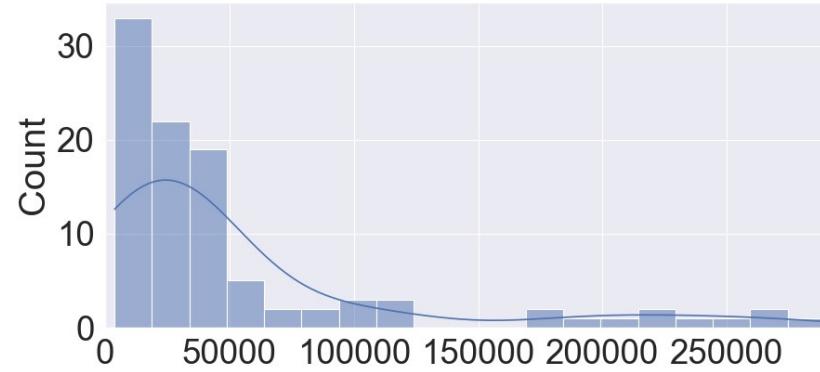
Three Variables



Five Variables



Mean transaction amount of firms



Number of orders



Final Model Result

RANKING	MERCHANT
1	UNNAMED (ABN: 57564805948)
2	Non Egestas PC (ABN: 31400548982)
3	UNNAMED (ABN: 49465266764)
4	UNNAMED (ABN: 62789659343)
5	Cras Convallis Ltd (ABN: 99801770627)
6	Sed Facilisis Vitae Incorporated (ABN: 10881038707)
7	Henderit Id Ante Corp. (ABN: 49514806178)
8	Vulputate Risus A Corporation (ABN: 48549026640)
9	UNNAMED (ABN: 29215623643)
10	Mauris Blandit Limited (ABN: 81548651453)

... (more refer to the appendix)

