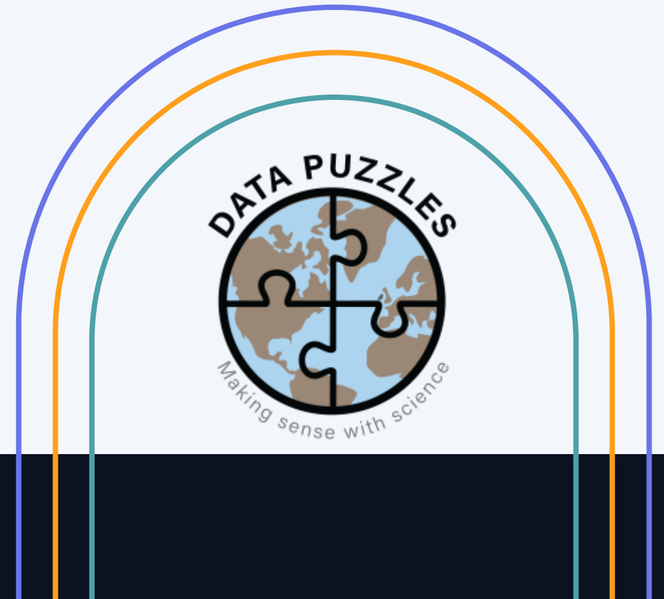
Building Blocks of Data Analytics



Agenda

01. Data Importance

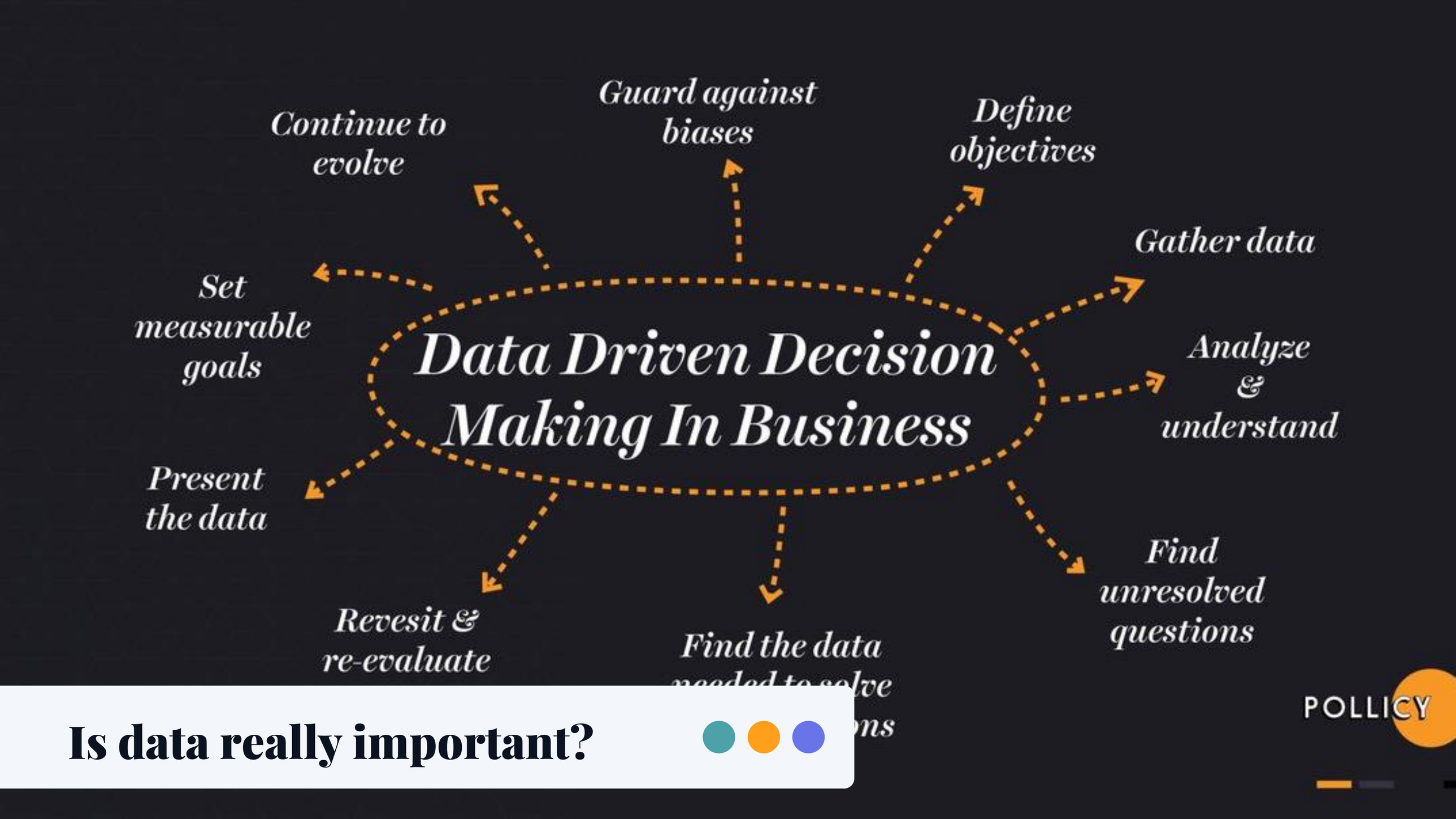
02. Data Roles

03. Case Study

04. Q&A Section

01.

Data Importance



Is data really important?

POLLICY

Data Importance

Process Optimization

- It can show company leaders how efficient or costly certain processes are.

Customer Satisfaction

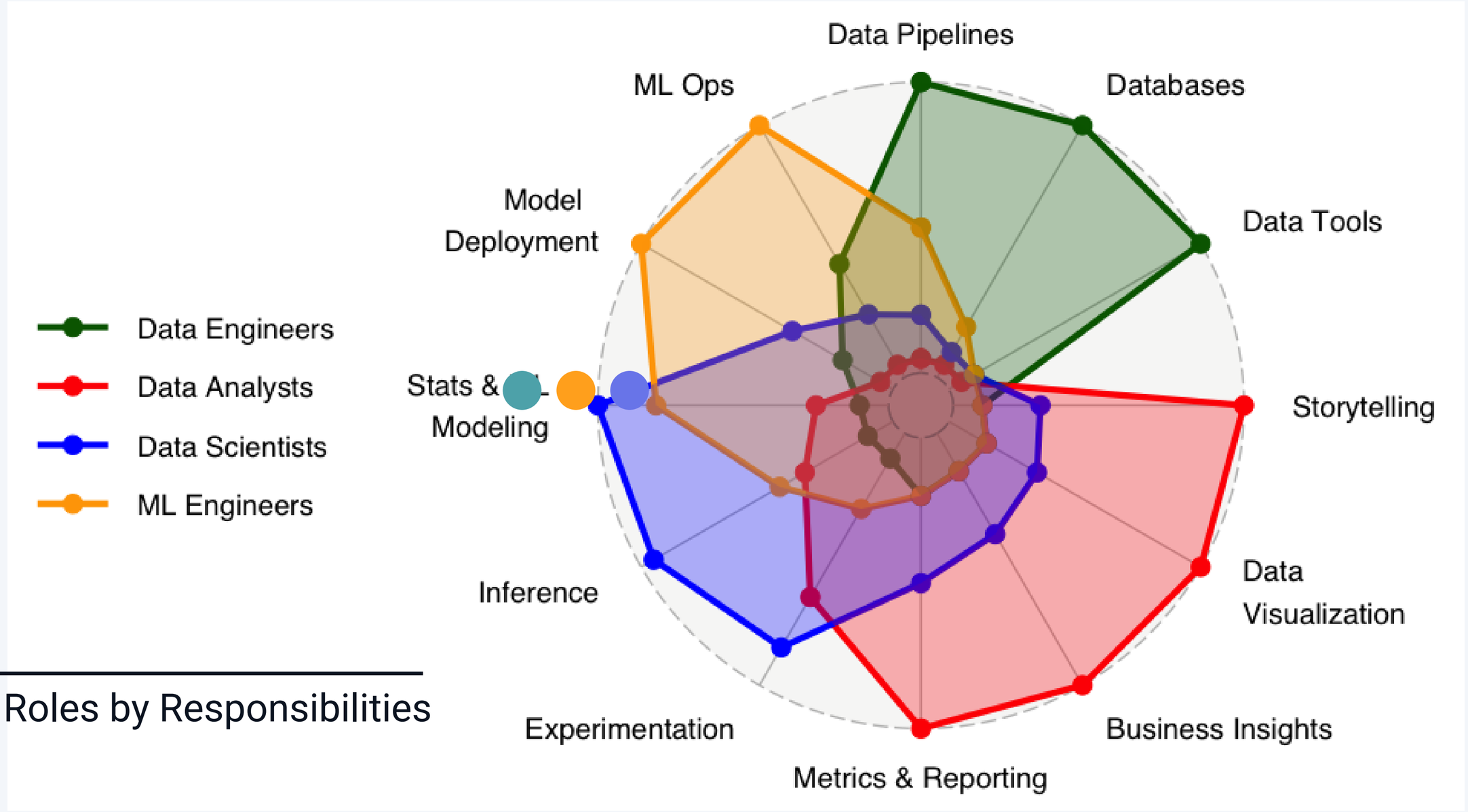
- Businesses can study the effects of their efforts on customer satisfaction and learn where they can improve. This can help the company create a more pleasing, customized experience for each customer.

Decision Making

- Help the company make tough decisions more quickly and understand the repercussions or benefits of decisions.

02.

Data Roles



Data Roles by Responsibilities

03.

Case Study

Bank X

2 out of 5

Credit card transactions identified/reported as fraudulent

10%

Impact on the bank cost regarding associated process and irrecuperable

Project Planning

Team Building

Getting the skills together

Problem Statement

Defining the scope for the project

Model Development

Implementing a ML Model

Deployment

Taking the model to production

System Design

Creating the workflow for transactions

Monitoring

Visualizing indicators

04.

The Team

Dream Team

The importance of building multidisciplinary teams.

Logan

Executive

James

Data Scientist

Olga

Risk Director

Brenda

IT Specialist

05.

The Problem

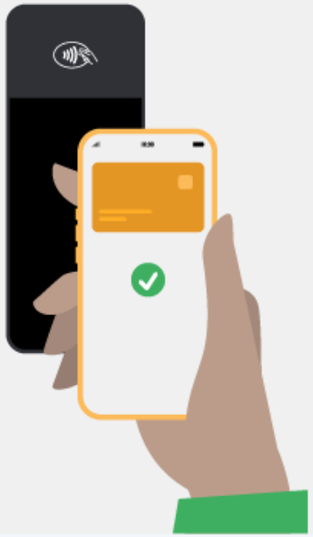
Fraudulent Transaction

— unauthorized or illegal activity involving the use of payment instruments or financial systems, typically for the purpose of obtaining money, goods, or services without proper consent or authorization from the account holder.

Transaction Types

Card Present

A customer uses their card
in a payment terminal.



