

LOAN RISK ASSESSMENT

Predict whether the loan be approved or denied?

Final Project Presentation

[by] **/PayRangers.**

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Jennifer Virginia Cahyadi - Muhammad Fathan Muttaqy

Who we are ?

/ **PayRangers.**

- **Data Science Team** dari perusahaan layanan konsultasi *data analytic and decisioning (DAD)*
- Bermitra dengan **Bank** untuk memberikan solusi dalam masalah *loan risk assessment*

Our Team



Alif Naufal Falih



Amelia Nisrinah



Febrianti



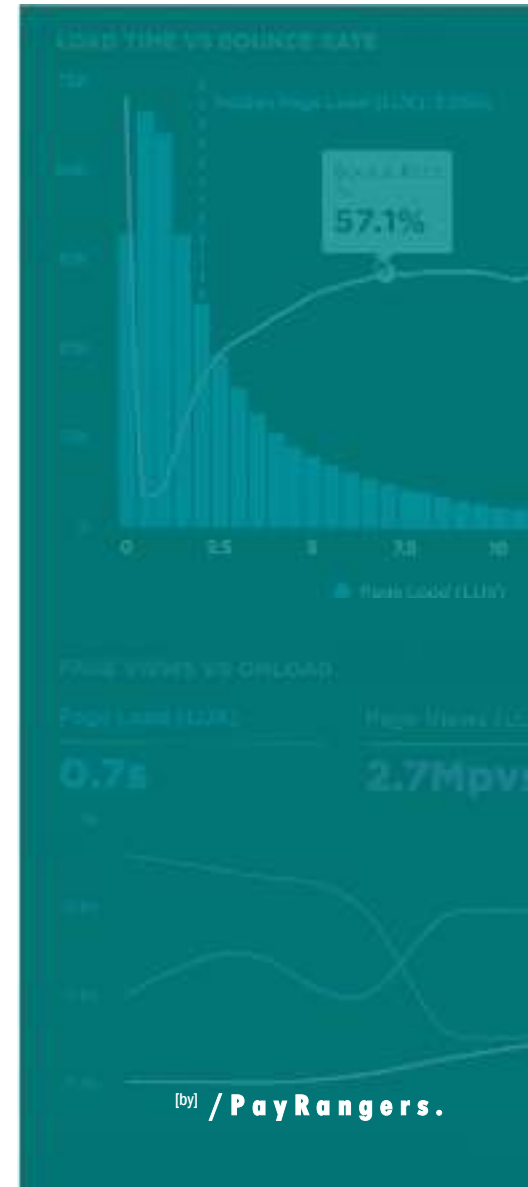
Jennifer Virginia C



M Fathan Muttaqy

Outline

1. Business Understanding
2. What are the **problems** of bank?
3. What are the **goals** that the bank **wants to achieve**?
4. What **we do** to **solve the problem**?
5. Business Recommendation