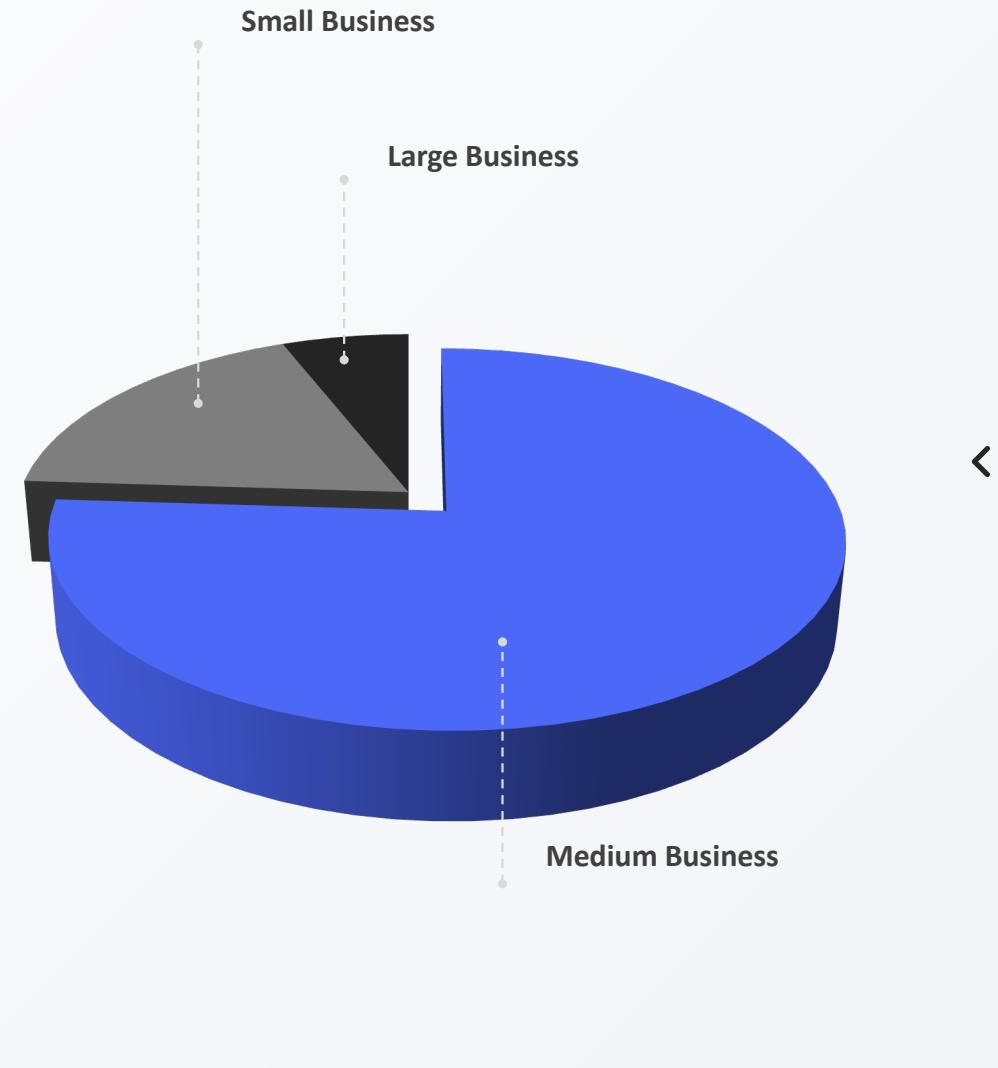
Final Model Analysis

Medium Business



Ranking Merchant

1	Unnamed, abn: 57564805948
2	Non Egestas PC, abn: 31400548982
3	Unnamed, abn: 49465266764
4	Unnamed, abn: 49465266764
5	Cras Convallis Ltd, abn: 99801770627
6	Sed Facilisis Vitae Incorporated, abn: 99801770627
:	:
:	:



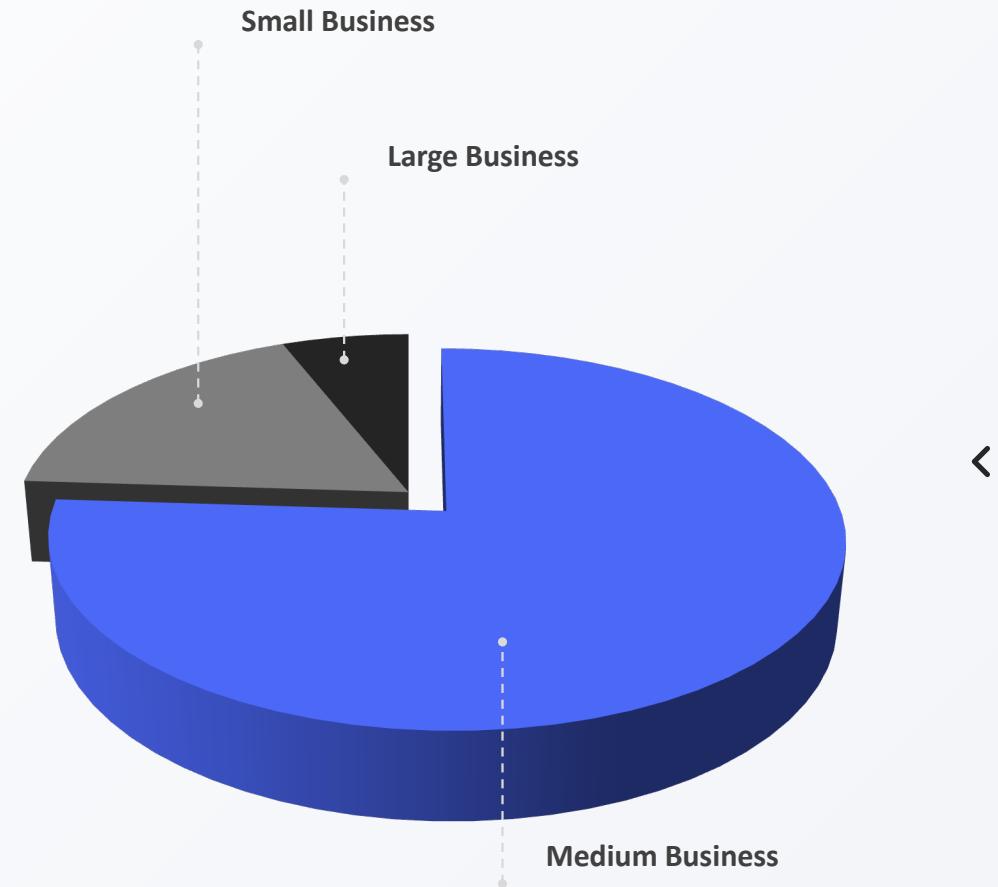
Final Model Analysis

Large Business



Ranking Merchant

11	Magnis Foundation, abn: 89640578182
14	Aliquet Phasellus Consulting, abn: 37459245212
18	Cum Sociis Natoque Incorporated, abn: 50866797623
20	Enim Etiam Industries, abn: 88547577701
21	Ipsum Company, abn: 30122382323
22	Mollis Dui In LLP, abn: 61447419161
	:
	.