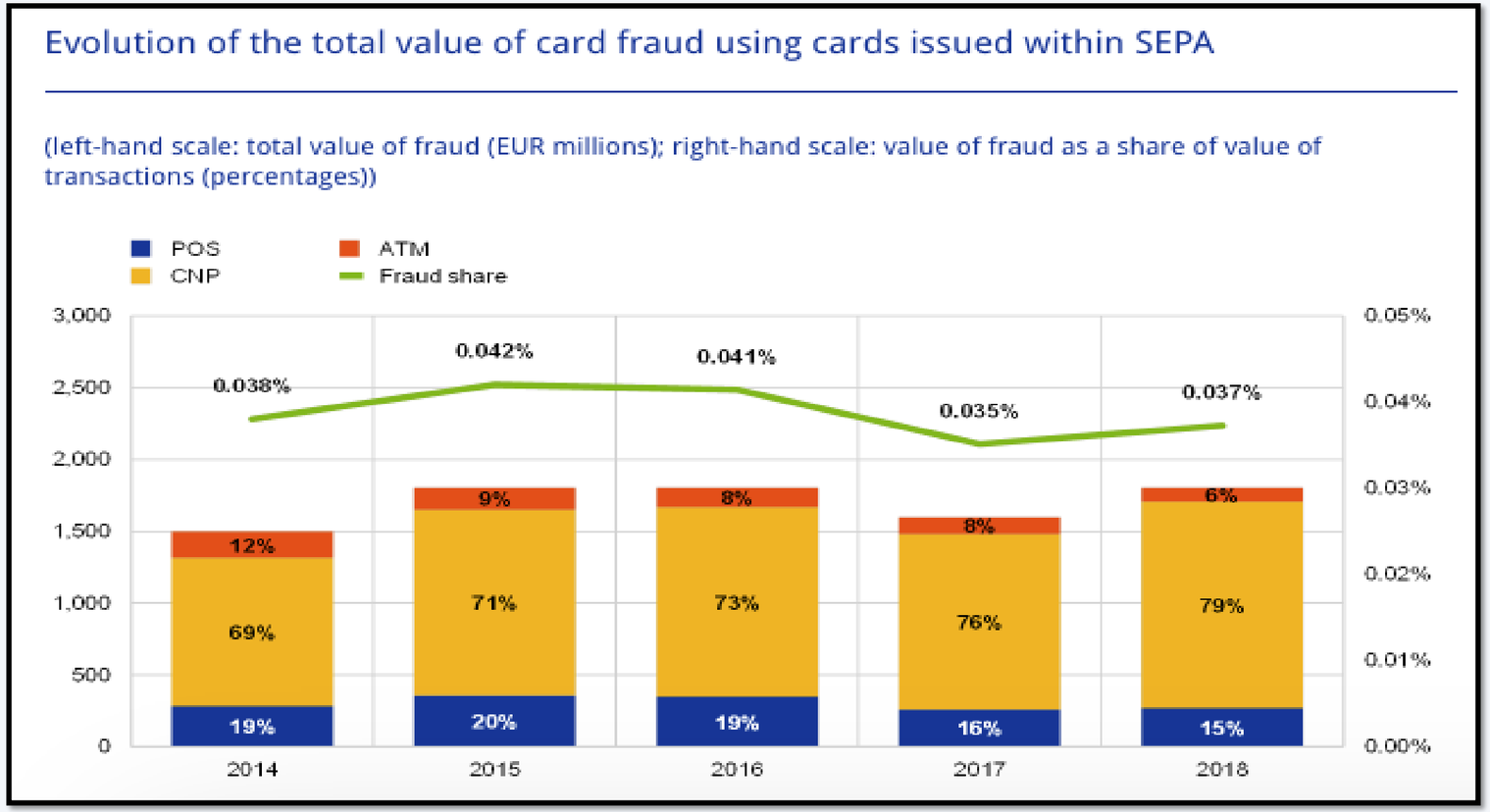
- Swiping a card
- Inserting a card
- Mobile payments
- Tap-and-go payments

Card Not Present

Payment is made, but the card is
not with the cardholder,
or the retailer does not see it.

- Ecommerce
- Mail order and telephone transactions (MOTO)
- Keying a card number in

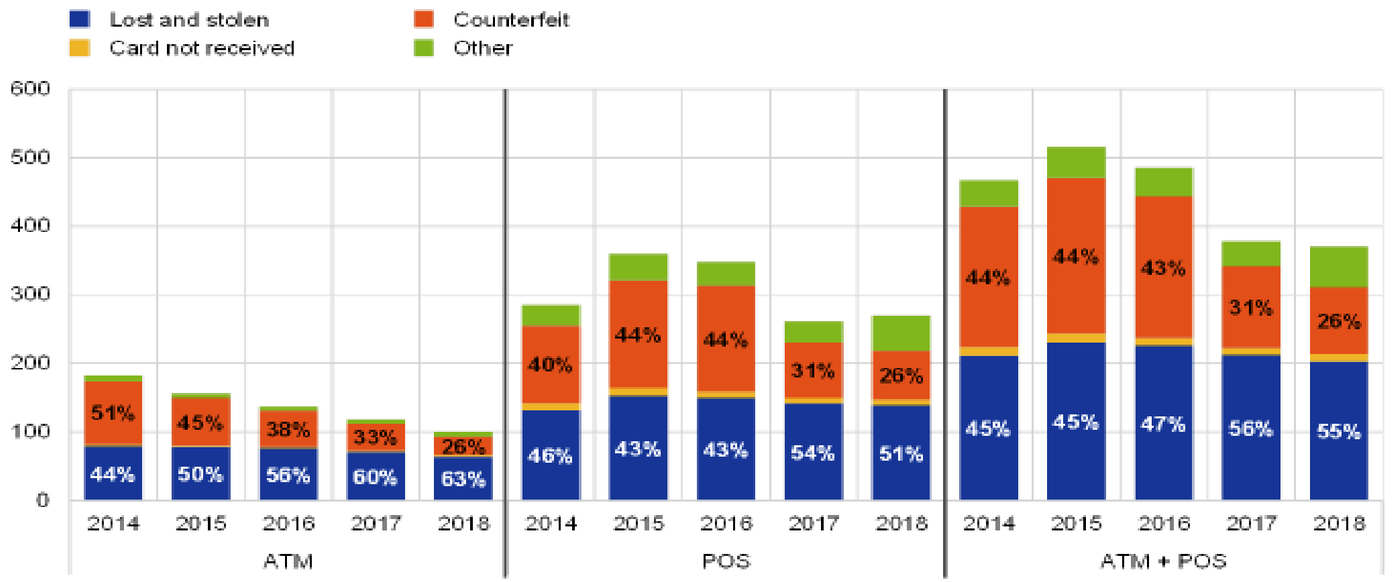
Types


Evolution of the total value of card fraud using cards issued within SEPA
(left-hand scale: total value of fraud (EUR millions); right-hand scale: value of fraud as a share of value of transactions (percentages))
POS
ATM
CNP
Fraud share
3,000
2,500
2,000
1,500
1,000
500
0
0.05%
0.04%
0.03%
0.02%
0.01%
0.00%
0.038%
0.042%
0.041%
0.035%
0.037%
12%
69%
19%
9%
71%
20%
8%
73%
19%
8%
76%
16%
6%
79%
15%
2014
2015
2016
2017
2018

Types

Evolution and breakdown of the value of card-present fraud by category

(total value of card present fraud (EUR millions))



06.

The Data

Credit Card Data

	TX_DATETIME	CUSTOMER_ID	TERMINAL_ID	TX_AMOUNT
0	2018-04-01 07:19:05	0	3	123.59
1	2018-04-01 19:02:02	0	3	46.51
2	2018-04-01 18:00:16	0	0	77.34
3	2018-04-02 15:13:02	0	2	32.35
4	2018-04-02 14:05:38	0	3	63.30
5	2018-04-02 15:46:51	0	3	13.59
6	2018-04-02 08:51:06	0	2	54.72
7	2018-04-02 20:24:47	0	3	51.89
8	2018-04-03 12:15:47	0	2	117.91
9	2018-04-03 08:50:09	0	1	67.72
10	2018-04-03 09:25:49	0	1	28.46
11	2018-04-03 15:33:14	0	2	50.25
12	2018-04-03 07:41:24	0	1	93.26
13	2018-04-04 01:15:35	0	0	46.40
14	2018-04-04 09:33:58	0	2	23.26
15	2018-04-05 16:19:09	0	1	71.96
16	2018-04-05 07:41:19	0	2	52.69

RowName: Transaction ID.

TX_DateTime: Transaction date and time.

Customer_ID: Unique identification number of the customer.

Terminal_ID: Unique identification number of the merchant.

TX_Amount: Transaction amount in EUR.

Credit Card Data

	CUSTOMER_ID	x_customer_id	y_customer_id
0	0	54.881350	71.518937
1	1	42.365480	64.589411
2	2	96.366276	38.344152
3	3	56.804456	92.559664
4	4	2.021840	83.261985

	TERMINAL_ID	x_terminal_id	y_terminal_id
0	0	54.881350	71.518937
1	1	60.276338	54.488318
2	2	42.365480	64.589411
3	3	43.758721	89.177300
4	4	96.366276	38.344152

Customer_ID: Unique identification number of the customer.

x_y_Customer: Customer's address.

Terminal_ID: Unique identification number of the merchant.

x_y_Terminal: Merchant's address.

07.

The Model

python™

R

SPSS®

sas®

open source™

Selecting the right platform for analytics

biztech age

Software Licenses

5 FAQs About

Features

	TX_DATETIME	CUSTOMER_ID	TERMINAL_ID	TX_AMOUNT
0	2018-04-01 07:19:05	0	3	123.59
1	2018-04-01 19:02:02	0	3	46.51
2	2018-04-01 18:00:16	0	0	77.34
3	2018-04-02 15:13:02	0	2	32.35
4	2018-04-02 14:05:38	0	3	63.30
5	2018-04-02 15:46:51	0	3	13.59
6	2018-04-02 08:51:06	0	2	54.72
7	2018-04-02 20:24:47	0	3	51.89
8	2018-04-03 12:15:47	0	2	117.91
9	2018-04-03 08:50:09	0	1	67.72
10	2018-04-03 09:25:49	0	1	28.46
11	2018-04-03 15:33:14	0	2	50.25
12	2018-04-03 07:41:24	0	1	93.26
13	2018-04-04 01:15:35	0	0	46.40
14	2018-04-04 09:33:58	0	2	23.26
15	2018-04-05 16:19:09	0	1	71.96
16	2018-04-05 07:41:19	0	2	52.69

Date Centric
Variables
• Day of Week. • Hour of Day.
• Weekend Flag. • Night Flag.

Customer Centric
Variables
• Average Daily Amount. • Total Daily Amount.
• Average Daily Transactions. • Total Daily Transactions.
• Fraud History. • First Time Purchase.

Merchant Centric
Variables
• Average Daily Amount. • Total Daily Amount.
• Average Daily Transactions. • Total Daily Transactions.
• Fraud History. • Clientele

Explore

```
tibble [1,754,155 × 20] (S3: tbl_df/tbl/data.frame)
 $ TRANS_FRAUD      : num [1:1754155] 0 0 0 0 0 0 0 0 0 0 ...
 $ CUSTOMER_ID      : num [1:1754155] 0 0 0 0 0 0 0 0 0 0 ...
 $ TERMINAL_ID      : num [1:1754155] 29 29 29 29 29 87 87 87 87 87 ...
 $ TRANS_AMOUNT     : num [1:1754155] 83.2 95.9 28.5 50.8 39 ...
 $ TRANS_DAY_OF_WEEK: num [1:1754155] 6 3 3 2 3 5 3 2 1 3 ...
 $ TRANS_HOUR_OF_DAY: int [1:1754155] 22 13 11 13 11 12 7 5 19 12 ...
 $ TRANS_WEEKEND    : num [1:1754155] 1 0 0 0 0 0 0 0 0 0 ...
 $ TRANS_NIGHT      : num [1:1754155] 1 0 0 0 0 0 0 1 0 0 ...
 $ CT_AVG_DAY_AMOUNT: num [1:1754155] 147 147 147 147 147 ...
 $ CT_AVG_DAY_TRANS : num [1:1754155] 2.4 2.4 2.4 2.4 2.4 2.4 2.4 2.4 2.4 2.4 ...
 $ CT_TOT_DAY_AMOUNT: num [1:1754155] 132 237 128 251 148 ...
 $ CT_TOT_DAY_TRANS : int [1:1754155] 2 4 2 3 2 3 2 1 3 2 ...
 $ CT_FRAUD_HIST    : num [1:1754155] 0 0 0 0 0 0 0 0 0 0 ...
 $ TM_AVG_DAY_AMOUNT: num [1:1754155] 105 105 105 105 105 ...
 $ TM_AVG_DAY_TRANS : num [1:1754155] 1.58 1.58 1.58 1.58 1.58 ...
 $ TM_TOT_DAY_AMOUNT: num [1:1754155] 83.2 119.1 295.7 50.8 39 ...
 $ TM_TOT_DAY_TRANS : int [1:1754155] 1 2 4 1 1 2 4 2 4 1 ...
 $ TM_FRAUD_HIST    : num [1:1754155] 0 2 2 2 2 0 0 0 0 0 ...
 $ TM_CLIENTELE     : int [1:1754155] 38 38 38 38 38 34 34 34 34 34 ...
 $ CT_PURCHASE_TM   : num [1:1754155] 0 1 2 3 4 0 1 2 3 4 ...
```