Business Understanding

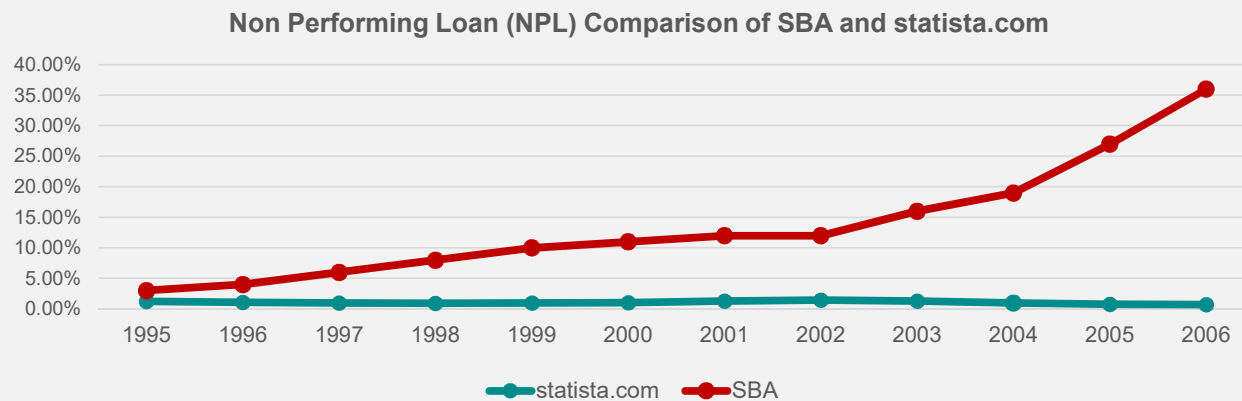


- ***The Small Business Administration (SBA)** provides **partial credit guarantees** for Small Business in U.S*
- *The **Bank as the lender** will determine whether a loan application will be approved or rejected*
- *Since SBA loans only guarantee a portion of the entire loan balance, banks will incur some losses if a small business defaults on its SBA-guaranteed loan.*



Problem & Goals

Problem



Dilihat dari data SBA setiap tahun angka *Non-Performing Loans (NPL)* terus meningkat.
Setiap tahun angkanya lebih buruk dibandingkan nilai rata-rata NPL di U.S.
yang bersumber dari statista.com

*The Federal Financial Institutions
Examination Council (FFIEC) :*

*Portfolios with fewer **than 6%**
Non-Performing Loans
are deemed healthy.*

Source : <https://help.distressedpro.com/>

Data SBA:

CHGOFF 17%

PIF 83%

Other problems (conventional business process) :

- *Manual form submission*
- *Manual review by bank analyst team*
- *Number of successful submissions reviewed*



Our Goals

Meminimalisir resiko gagal bayar (*charge off*)

Target : Angka ***Chargeoff*** kurang dari **6%**

Business Metrics : *Default Rate*

What We Do To Solve The Problem?



Identify The Most Important Factor

Insight form historical data



Making Machine Learning Model

Predict whether the loan be approved or denied



Business Recommendation

*Model impact and result to business
based on data*

01. Identify The Most Important Factor

Dataset Overview

Column: 27

Rows : 899.164

Target : MIS_Status

■ **CHGOFF** (Charged off)

■ **PIF** (Paid in full)

Imbalance Target

| No | Variable Name |
|----|---------------|
| 1 | LoanNr_ChkDgt |
| 2 | Name |
| 3 | City |
| 4 | State |
| 5 | Zip |
| 6 | Bank |
| 7 | BankState |
| 8 | NAICS |
| 9 | ApprovalFY |
| 10 | NewExist |
| 11 | FranchiseCode |
| 12 | UrbanRural |
| 13 | RevLineCr |
| 14 | LowDoc |

| No | Variable Name |
|----|-------------------|
| 15 | MIS_Status |
| 16 | Term |
| 17 | NoEmp |
| 18 | CreateJob |
| 19 | RetainedJob |
| 20 | ApprovalDate |
| 21 | ChgOffDate |
| 22 | DisbursementDate |
| 23 | DisbursementGross |
| 24 | BalanceGross |
| 25 | ChgOffPrinGr |
| 26 | GrAppv |
| 27 | SBA_Appv |

