# CREDIT RISK PREDICTION

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## Problem

Credit risk refers to the risk of loss that a lender faces due to a borrower's failure to repay any type of loan or debt

### Time

Performing manual assessments would consume a significant amount of time.

### Human Error

Human Error It can be happen if we make wrong decisions & will cause considerable losses

### Bias

Human judgment in credit risk assessment can be subjective and prone to bias

# Goals

Our objective is to utilize machine learning algorithms to forecast the likelihood of loan approval, enabling us to identify secure loans in advance. Furthermore, lending companies can utilize this model to determine interest rates, loan terms, and repayment periods accurately.

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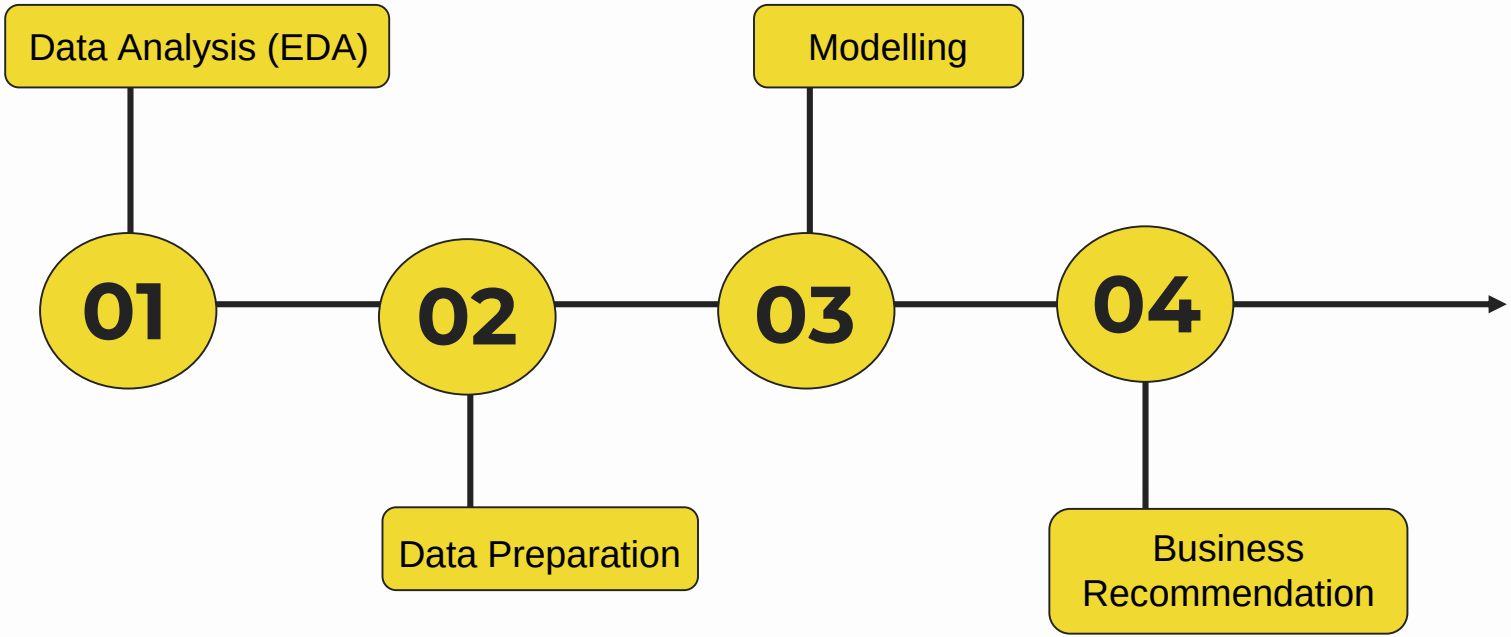