1,754,155 transactions

20 variables

A tibble: 6 × 20

TRANS_FRAUD <dbl>	CUSTOMER_ID <dbl>	TERMINAL_ID <dbl>	TRANS_AMOUNT <dbl>	TRANS_DAY_OF_WEEK <dbl>	TRANS_HOUR_OF_DAY <int>	TRANS_WEEKEND <dbl>	TRANS_NIGHT <dbl>	CT_AVG_DAY_AMOUNT <dbl>	CT_AVG_DAY_TRANS <dbl>
0	0	29	83.19	6	22	1	1	147.477	2.4
0	0	29	95.94	3	13	0	0	147.477	2.4
0	0	29	28.46	3	11	0	0	147.477	2.4
0	0	29	50.75	2	13	0	0	147.477	2.4
0	0	29	39.04	3	11	0	0	147.477	2.4
0	0	87	33.14	5	12	0	0	147.477	2.4

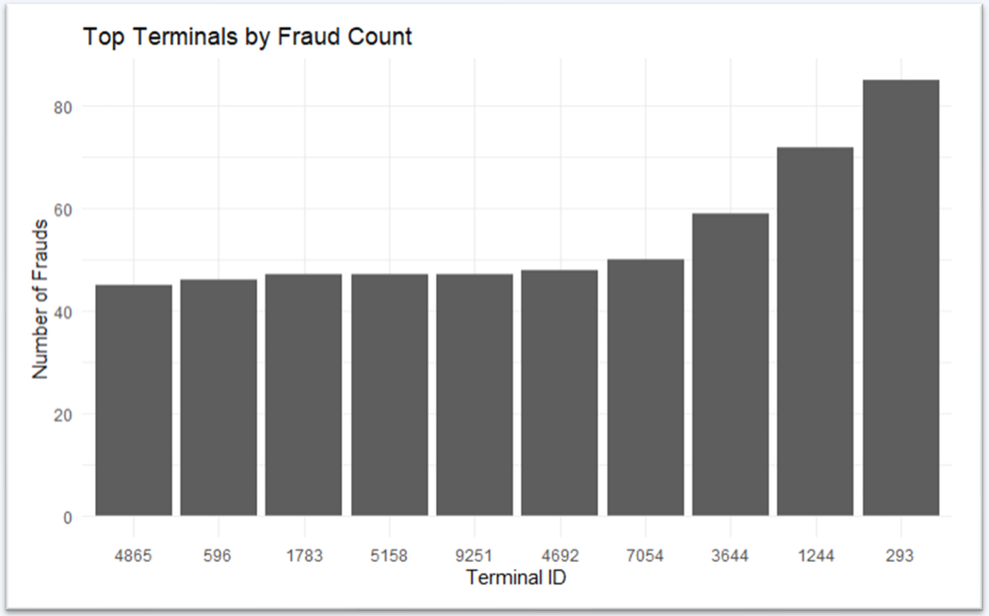
5 rows | 1-10 of 20 columns

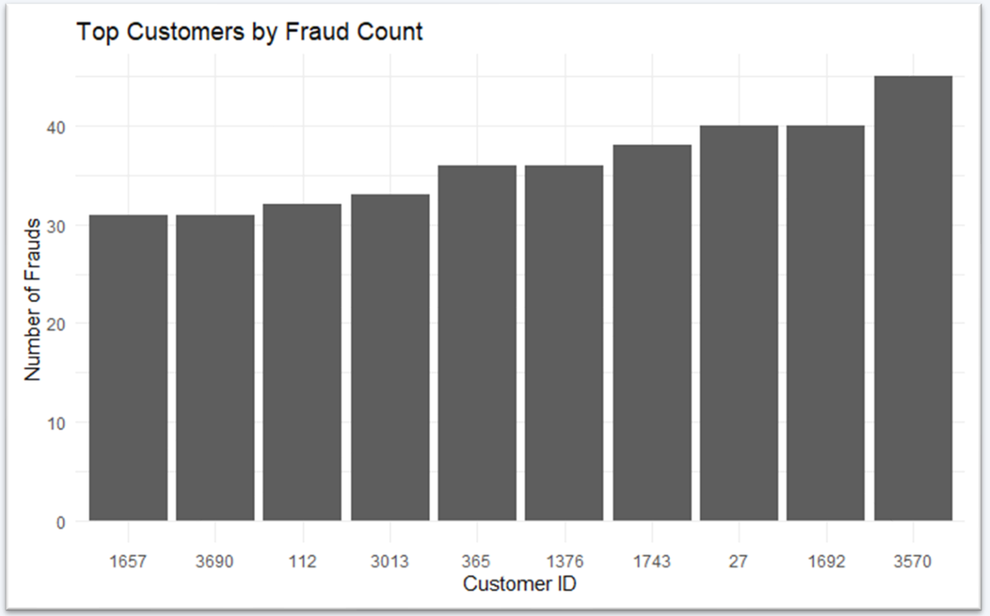
Explore

```
   TRANS_ID          DATETIME                      CUSTOMER_ID    TERMINAL_ID    TRANS_AMOUNT      TRANS_FRAUD       TRANS_FRAUD_SCENARIO TRANS_DAY_OF_WEEK TRANS_HOUR_OF_DAY TRANS_WEEKEND
Min.   :      0   Min.   :2018-04-01 00:00:31.00   Min.   :   0   Min.   :   0   Min.   :   0.00   Min.   :0.000000   Min.   :0.00000      Min.   :1.000     Min.   : 0.0      Min.   :0.0000
1st Qu.: 438539   1st Qu.:2018-05-16 14:40:46.50   1st Qu.:1252   1st Qu.:2502   1st Qu.:  21.01   1st Qu.:0.000000   1st Qu.:0.00000      1st Qu.:2.000     1st Qu.: 8.0      1st Qu.:0.0000
Median : 877077   Median :2018-07-01 11:11:10.00   Median :2506   Median :4994   Median :  44.64   Median :0.000000   Median :0.00000      Median :4.000     Median :11.0      Median :0.0000
Mean   : 877077   Mean   :2018-07-01 11:20:33.71   Mean   :2504   Mean   :4997   Mean   :  53.63   Mean   :0.008369   Mean   :0.01882      Mean   :3.981     Mean   :11.5      Mean   :0.2837
3rd Qu.:1315616   3rd Qu.:2018-08-16 08:01:01.50   3rd Qu.:3765   3rd Qu.:7495   3rd Qu.:  76.95   3rd Qu.:0.000000   3rd Qu.:0.00000      3rd Qu.:6.000     3rd Qu.:15.0      3rd Qu.:1.0000
Max.   :1754154   Max.   :2018-09-30 23:59:57.00   Max.   :4999   Max.   :9999   Max.   :2628.00   Max.   :1.000000   Max.   :3.00000      Max.   :7.000     Max.   :23.0      Max.   :1.0000
 TRANS_NIGHT     LOG_TRANS_AMOUNT  TRANS_AMOUNT_BIN  CT_AVG_DAY_AMOUNT CT_AVG_DAY_TRANS CT_TOT_DAY_AMOUNT CT_TOT_DAY_TRANS CT_FRAUD_HIST    TM_AVG_DAY_AMOUNT TM_AVG_DAY_TRANS      DATE
Min.   :0.0000   Min.   :0.000    low      :438733   Min.   :  5.383   Min.   :1.000   Min.   :   0.00   Min.   : 1.00   Min.   : 0.000   Min.   : 44.27    Min.   :1.068    Min.   :2018-04-01
1st Qu.:0.0000   1st Qu.:3.091    medium   :438492   1st Qu.: 73.708   1st Qu.:2.235   1st Qu.:  67.88   1st Qu.: 2.00   1st Qu.: 0.000   1st Qu.: 76.19    1st Qu.:1.478    1st Qu.:2018-05-16
Median :0.0000   Median :3.821    high     :438467   Median :140.048   Median :2.931   Median : 147.24   Median : 3.00   Median : 0.000   Median : 84.71    Median :1.574    Median :2018-07-01
Mean   :0.1897   Mean   :3.660    very_high:438463   Mean   :151.685   Mean   :2.827   Mean   : 191.61   Mean   : 3.57   Mean   : 1.857   Mean   : 85.20    Mean   :1.589    Mean   :2018-06-30
3rd Qu.:0.0000   3rd Qu.:4.356                       3rd Qu.:217.138   3rd Qu.:3.469   3rd Qu.: 269.91   3rd Qu.: 5.00   3rd Qu.: 2.000   3rd Qu.: 93.56    3rd Qu.:1.686    3rd Qu.:2018-08-16
Max.   :1.0000   Max.   :7.874                       Max.   :433.615   Max.   :4.281   Max.   :4254.52   Max.   :14.00   Max.   :45.000   Max.   :141.32    Max.   :2.426    Max.   :2018-09-30
TM_TOT_DAY_AMOUNT TM_TOT_DAY_TRANS TM_FRAUD_HIST     TM_CLIENTELE   CT_PURCHASE_TM
Min.   :   0.00   Min.   : 1.000   Min.   : 0.0000   Min.   :10.00   Min.   : 0.000
1st Qu.:  46.28   1st Qu.: 1.000   1st Qu.: 0.0000   1st Qu.:31.00   1st Qu.: 1.000
Median :  90.49   Median : 2.000   Median : 0.0000   Median :35.00   Median : 2.000
Mean   : 107.26   Mean   : 2.001   Mean   : 0.7327   Mean   :34.55   Mean   : 3.226
3rd Qu.: 148.93   3rd Qu.: 3.000   3rd Qu.: 0.0000   3rd Qu.:39.00   3rd Qu.: 5.000
Max.   :2628.00   Max.   :11.000   Max.   :84.0000   Max.   :59.00   Max.   :35.000
```

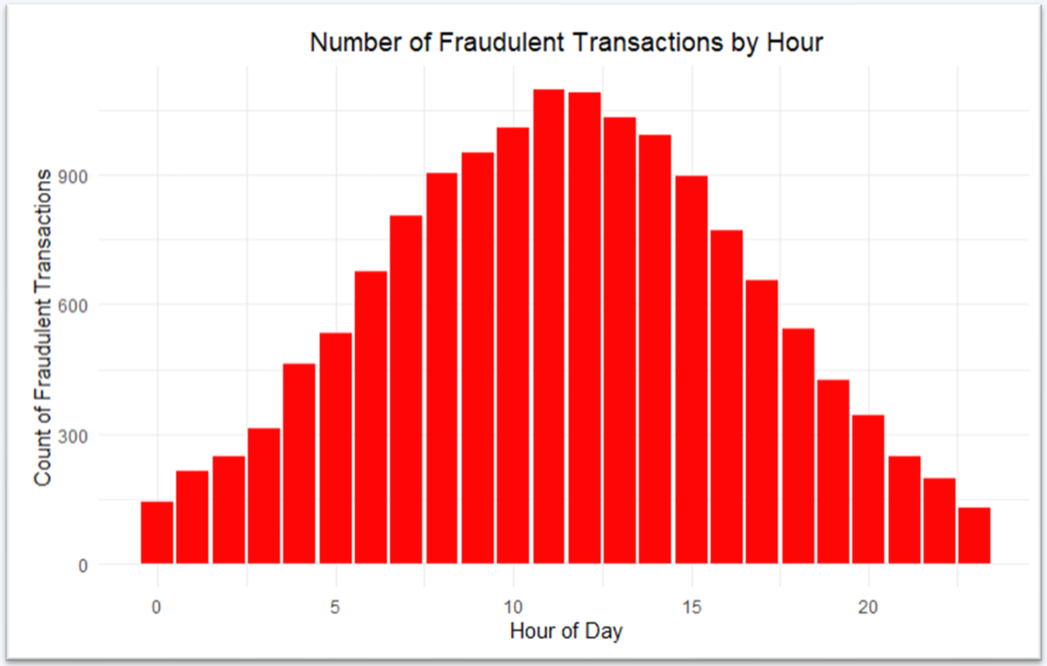
Summary Statistics

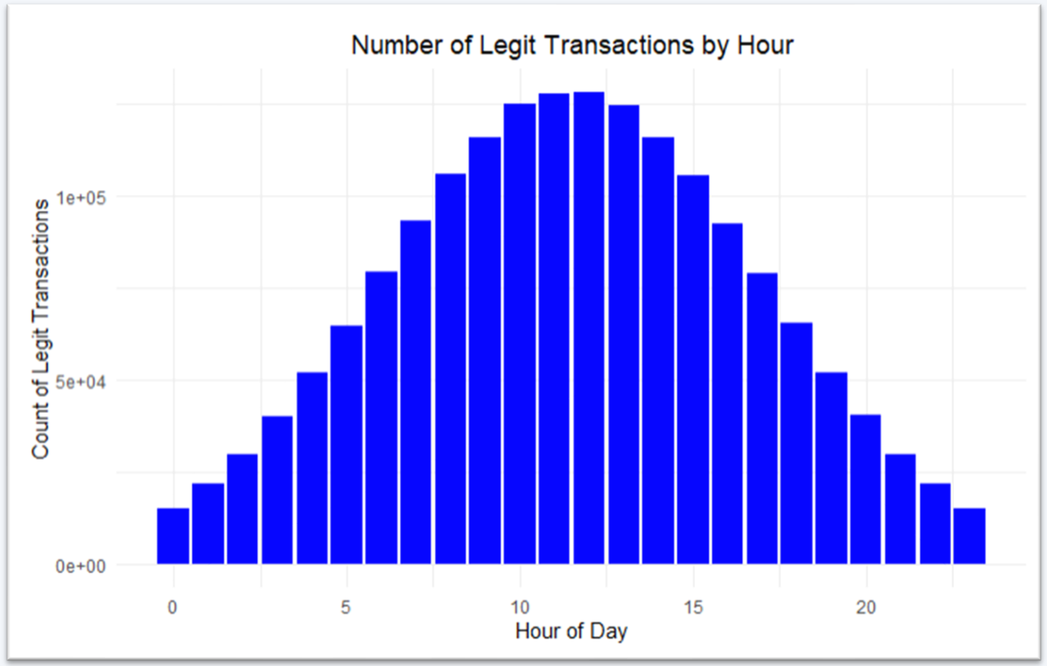
Explore


Top Terminals by Fraud Count
Number of Frauds
0
20
40
60
80
4865
596
1783
5158
9251
4692
7054
3644
1244
293
Terminal ID