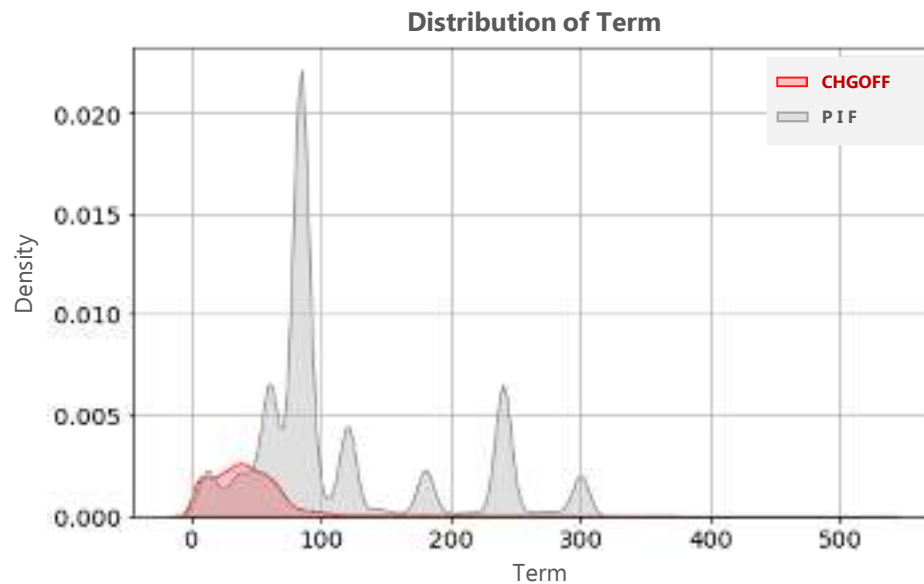


Data Pre-Processing

| | | |
|----|--------------------------|---|
| 1. | Handling Missing Value | <ul style="list-style-type: none">• Drop null value• Handling error values |
| 2. | Encoding | Label Encoding |
| 3. | Engineering | <ul style="list-style-type: none">• Feature Extraction• Feature Selection |
| 4. | Handling Outlier | <ul style="list-style-type: none">• Feature Transformation using BoxCox• Handling outlier using Z-score method |
| 5. | Split Data Set | 80% Train & 20% Test |
| 6. | Scaling | Standardization |
| 7. | Handling Class Imbalance | Over sampling SMOTE |

Data Insight

1. Pengaruh jangka waktu pinjaman (Term)



Semakin lama jangka waktu pinjaman, maka semakin kecil tingkat **Chargeoff**

Why did it happen?

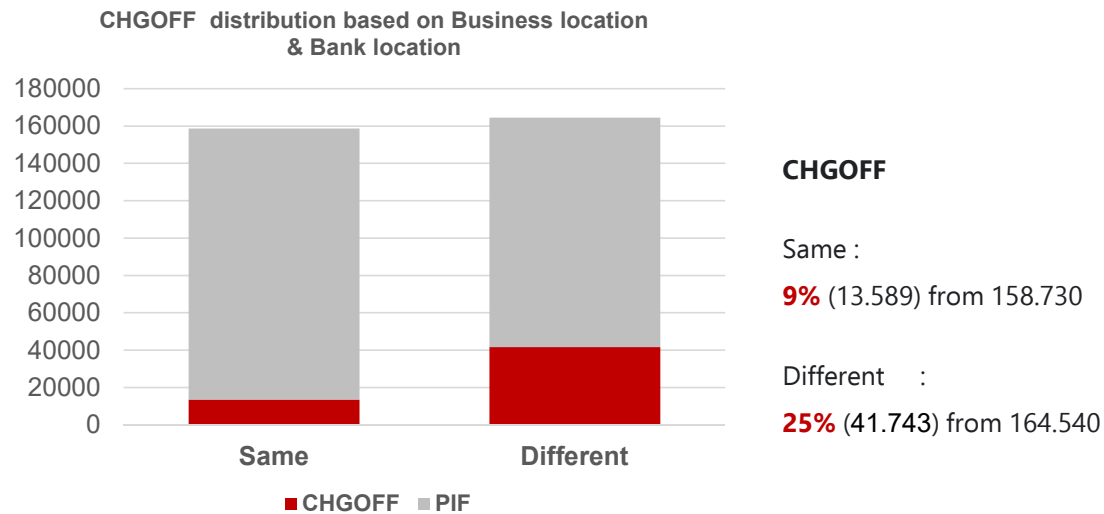
Cicilan perbulan lebih sedikit sehingga meringankan debitur

Recommendation :

Memberikan perpanjangan jangka waktu pinjaman

Data Insight

2. Pengaruh lokasi bisnis dengan lokasi Bank (StateSame)



Lokasi bisnis yang **sama** dengan lokasi Bank, angka **Chargeoff** lebih sedikit dibandingkan lokasi bisnis yang **berbeda** dengan lokasi bank.

Why did it happen?