# 01

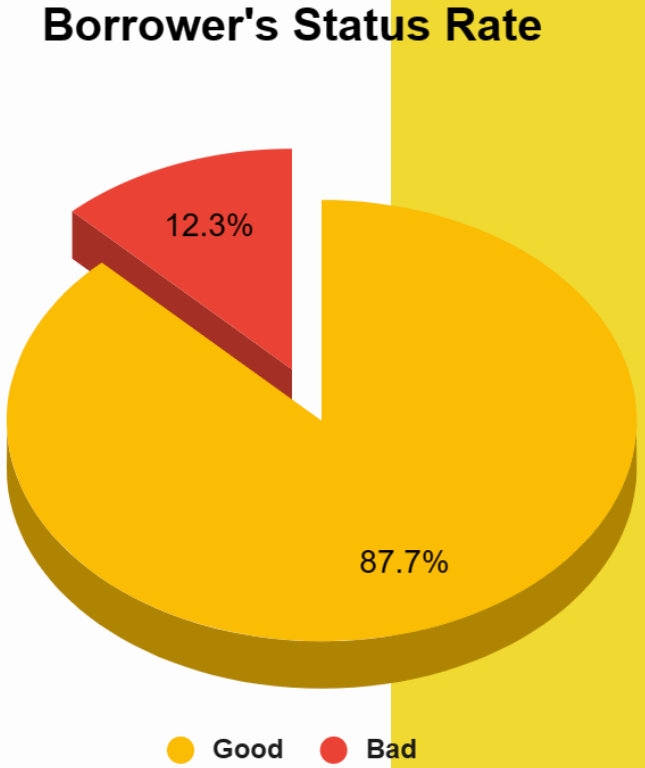
# Data Analysis (EDA)

# What happened?

The data analysis from 2007 to 2016 reveals a significant data imbalance, with 87.71% classified as "good" borrowers and only 12.29% as "bad." This high proportion of "bad" borrowers poses a challenge. To address this, we'll explore innovative solutions to enhance credit risk modeling, uncover hidden patterns, and empower informed lending decisions.

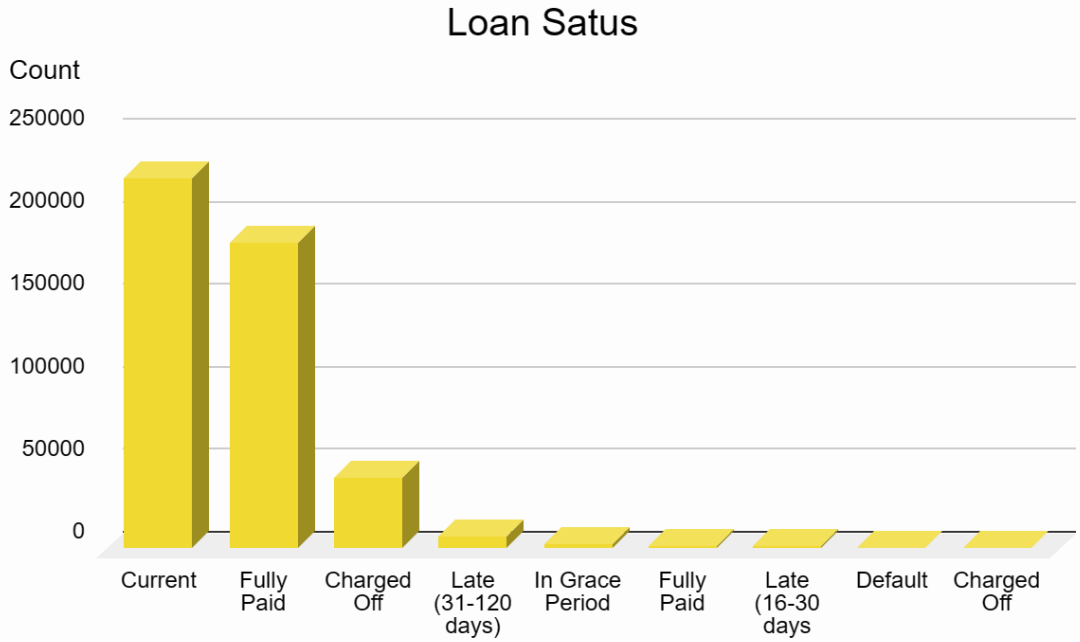
# The loan’s problem

We get the imbalance data which have 87.71% good borrower and 12.29% bad borrower from 2007 until 2016