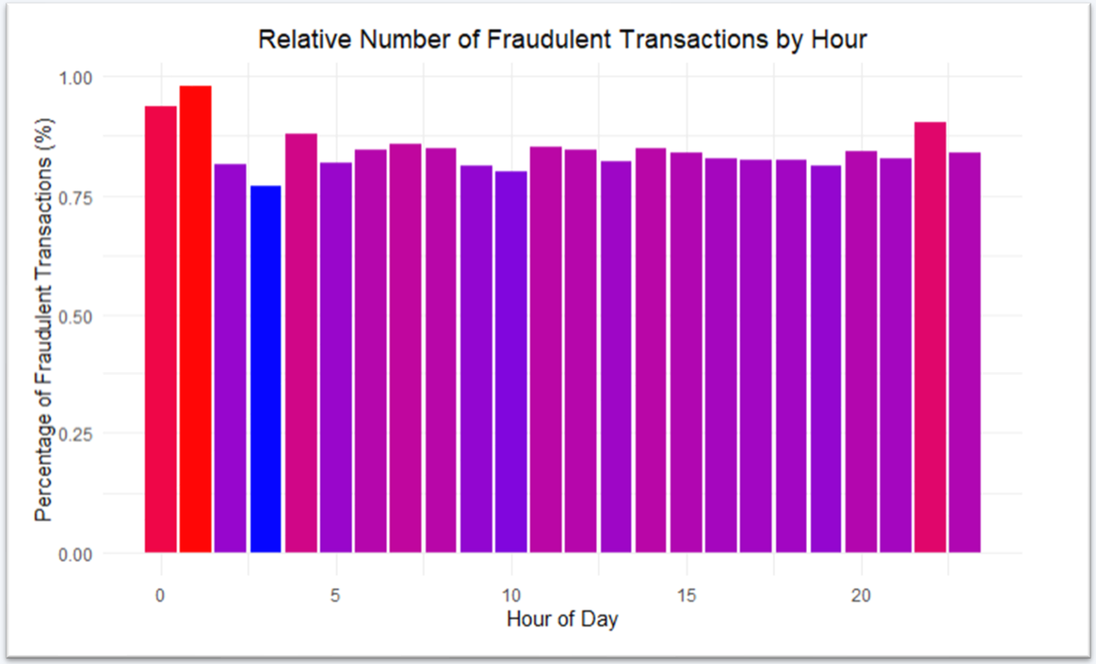

Top Customers by Fraud Count
Number of Frauds
0
10
20
30
40
1657
3690
112
3013
365
1376
1743
27
1692
3570
Customer ID

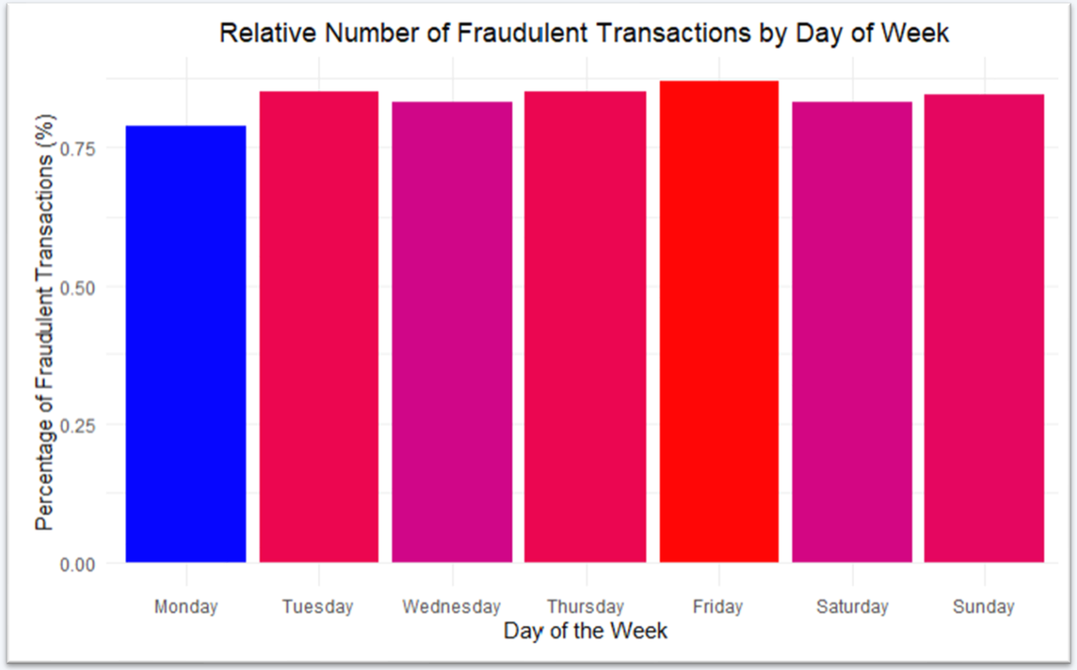
Explore


Number of Fraudulent Transactions by Hour
Count of Fraudulent Transactions
900
600
300
0
0
5
10
15
20
Hour of Day

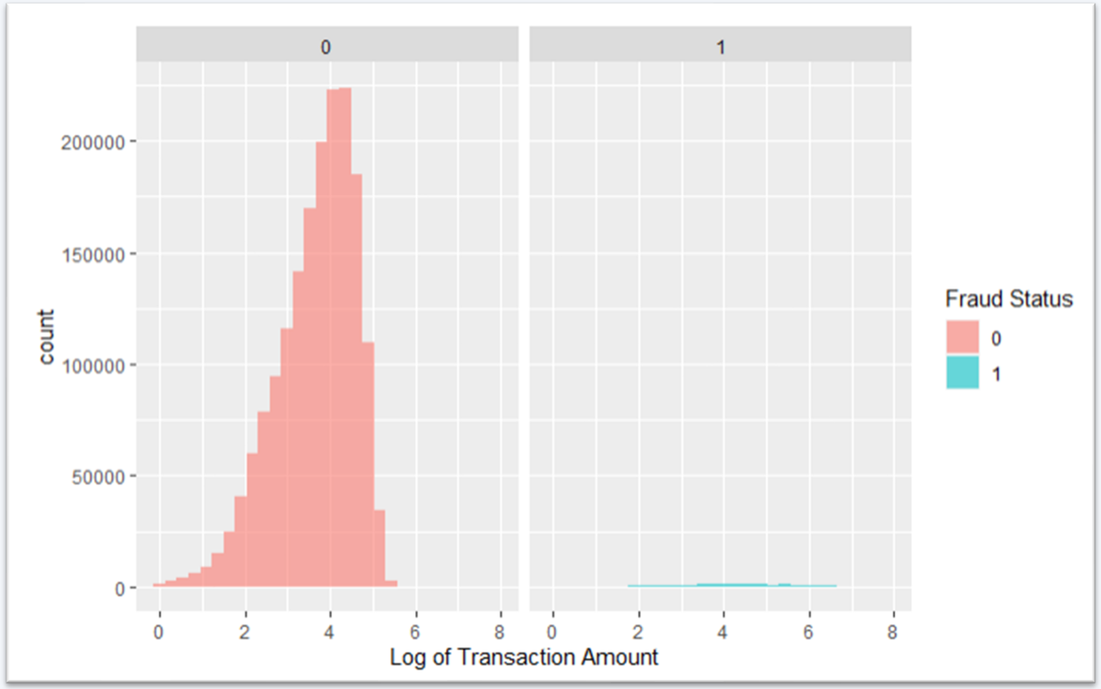

Number of Legit Transactions by Hour
Count of Legit Transactions
1e+05
5e+04
0e+00
0
5
10
15
20
Hour of Day

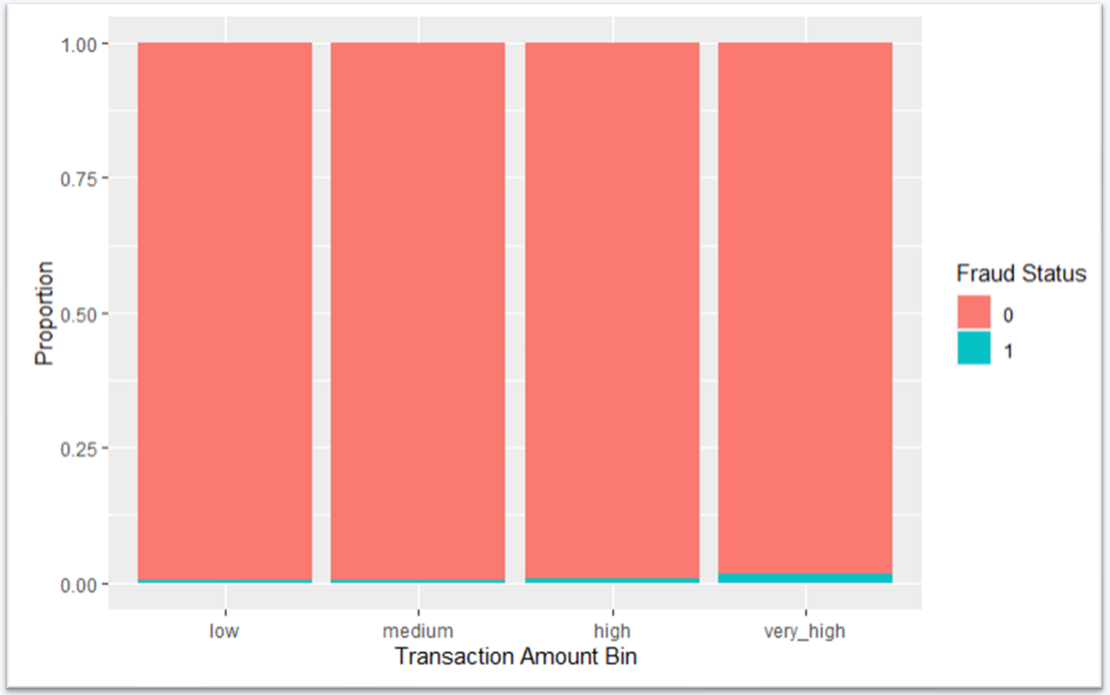
Explore


Relative Number of Fraudulent Transactions by Hour
Percentage of Fraudulent Transactions (%)
1.00
0.75
0.50
0.25
0.00
0
5
10
15
20
Hour of Day