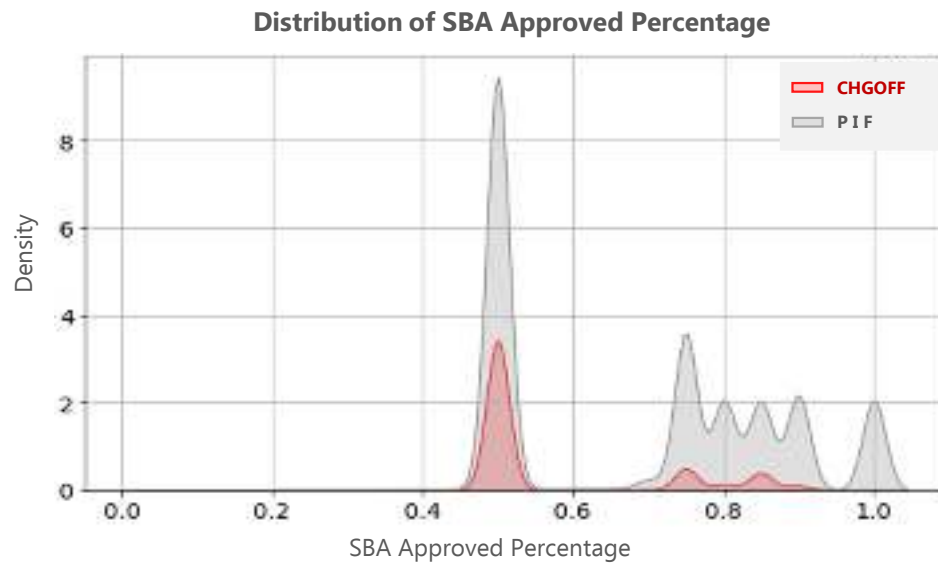
- ✓ Memudahkan Bank memantau bisnis debitur
- ✓ Informasi nasabah mudah diperoleh

Recommendation :

- Merekomendasikan peminjam untuk mengajukan pinjaman pada cabang Bank yang berlokasi sama dengan lokasi bisnis
- *Marketing Campaign* untuk memperluas nasabah dilokasi yang sama

Data Insight

3. Pengaruh presentase jaminan yang diberikan oleh SBA



Program SBA Express (jaminan 50%) memiliki distribusi data pinjaman yang tinggi dengan tingkat *Chargeoff* yang tinggi pula

Source : <https://www.sba.gov/partners/lenders/7a-loan-program/terms-conditions-eligibility>

Why did it happen?

- ✓ Lebih mudah mendapatkan persetujuan
- ✓ Waktu *review* singkat

Recommendation :