# Applicants by Loan Status

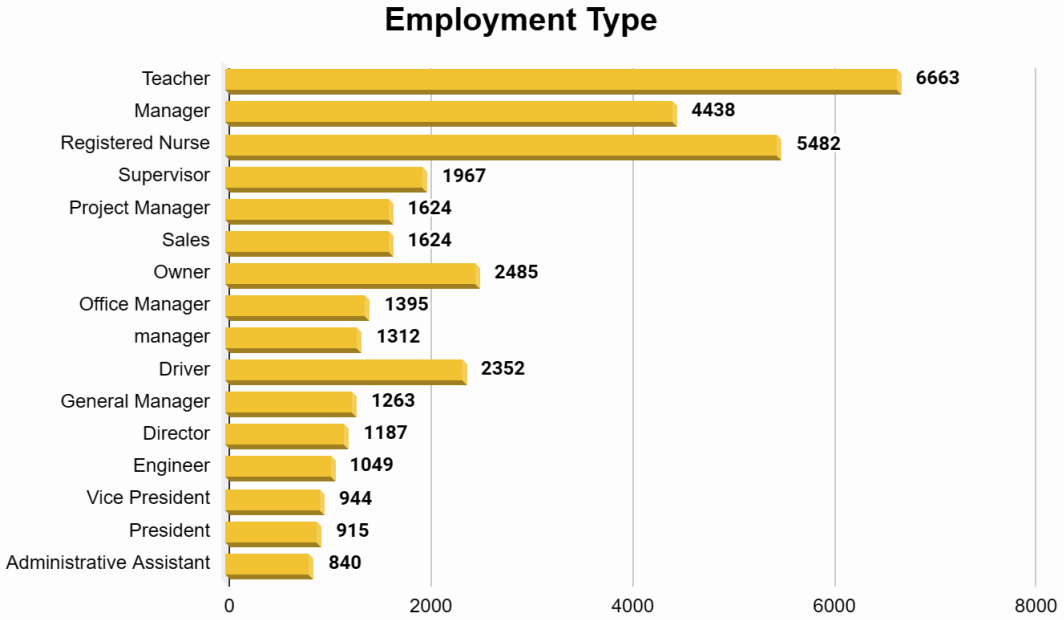
There are about 48% applicants with loan status of Current, followed by loan status of Fully Paid with 39.6%.

# Applicants by Employment Type

- Teachers and managers are the most common occupations among borrowers. This is likely due to the fact that these occupations tend to have higher salaries, which makes them more likely to be able to afford a mortgage.

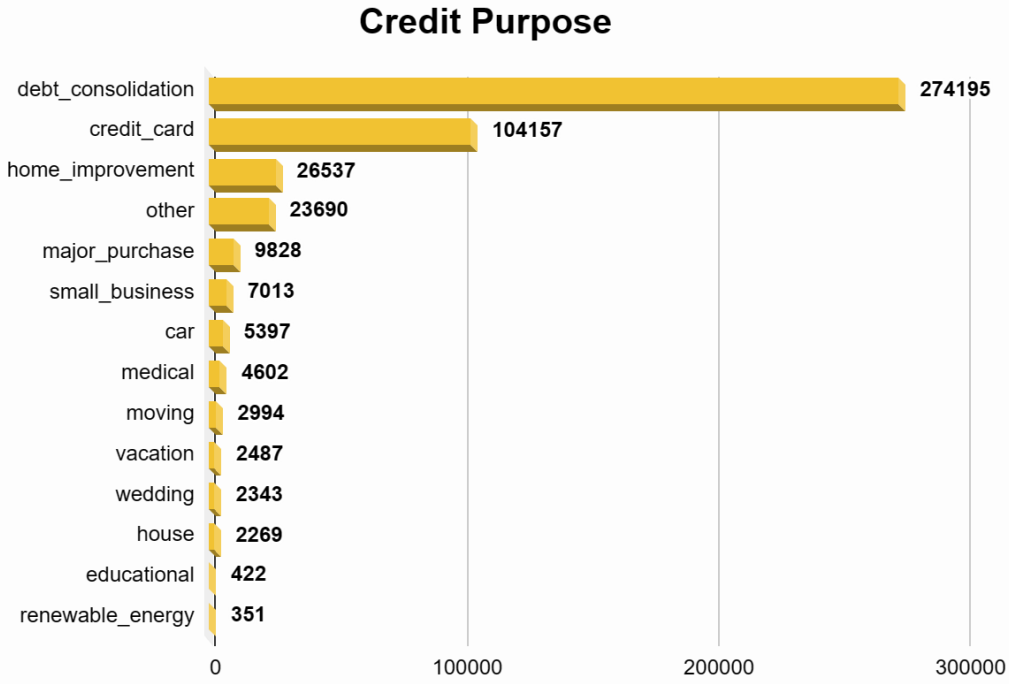
- Registered nurses are also a common occupation among borrowers. This is likely due to the fact that the healthcare industry is growing rapidly, which is creating more job opportunities for nurses.