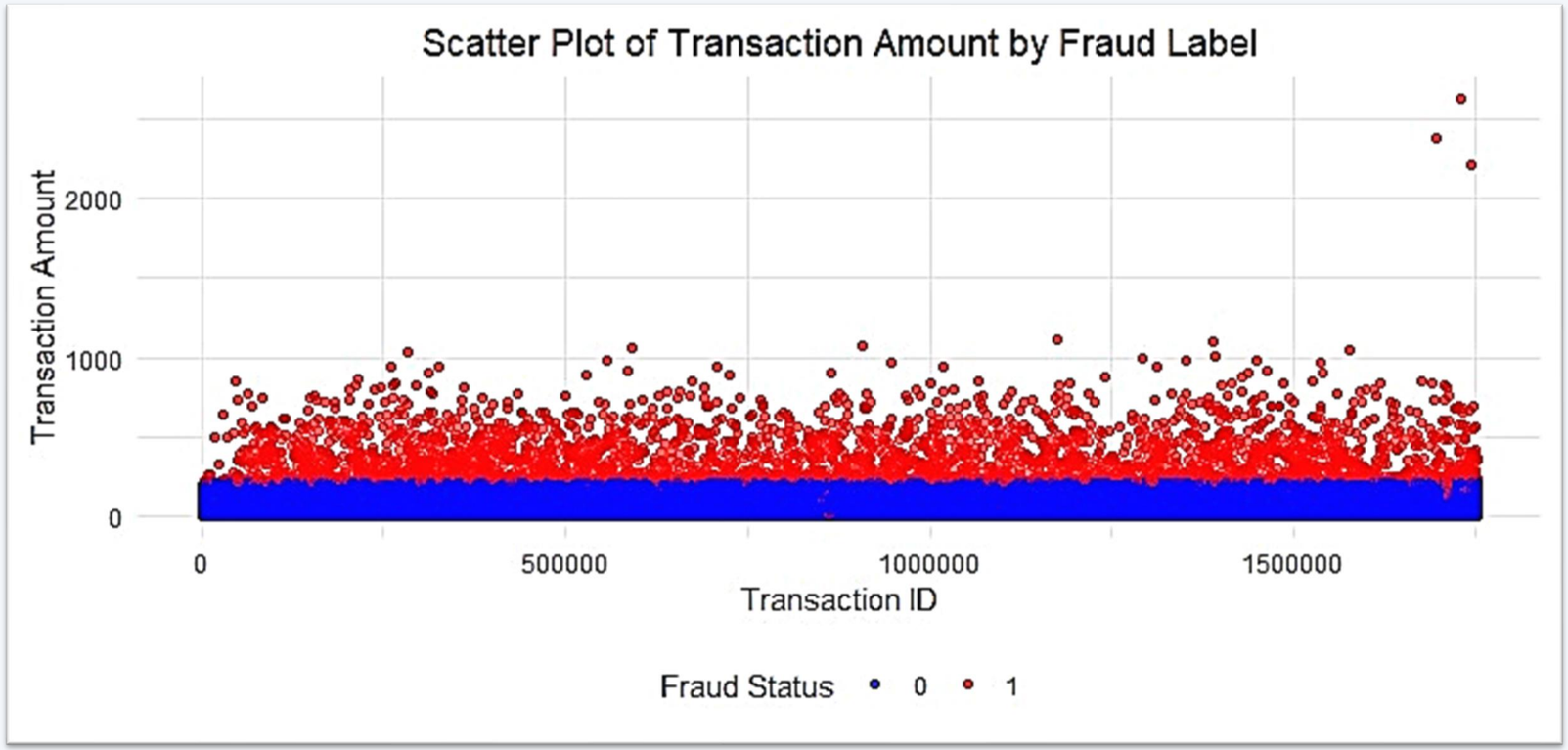

Relative Number of Fraudulent Transactions by Day of Week
Percentage of Fraudulent Transactions (%)
0.75
0.50
0.25
0.00
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Day of the Week

Explore

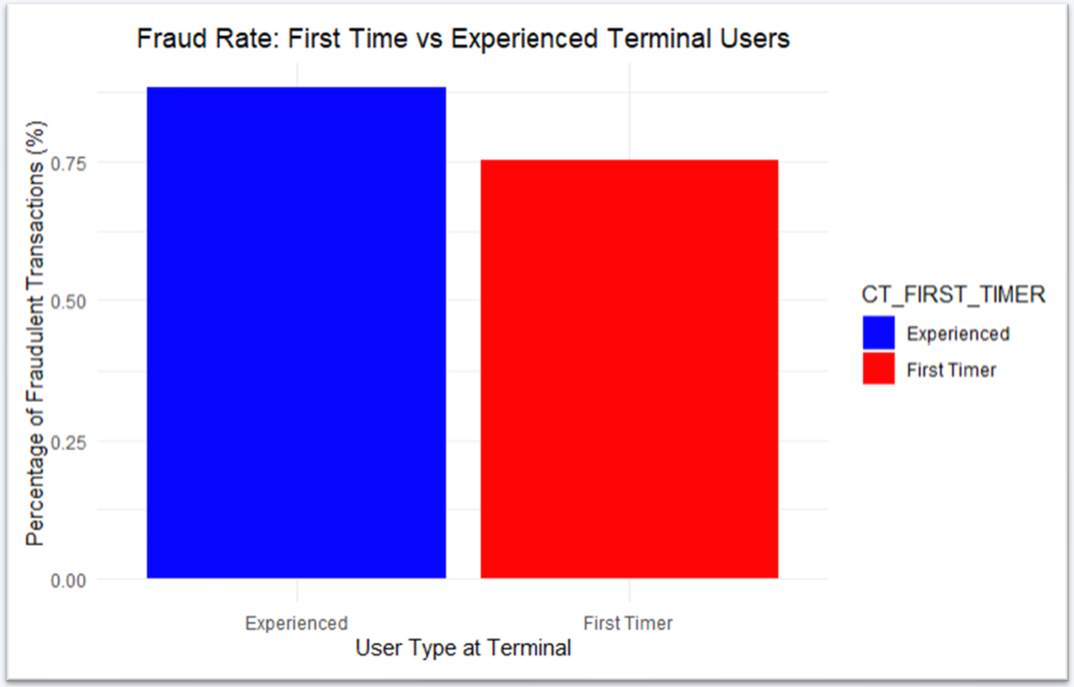

0
1
200000
150000
100000
50000
0
count
0
2
4
6
8
Log of Transaction Amount
Fraud Status
0
1

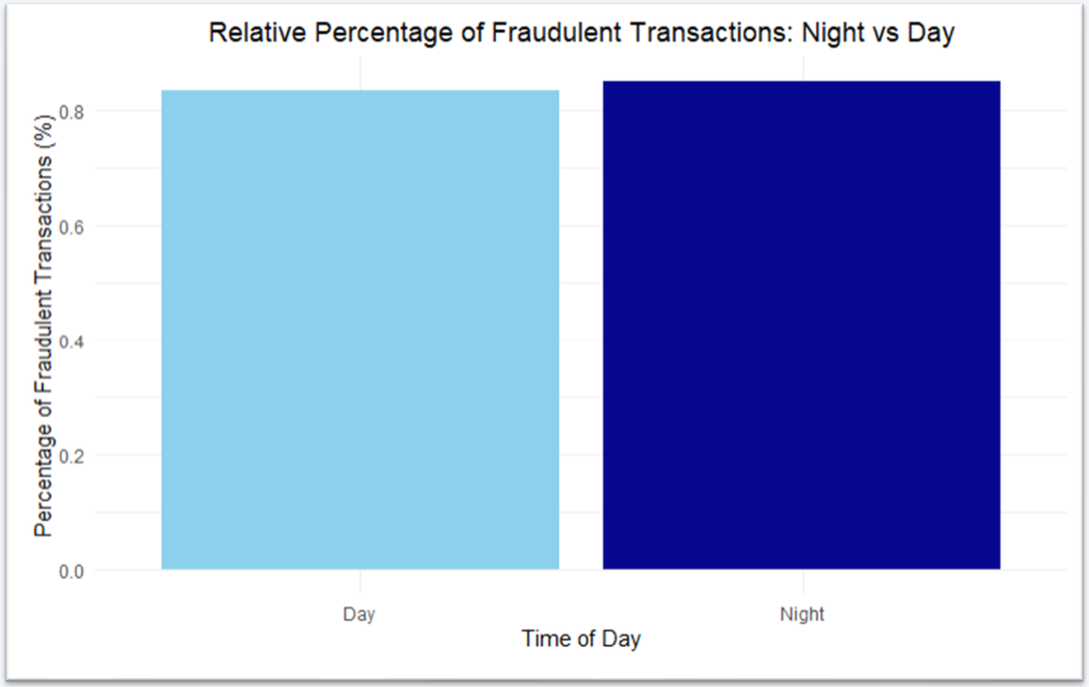

1.00
0.75
0.50
0.25
0.00
Proportion
low
medium
high
very_high
Transaction Amount Bin
Fraud Status
0
1

Explore

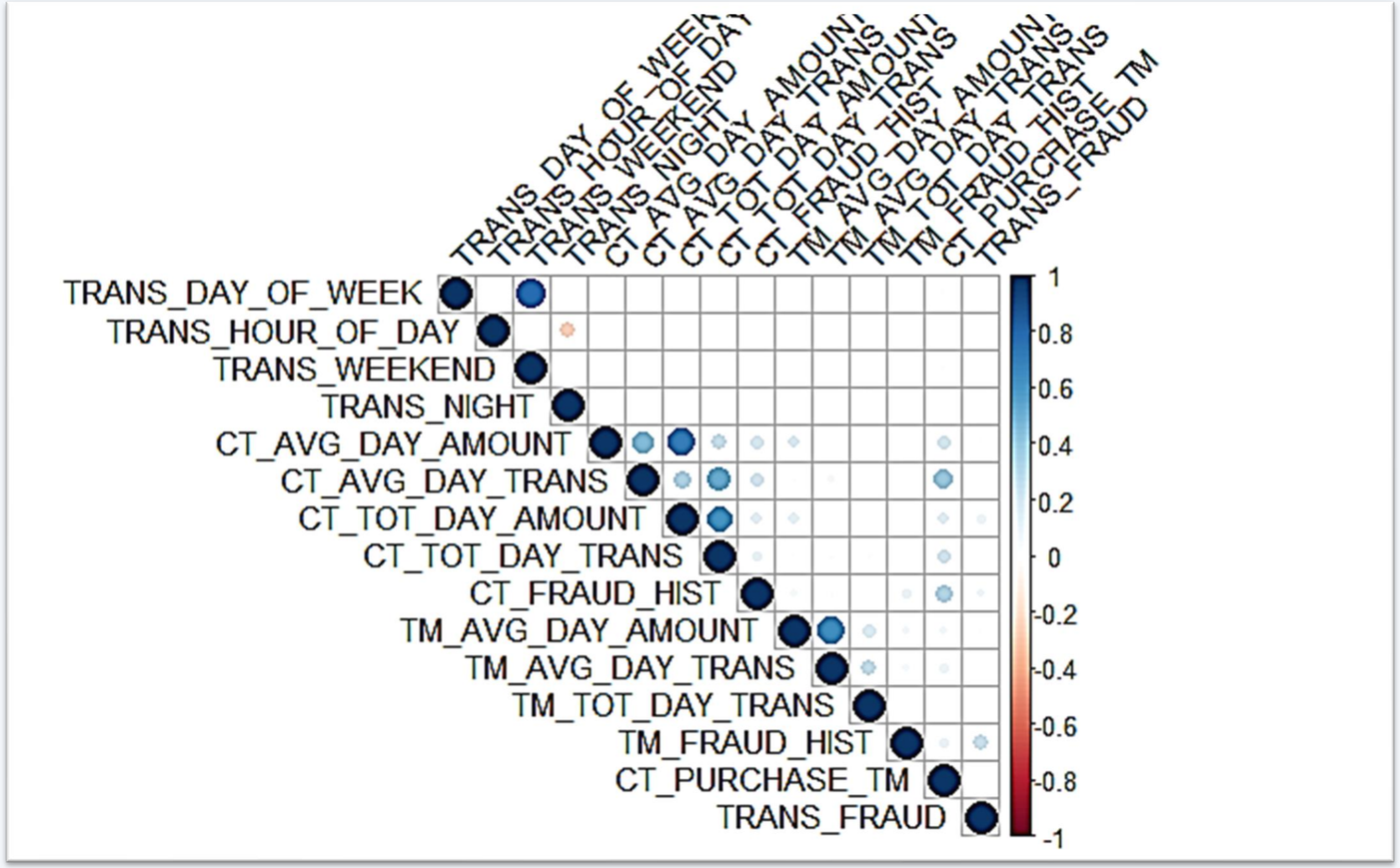

Scatter Plot of Transaction Amount by Fraud Label
Transaction Amount
2000
1000
0
0
500000
1000000
1500000
Transaction ID
Fraud Status
0
1