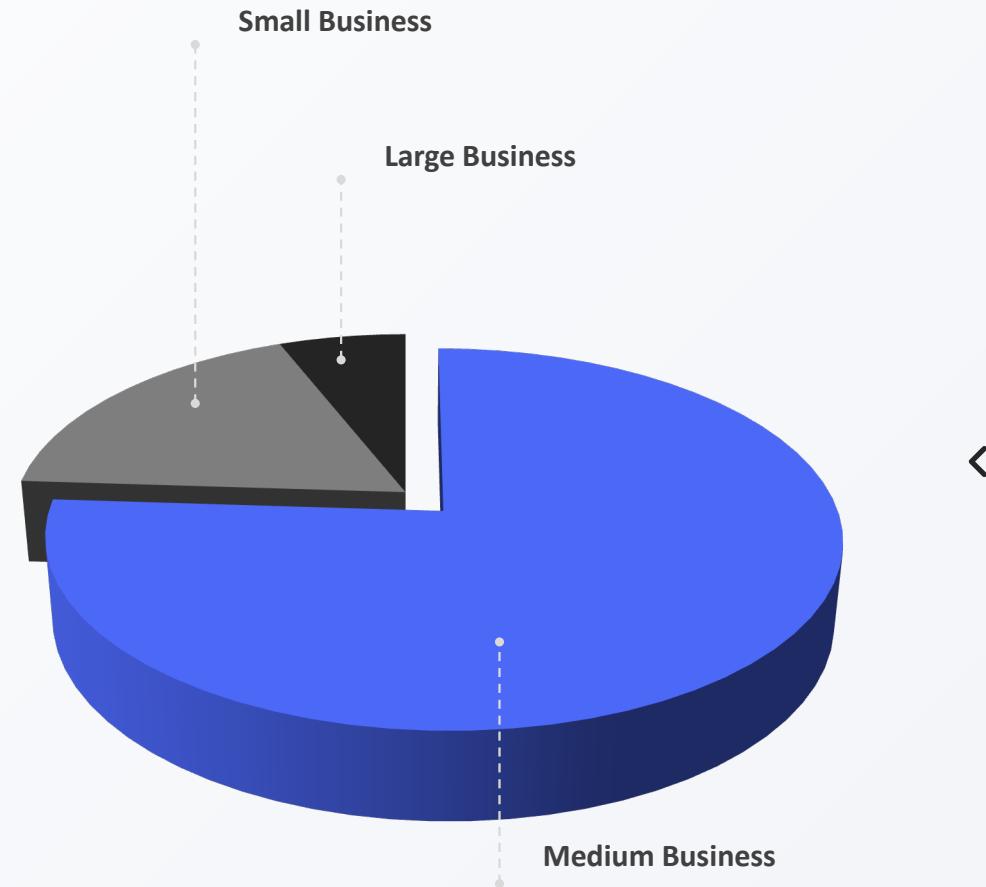
Final Model Analysis

Small Business



Ranking Merchant

23	Unnamed, abn: 20562405782
72	Unnamed, abn: 29566626791
76	Unnamed, abn: 74648589246
80	Unnamed, abn: 75342681786
83	Unnamed, abn: 33604812025
94	Unnamed, abn: 79953723663





- Potential for Overfitting
- Limited Resources and data provided

Bibliography

- <https://scikit-learn.org/stable/modules/generated/sklearn.ensemble.RandomForestRegressor.html>
- https://www.youtube.com/watch?v=J4Wdy0Wc_xQ&t=4s
- <https://risnews.com/raising-bar-revenues-and-loyalty-buy-now-pay-later-solutions>
- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9198328/>
- https://www.ncoss.org.au/wp-content/uploads/2021/09/Young-People-and-BNPL_NCOSS-Cost-of-Living-in-NSW-Report_September-2021_FINAL.pdf
- <https://asic.gov.au/regulatory-resources/find-a-document/reports/rep-600-review-of-buy-now-pay-later-arrangements/>
- <https://ro.uow.edu.au/compapers/139/>