# Applicant by Credit Purpose

- Debt consolidation is the most common credit purpose. This is likely due to the fact that many people have high-interest credit card debt, and they are looking to consolidate this debt into a single loan with a lower interest rate.

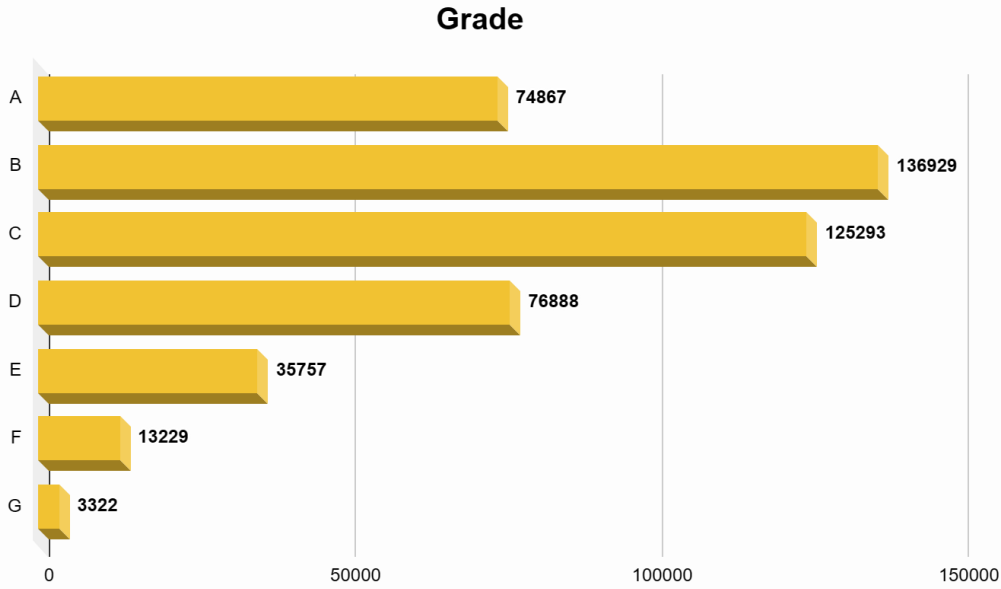
- Credit card debt is the second most common credit purpose. This is likely due to the fact that many people use credit cards for everyday purchases, and they can quickly accumulate debt if they are not careful.



# Applicant by Grade

- The distribution of borrower grades follows a typical bell-shaped curve, with a higher concentration of borrowers in the middle grades (B, C, and D) and fewer borrowers in the extreme grades (A, E, F, and G). This suggests that the majority of borrowers are considered to have moderate credit risk.