Explore


Fraud Rate: First Time vs Experienced Terminal Users
Percentage of Fraudulent Transactions (%)
0.00
0.25
0.50
0.75
Experienced
First Timer
User Type at Terminal
CT_FIRST_TIMER
Experienced
First Timer

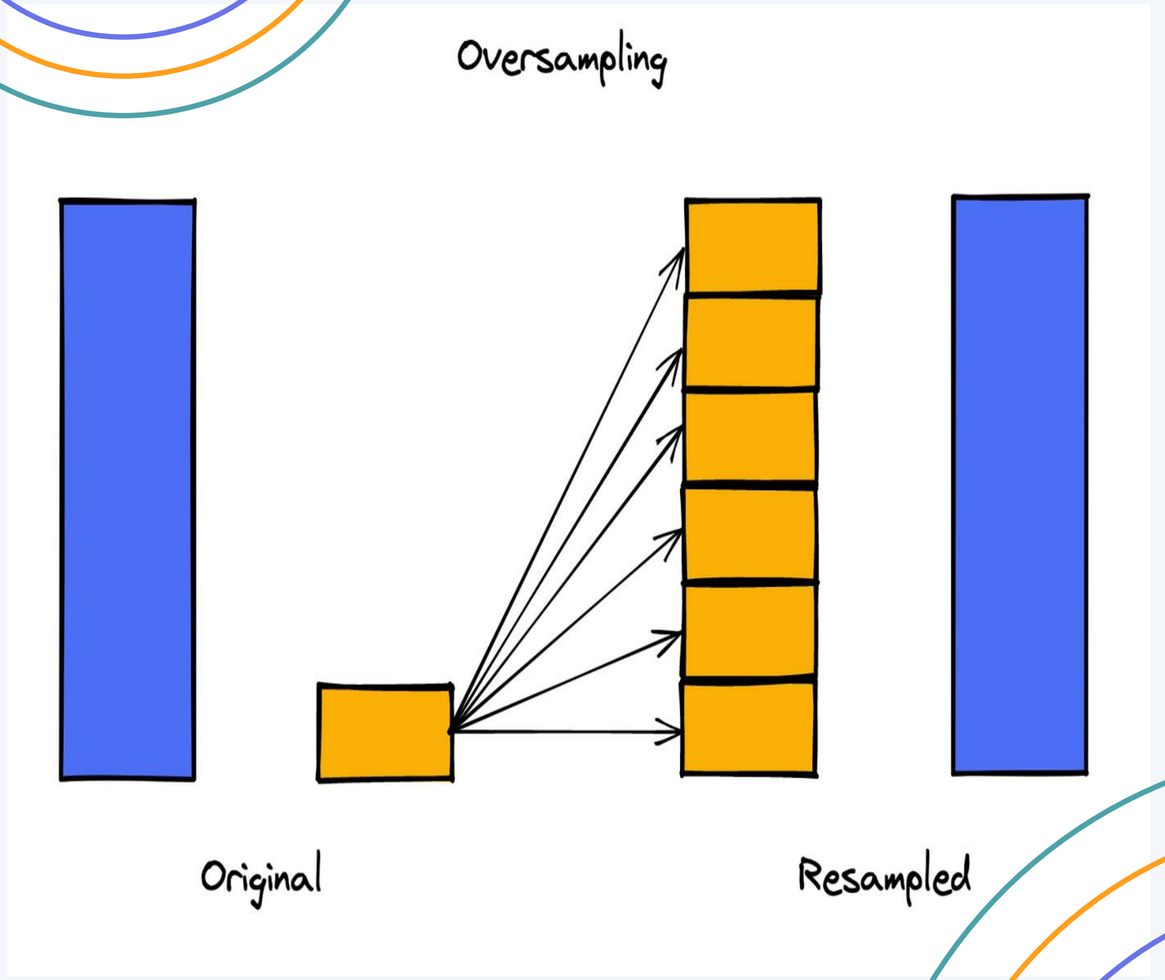

Relative Percentage of Fraudulent Transactions: Night vs Day
Percentage of Fraudulent Transactions (%)
0.0
0.2
0.4
0.6
0.8
Day
Night
Time of Day

Explore

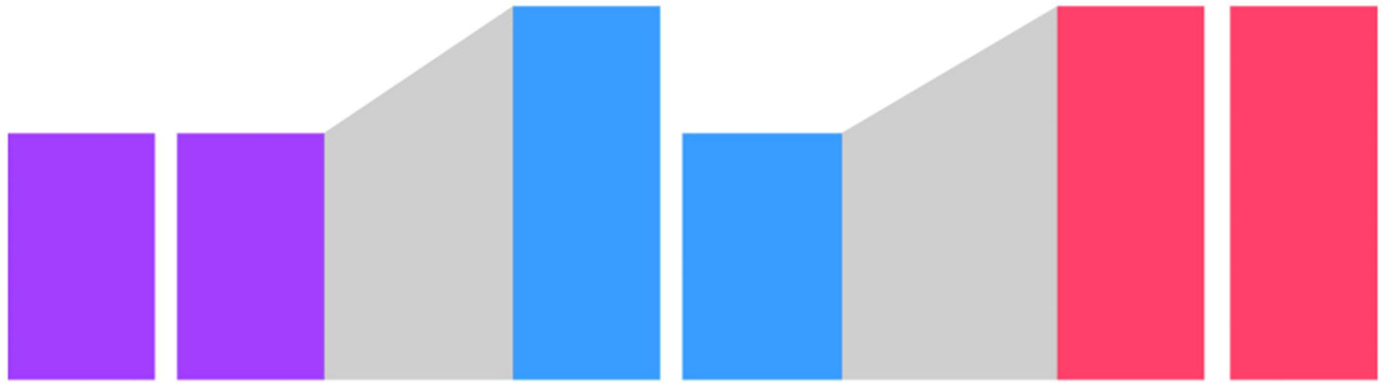

TRANS_DAY_OF_WEEK
TRANS_HOUR_OF_DAY
TRANS_WEEKEND
TRANS_NIGHT
CT_AVG_DAY_AMOUNT
CT_AVG_DAY_TRANS
CT_TOT_DAY_AMOUNT
CT_TOT_DAY_TRANS
CT_FRAUD_HIST
TM_AVG_DAY_AMOUNT
TM_AVG_DAY_TRANS
TM_TOT_DAY_TRANS
TM_FRAUD_HIST
CT_PURCHASE_TM
TRANS_FRAUD
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1

Resampling

Aleatory process to balance the dataset.



Resampling

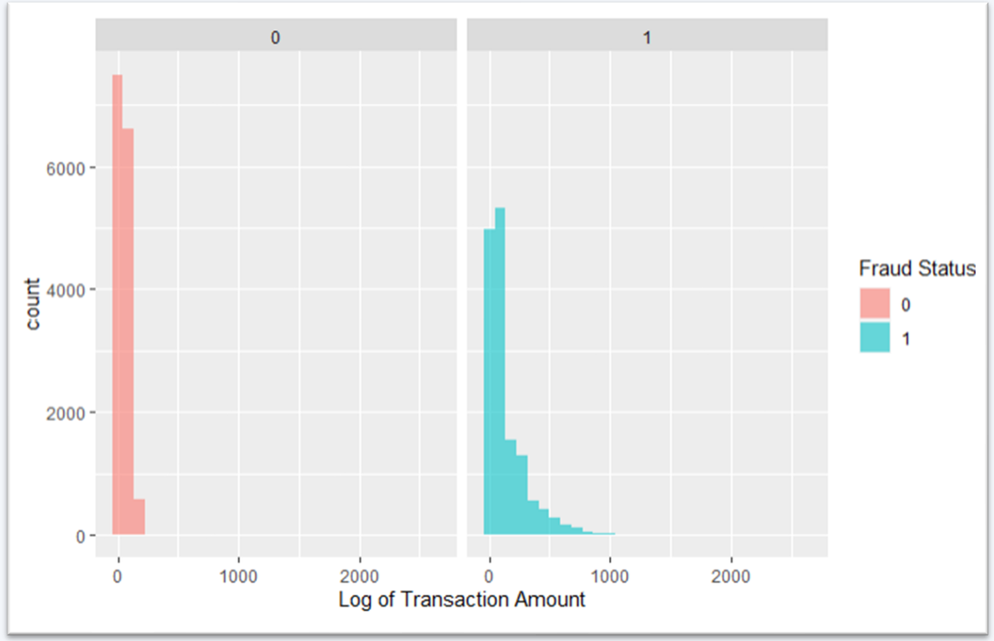


In undersampling, we pull all the rare events while pulling a sample of the abundant events in order to equalize the datasets.

These methods can be used separately or together;one is not better than the other. Which method a data scientist uses depends on the dataset and analysis.

Under-Sampling

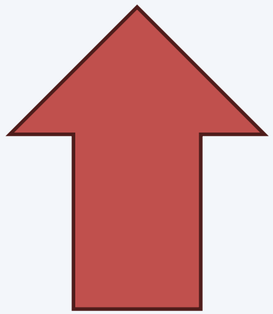
```
tibble [29,362 × 20] (S3: tbl_df/tbl/data.frame)
 $ TRANS_FRAUD      : num [1:29362] 1 1 1 1 1 1 1 1 1 1 ...
 $ CUSTOMER_ID      : num [1:29362] 0 1 1 1 1 1 1 1 1 1 ...
 $ TERMINAL_ID      : num [1:29362] 2352 5 5 1083 1083 ...
 $ TRANS_AMOUNT     : num [1:29362] 22.54 205.35 273.6 31.33 0.57 ...
 $ TRANS_DAY_OF_WEEK: num [1:29362] 4 7 1 4 5 3 2 1 5 6 ...
 $ TRANS_HOUR_OF_DAY: int [1:29362] 12 13 9 10 18 8 12 8 6 18 ...
 $ TRANS_WEEKEND    : num [1:29362] 0 1 0 0 0 0 0 0 0 1 ...
 $ TRANS_NIGHT      : num [1:29362] 0 0 0 0 0 0 0 0 0 0 ...
 $ CT_AVG_DAY_AMOUNT: num [1:29362] 147 191 191 191 191 ...
 $ CT_AVG_DAY_TRANS : num [1:29362] 2.4 3.69 3.69 3.69 3.69 ...
 $ CT_TOT_DAY_AMOUNT: num [1:29362] 22.5 549.8 321.4 203.8 120 ...
 $ CT_TOT_DAY_TRANS : int [1:29362] 1 7 2 5 3 7 5 6 6 6 ...
 $ CT_FRAUD_HIST    : num [1:29362] 0 1 10 18 19 20 4 15 16 17 ...
 $ TM_AVG_DAY_AMOUNT: num [1:29362] 81.5 91.2 91.2 94 94 ...
 $ TM_AVG_DAY_TRANS : num [1:29362] 1.28 1.48 1.48 1.55 1.55 ...
 $ TM_TOT_DAY_AMOUNT: num [1:29362] 36.32 324.51 273.6 31.33 0.57 ...
 $ TM_TOT_DAY_TRANS : int [1:29362] 2 3 1 1 1 4 4 4 1 2 ...
 $ TM_FRAUD_HIST    : num [1:29362] 9 0 1 12 18 21 1 2 13 21 ...
 $ TM_CLIENTELE     : int [1:29362] 27 32 32 36 36 36 35 33 33 33 ...
 $ CT_PURCHASE_TM   : num [1:29362] 4 1 2 4 5 6 0 2 3 4 ...
```



Near-Miss Under-Sampling

Model and Algorithm Selection

1. Unsupervised Learning
2. Supervised Learning
3. Semi-supervised Learning
   Reinforcement Learning



Supervised Algorithms

- Logistic Regression
- Decision Trees
- Random Forest
- Gradient Boosting Machine
- Support Vector Machine