- ✓ Menggunakan *Machine Learning model*

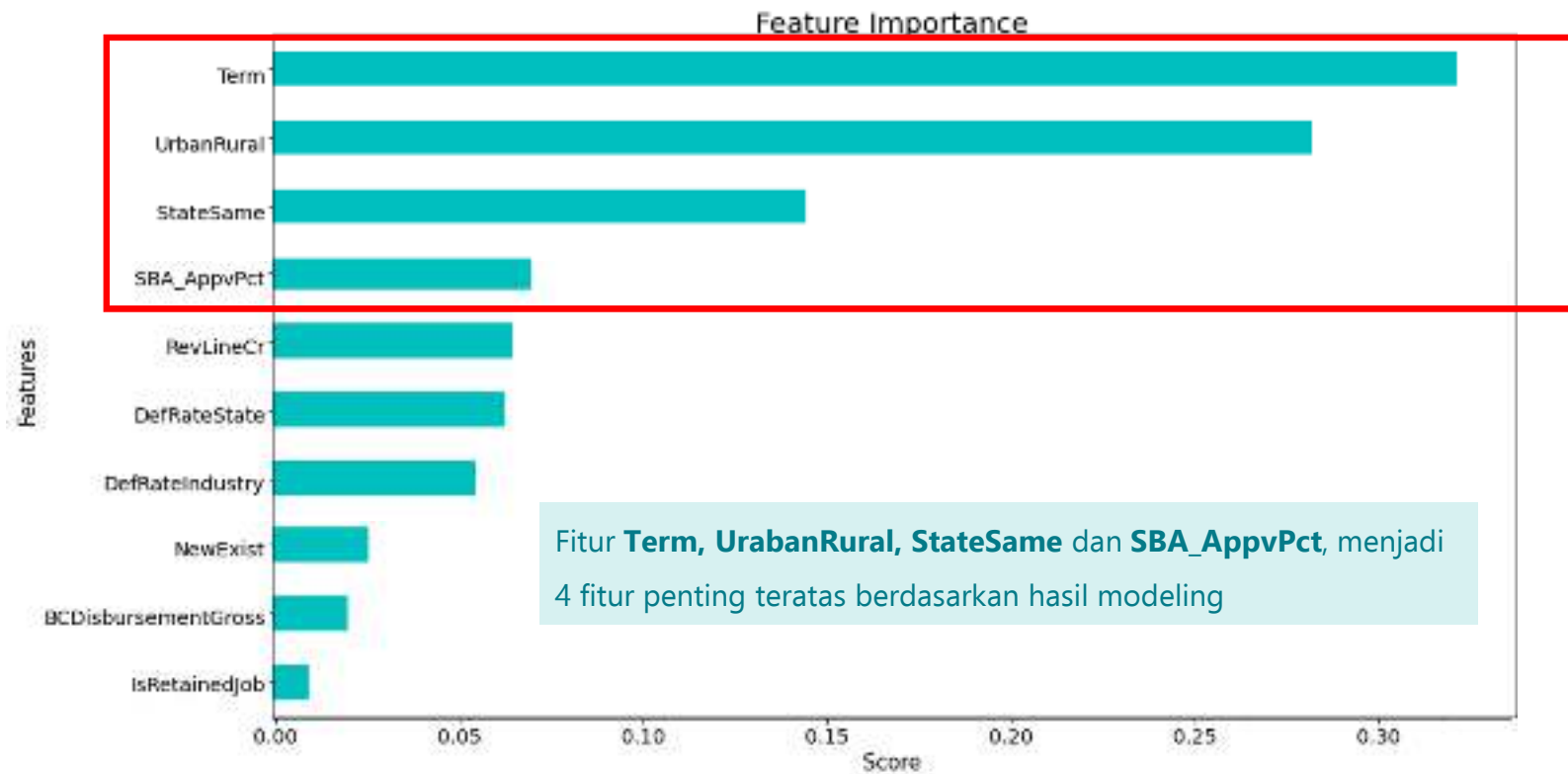
02. Making Machine Learning Model

Model Comparison

| <div>Evaluation Model</div> <div>Algorithm</div> | Accuracy | Precision | Recall | AUC-test | AUC-train | Cross-Validation (AUC) |
|--|----------|-----------|--------|-------------|-------------|------------------------|
| Decision Tree (after tuning) | 0.93 | 0.77 | 0.84 | 0.96 | 0.98 | 92.76 |
| Random Forest Classifier | 0.95 | 0.85 | 0.83 | 0.97 | 1.00 | 96.24 |
| Adaboost Classifier | 0.91 | 0.70 | 0.84 | 0.95 | 0.96 | 95.31 |
| XGBoost Classifier | 0.93 | 0.79 | 0.83 | 0.97 | 0.98 | 96.43 |

- Matrics evaluasi yang digunakan adalah **AUC**
- **XGBoost** algoritma yang **paling baik** dengan *gap antara AUC train dan test yang sangat kecil*, dengan hasil Cross Validation yang paling tinggi dari yang lainnya