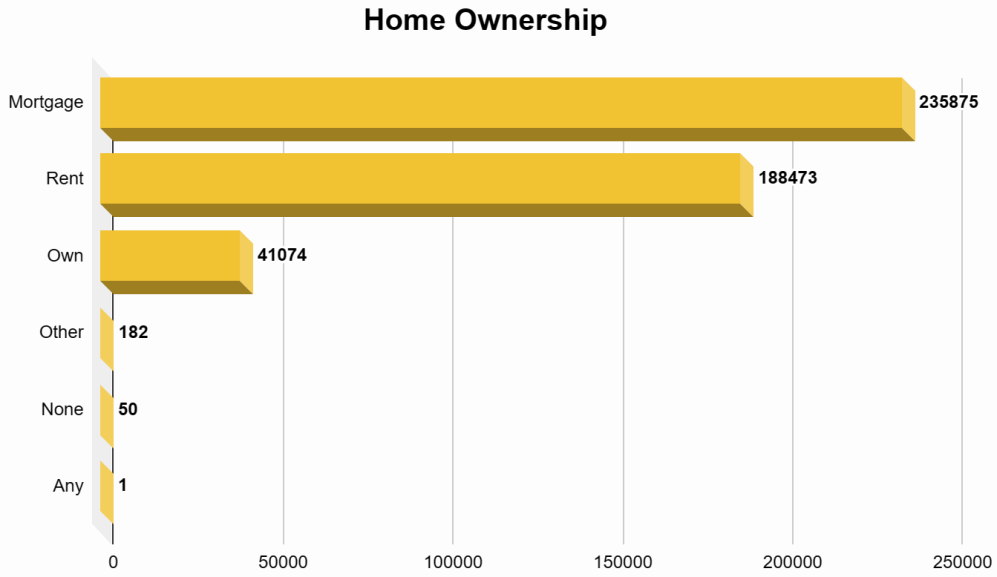
- Grades A and B represent a relatively lower credit risk compared to the other grades. These borrowers typically have a higher creditworthiness and are more likely to have a good repayment history.



# Applicant by Home Ownership

- The largest number of borrowers, 235,875, have a mortgage as their homeownership status. This indicates that a significant portion of borrowers in the dataset are homeowners who have obtained a mortgage to finance their property.

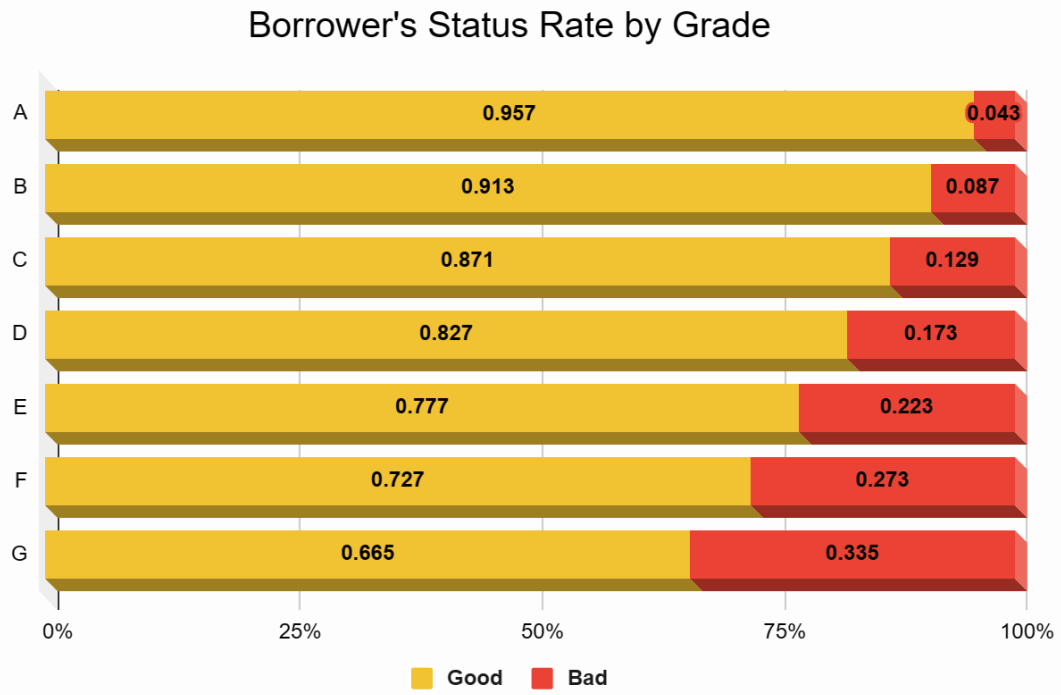
- The second most common homeownership status is "Rent" with 188,473 borrowers. This suggests that a considerable number of borrowers are renting their homes instead of owning them.