Highly accurate

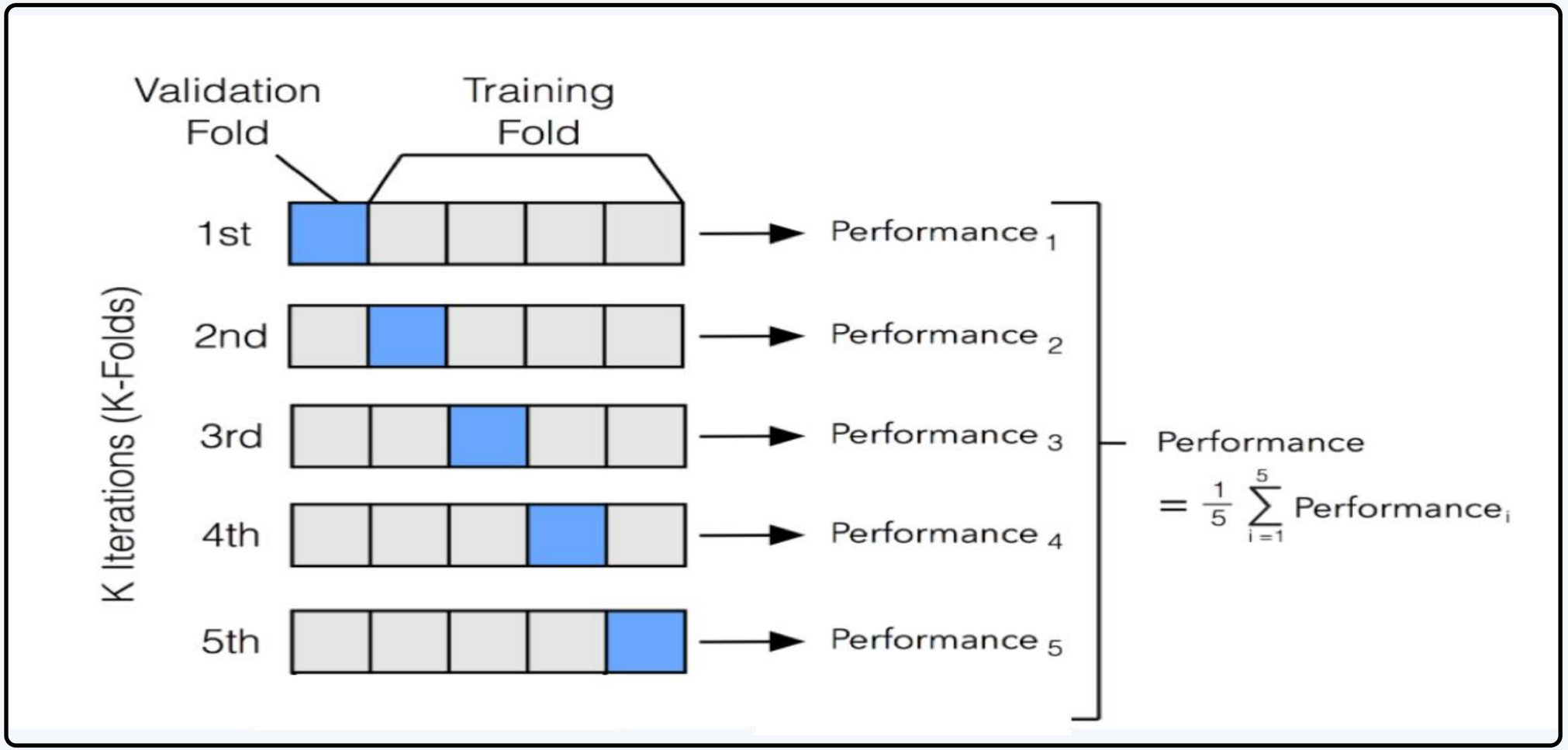
Highly reliable

Low computational complexity

Ease of overfitting

Label Dependency

Cross-Validation



Model should be trained using cross-validation in the training dataset (0.80 split)

Metrics

Train Datset

	AUC ROC	Average precision
Logistic regression	0.892	0.663
Decision tree with depth of two	0.802	0.586
Decision tree - unlimited depth	1.000	1.000
Random forest	1.000	1.000
XGBoost	1.000	0.995

Test Datset

	AUC ROC	Average precision
Logistic regression	0.871	0.606
Decision tree with depth of two	0.763	0.496
Decision tree - unlimited depth	0.788	0.309
Random forest	0.867	0.658
XGBoost	0.862	0.639

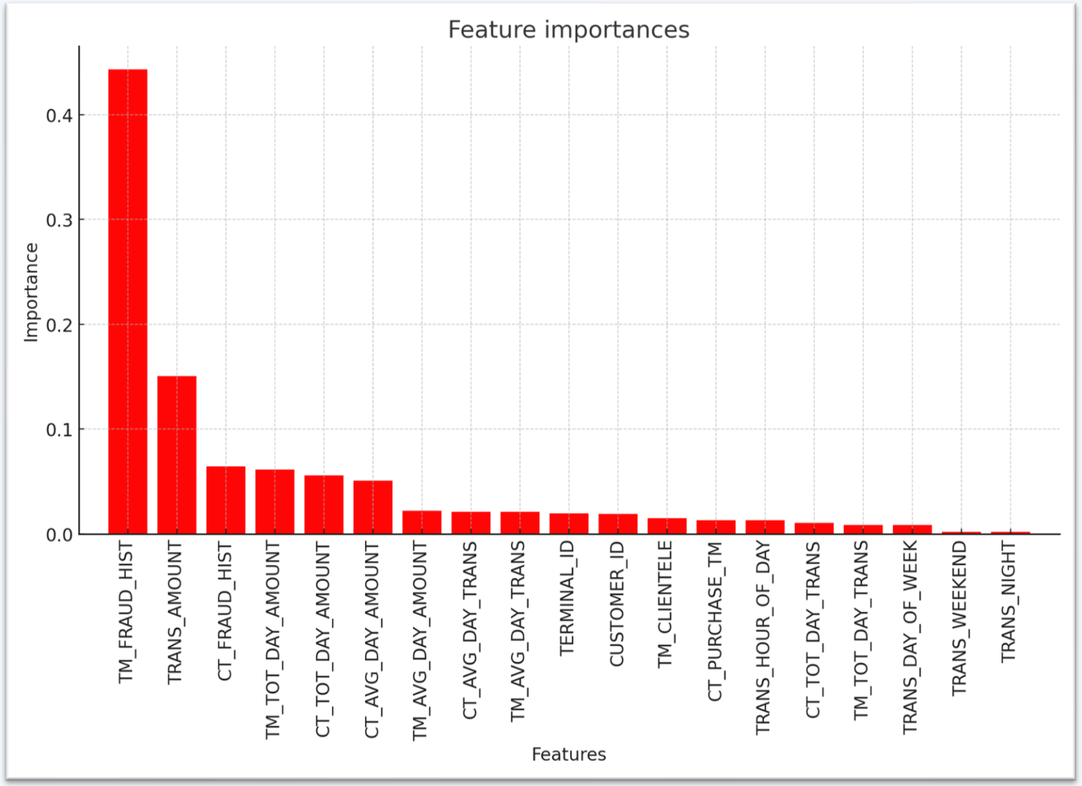
Time in Minutes (Balanced Dataset)

	Training execution time	Prediction execution time
Logistic regression	1.566042	0.010171
Decision tree with depth of two	0.079466	0.004938
Decision tree - unlimited depth	0.759311	0.007423
Random forest	2.057255	0.106525
XGBoost	6.960977	0.132526

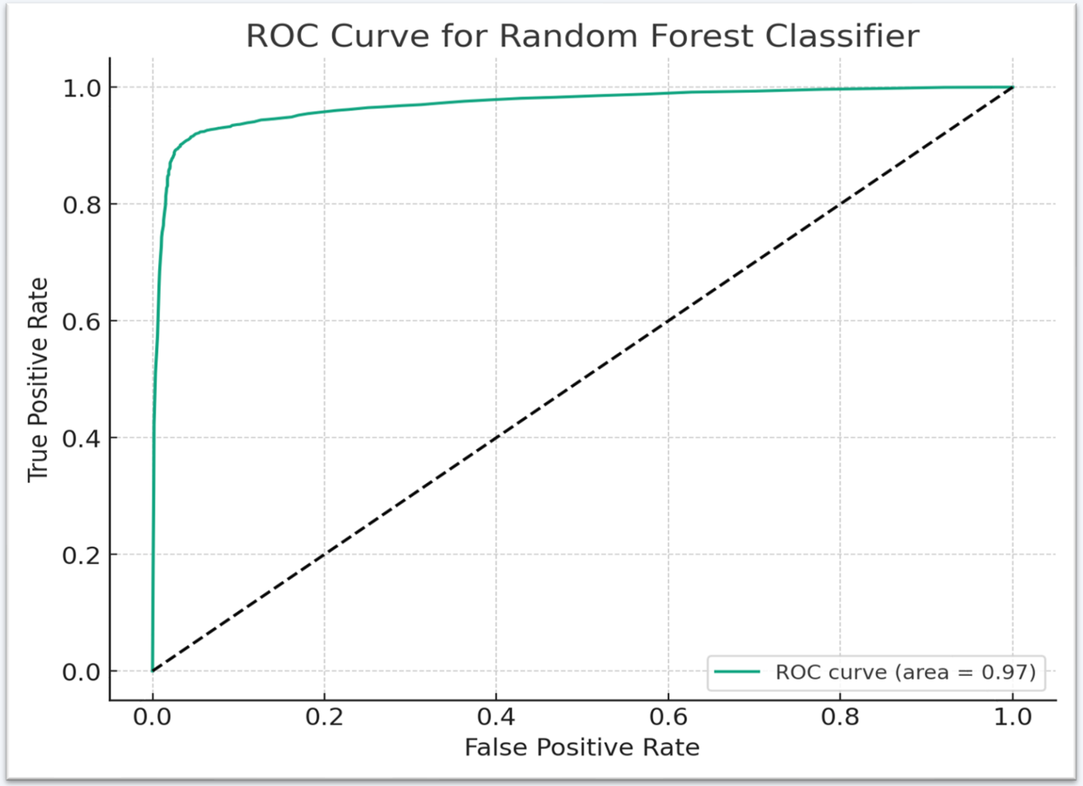
Time in Minutes (Full Dataset)

	Training execution time	Prediction execution time
Logistic regression	28.249504	0.724941
Decision tree with depth of two	5.608281	0.330950
Decision tree - unlimited depth	63.460486	0.684312
Random forest	82.199115	3.443370
XGBoost	107.674864	1.679429

Metrics



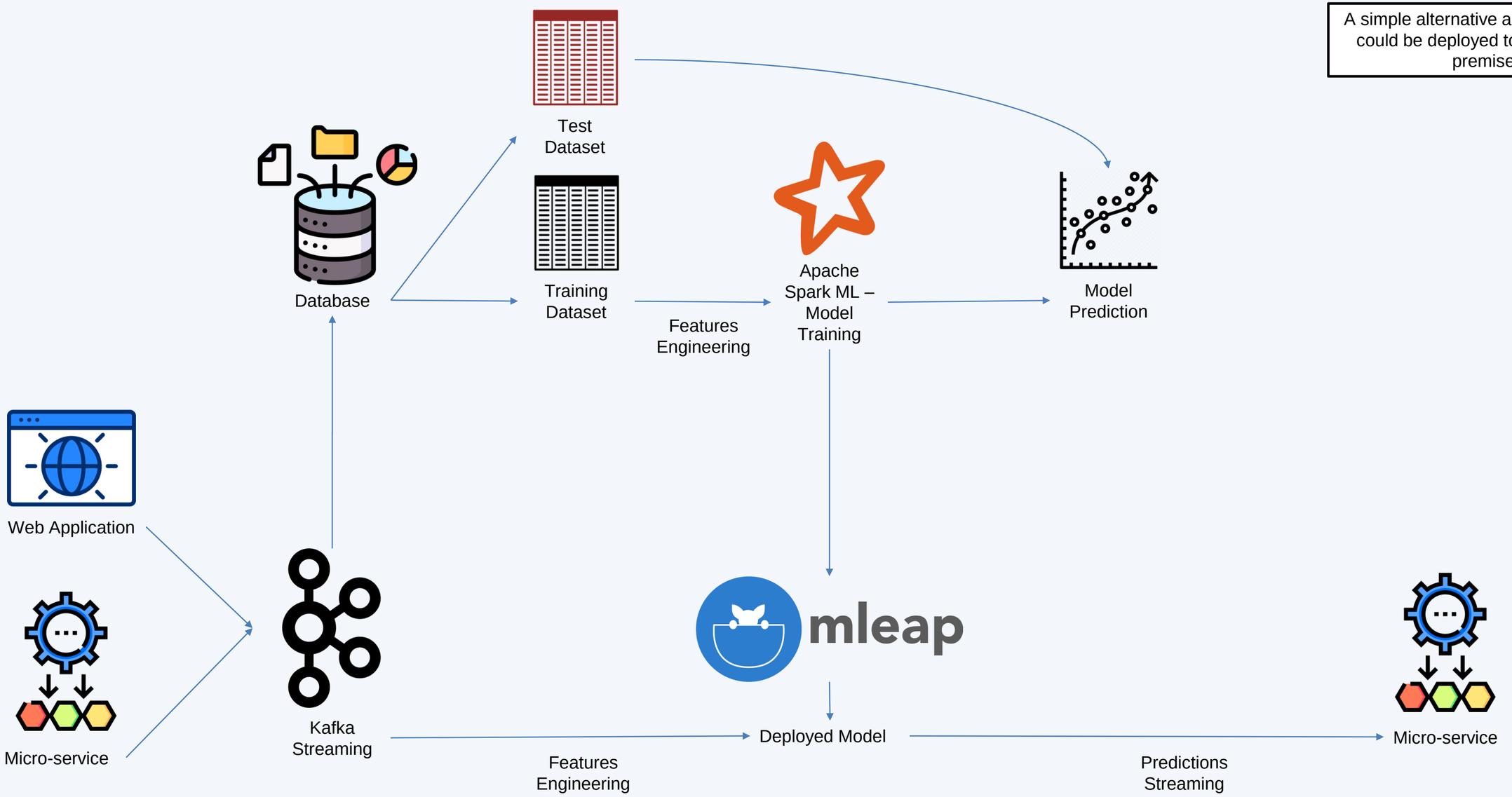
The model confirm the insights coming from the data exploration.