# Applicant by Status and Grade

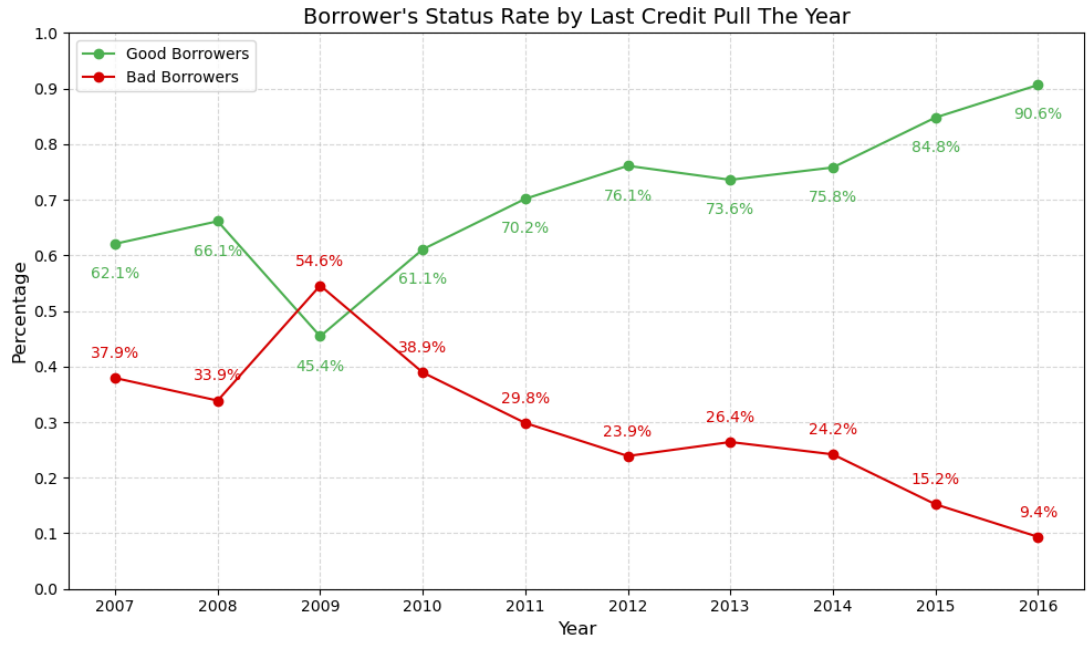
- Borrowers with a grade of A are the least likely to default on their loans. Only 4.3% of borrowers with a grade of A defaulted on their loans, while 95.7% were good borrowers.

- Borrowers with a grade of G are the most likely to default on their loans. 33.5% of borrowers with a grade of G defaulted on their loans, while only 66.5% were good borrowers.



# Applicant by Last Credit Pull

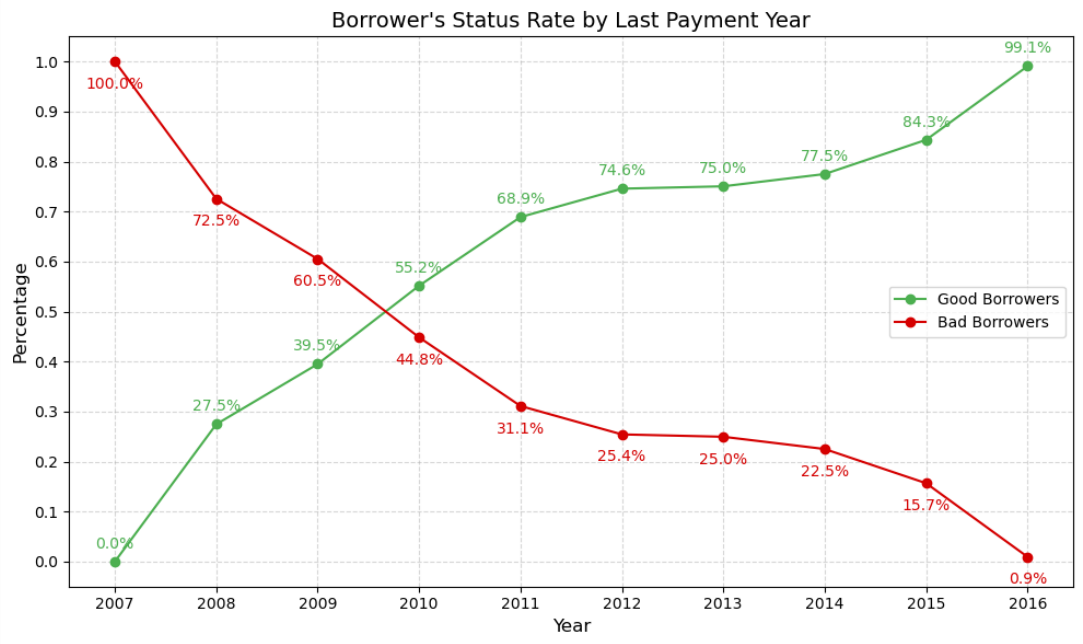
The percentage of good borrowers has generally remained higher than the percentage of bad borrowers across the years from 2007 to 2016. This indicates that, on average, a higher proportion of borrowers have been classified as good borrowers.



# Applicant by Last Credit Pull

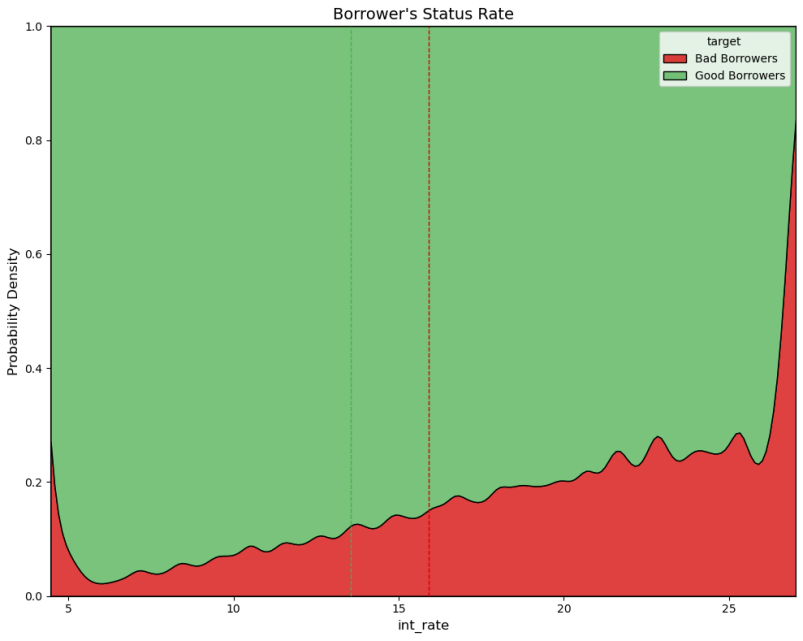
- There is a decreasing trend in the percentage of borrowers experiencing issues (bad borrowers) from 2007 to 2016. This indicates an overall improvement in the quality of borrowers over time.

- The percentage of borrowers who successfully make payments (good borrowers) tends to increase each year. This suggests that the number of borrowers effectively managing their repayment obligations is growing over time.