Performance based only on detecting correctly fraudulent transactions.

Architecture

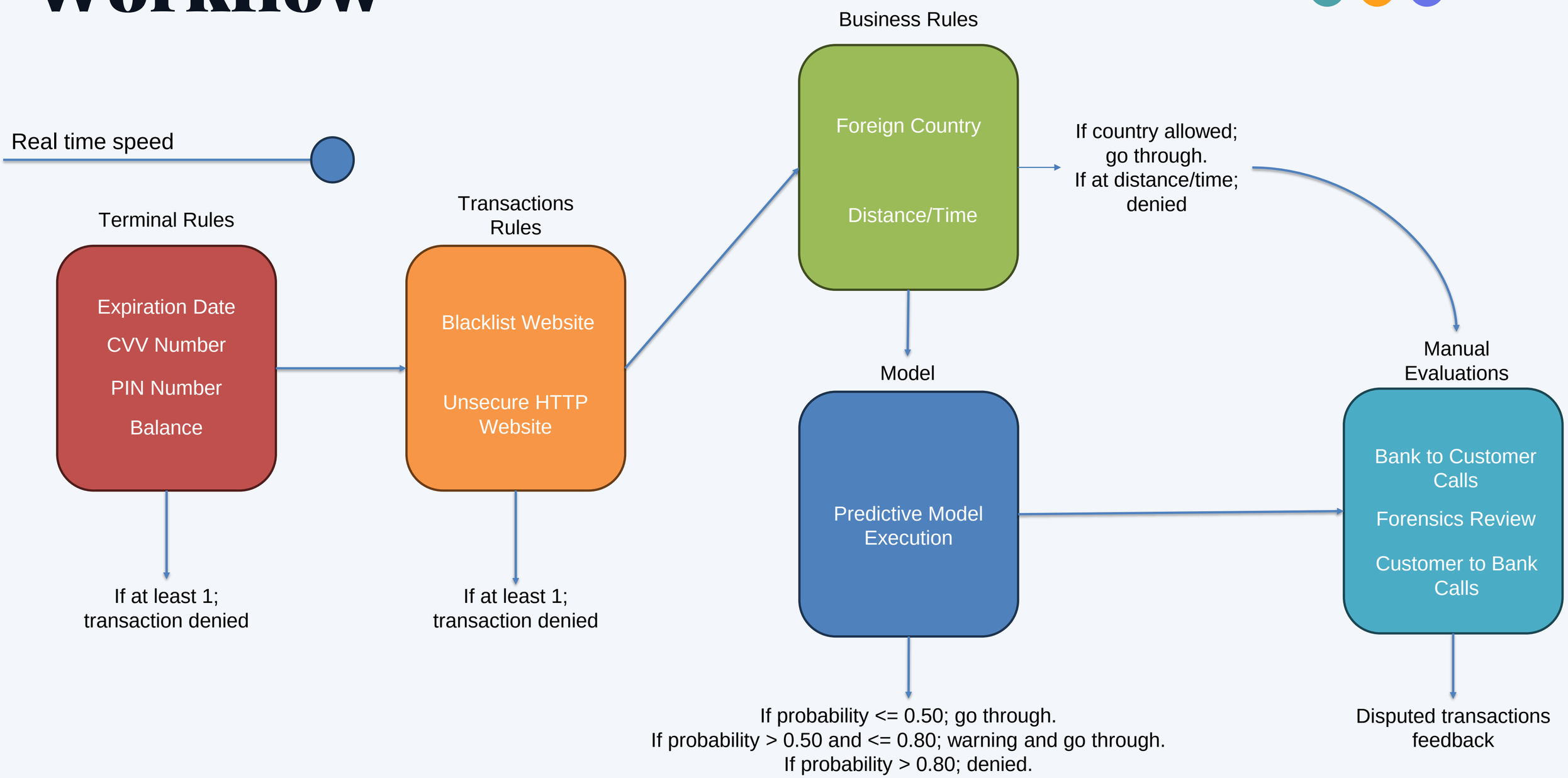
A simple alternative architecture that could be deployed to cloud or on-premise.



08.

The System

Workflow


Real time speed
Terminal Rules
Expiration Date
CVV Number
PIN Number
Balance
If at least 1; transaction denied
Transactions Rules
Blacklist Website
Unsecure HTTP Website
If at least 1; transaction denied
Business Rules
Foreign Country
Distance/Time
If country allowed; go through.
If at distance/time; denied
Model
Predictive Model Execution
If probability <= 0.50; go through.
If probability > 0.50 and <= 0.80; warning and go through.
If probability > 0.80; denied.
Manual Evaluations
Bank to Customer Calls
Forensics Review
Customer to Bank Calls
Disputed transactions feedback

09.

The Monitor

This Shiny app displays a confusion matrix.

Choose csv file

Browse... test(1).csv

Upload complete

Reference column

reference

Prediction column

prediction

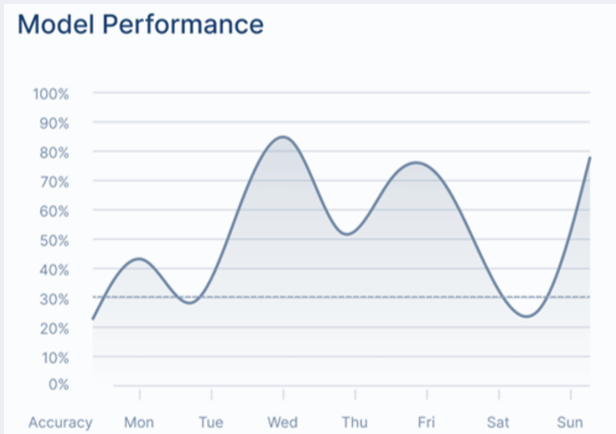
Reference:

Predicted:	Positive	Negative	Total		
Positive	**a** **true positive** 54	**b** **false positive** 32	a + b 86	**Positive Predictive Value (PPV)** a/(a+b) 0.63	**False Discovery Rate (FDR)** 1-PPV 0.37
Negative	**c** **false negative** 27	**d** **true negative** 231	c + d 258	**Negative Predictive Value (NPV)** d/(c+d) 0.9	**False Omission Rate (FOR)** 1-NPV 0.1
Total	a + c 81	b + d 263	a+b+c+d 344		
	Sensitivity True Positive Rate (TPR) a/(a+c) 0.67	**Specificity True Negative Rate (TNR)** d/(b+d) 0.88		**Prevalence** (a+c)/(a+b+c+d) 0.24	**Pos Likelihood Ratio (LR+)** TPR/FPR 5.48
					Neg Likelihood Ratio (LR-) FNR/TNR 0.38

IT Responsibility: Keep the system running.

Business Responsibility: Keep the system quality through monitoring.

Customer satisfaction could take a hit if False Positive increase.



What was violated

Monitor Name: Loss Rate Monitor

Monitor Type: Performance Degradation

Condition: Win Rate < 30%

Monitoring

1- Every project needs to be planned and KPIs must be stablish before the kick-off.

2- Multidisciplinary teams are quite important; but only the necessary people for the project.

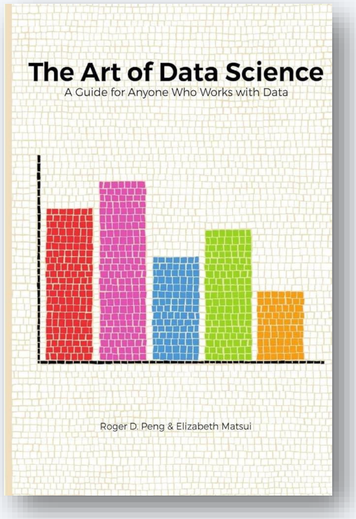
3- Data volume is great, but data quality is king.

4- Data could discard our 20 years experience hypothesis over a certain business problem.

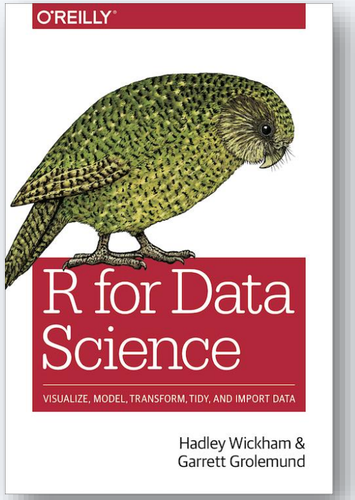
5- Fancy is not always better for real business solutions; pragmatism is key.

6- IT are friends, not food. 

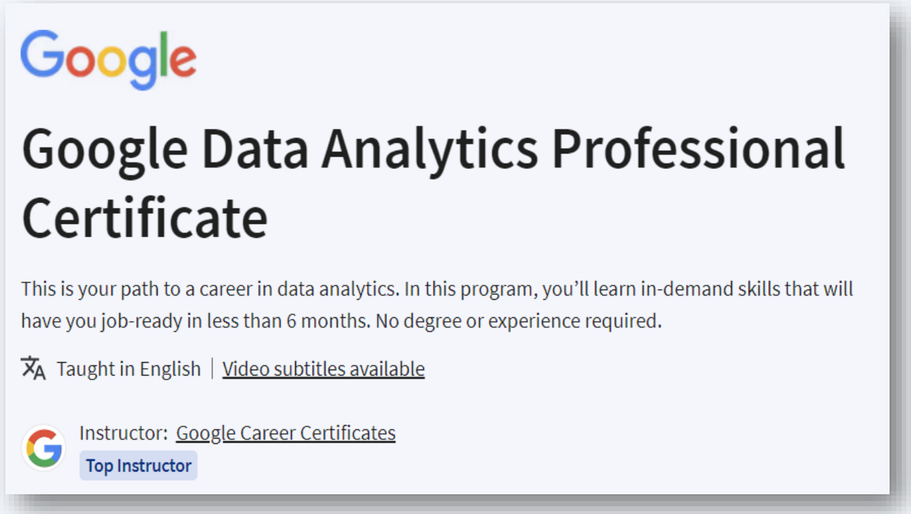
Lessons Learned



https://bookdown.org/rdpeng/artofdatascience/



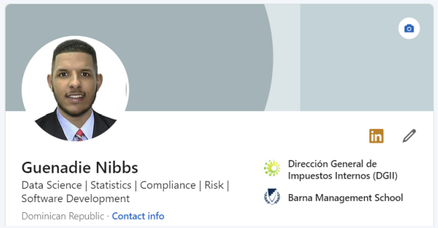
https://r4ds.had.co.nz/



https://www.coursera.org/professional-certificates/google-data-analytics

https://www.youtube.com/watch?v=_V8eKsto3Ug&t=3980s&ab_channel=freeCodeCamp.org

Questions?



https://www.linkedin.com/in/guenadie-nibbs-1912b933/

What's Next Guys?

thank you!

"Success is no accident. It is hard work, perseverance, learning, studying, sacrifice and most of all, love of what you are doing or learning to do." — Pele