# Applicant by Interest Rate

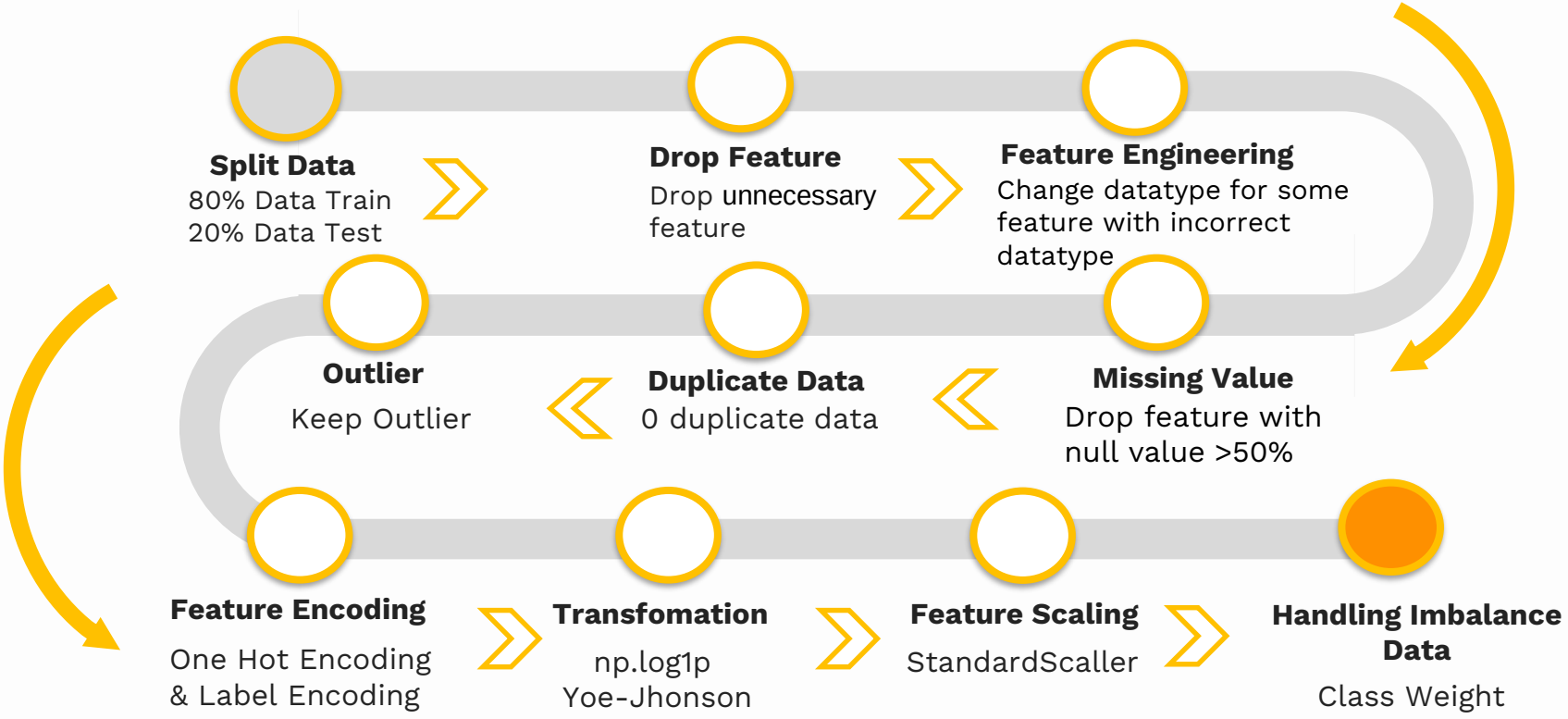
Borrowers with high-interest rates have a higher probability to have a bad loan status than those with a low-interest rate.



# 02

# Data Preparation

# Data Pre-Processing



# 03 Modelling & Evaluation

# Model Evaluation

| Model | Recall | | Precision | | F1 Score | | ROC-AUC | |
|---|---|---|---|---|---|---|---|---|
| | Train | Test | Train | Test | Train | Test | Train | Test |
| Logistic Regression | 0.655 | 0.655 | 0.434 | 0.433 | 0.522 | 0.521 | 0.842 | 0.842 |
| Decision Tree | 1.000 | 0.545 | 1.000 | 0.528 | 1.000 | 0.536 | 1.000 | 0.738 |
| Random Forest | 1.000 | 0.464 | 1.000 | 0.982 | 1.000 | 0.631 | 1.000 | 0.851 |
| XGBClassifier | 0.531 | 0.507 | 0.976 | 0.955 | 0.688 | 0.663 | 0.926 | 0.892 |

The **XGBClassifier** model performs better based on the **ROC-AUC and Precision score**

# Hyperparameter Tuning : Model XGBClassifier

| | Recall | | Precision | | F1 Score | | ROC-AUC | |
|---|---|---|---|---|---|---|---|---|
| | Train | Test | Train | Test | Train | Test | Train | Test |
| **Before Tuning** | 0.531 | 0.507 | 0.976 | 0.955 | 0.688 | 0.663 | 0.926 | 0.892 |
| **After Tuning** | 0.550 | 0.510 | 0.985 | 0.961 | 0.706 | 0.667 | 0.945 | 0.901 |

**The XGBClassifier** model emerges as the best-fit model.

04

# Recommendation

# Business Recommendation

- Use the predictive model for informed credit decisions.
- Adjust interest rates based on default risk probability.
- Address late payments near the end of loan terms.


- Utilize segmented marketing for tailored financing offers.
- Provide financial education and support programs to borrowers to improve their repayment capabilities.
- Implement proactive collections strategies.

# Thanks!

**Do you have any questions?**

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