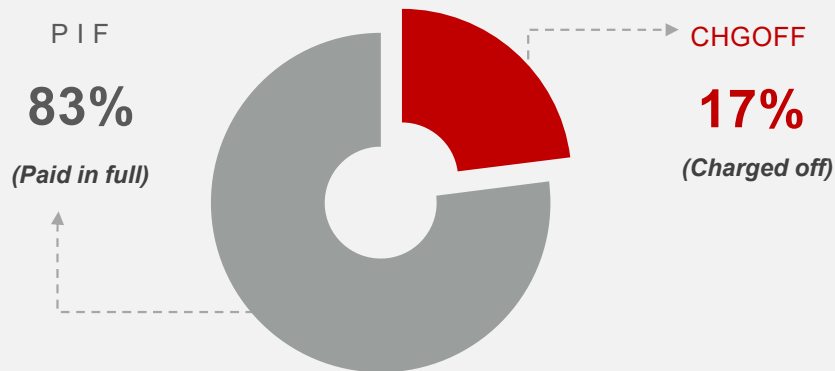
Feature Importance



Impact of Machine Learning Models

BEFORE

Percentage of default loans



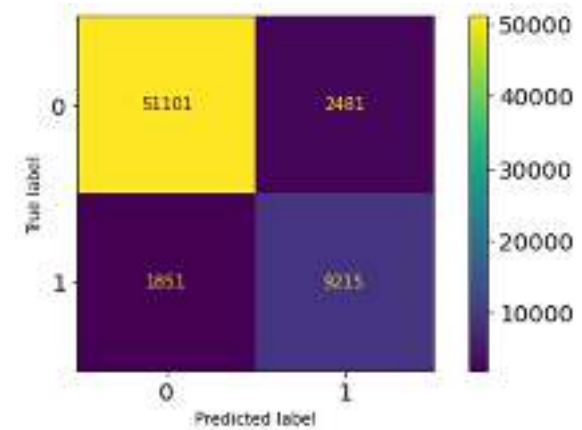
Charge off before using ML Model **17%**
of 64,648 Creditor

*The Federal Financial Institutions
Examination Council (FFIEC) :
Portfolios with fewer **than 6% Non-
Performing Loans** are deemed
healthy.*

Source : <https://help.distressedpro.com/>

AFTER

Model prediction results



Charge off after using ML Model **4.63%**
of 53,582 Lost Creditor 3.45%

The background image is a teal-tinted photograph of a person's hands holding a printed bar chart. The person is also holding a pen. On the desk in front of them are a laptop, a small potted plant, a piggy bank, and some papers. The title 'Business Recommendation' is overlaid in white text.

Business Recommendation

[by] / **PayRangers.**

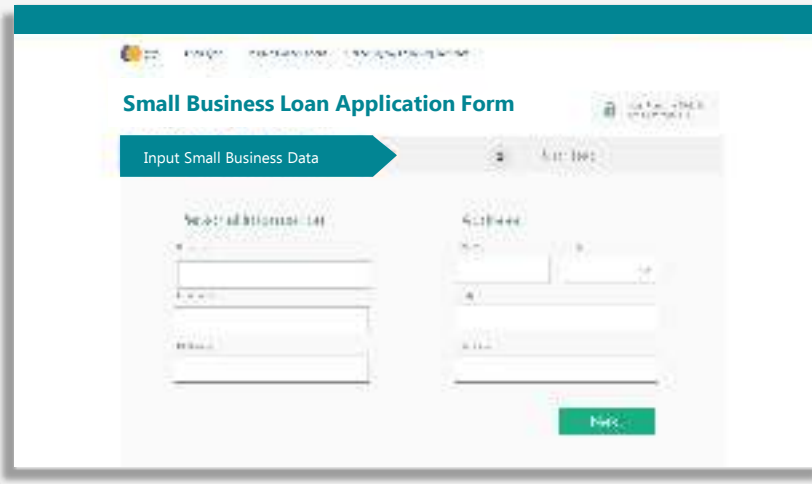
Business Recommendation

Menggunakan *Machine Learning Model* untuk melakukan *review otomatis* terhadap pengajuan pinjaman yang masuk, apakah harus di *approve* atau di *reject* berdasarkan *feature-feature* yang diinput

Before ML Model

A complex, cluttered paper-based Small Business Loan Application Form. It features a dense grid of fields, checkboxes, and text, making it difficult to navigate and process. The form is titled "Small Business Loan Application Form" at the top.

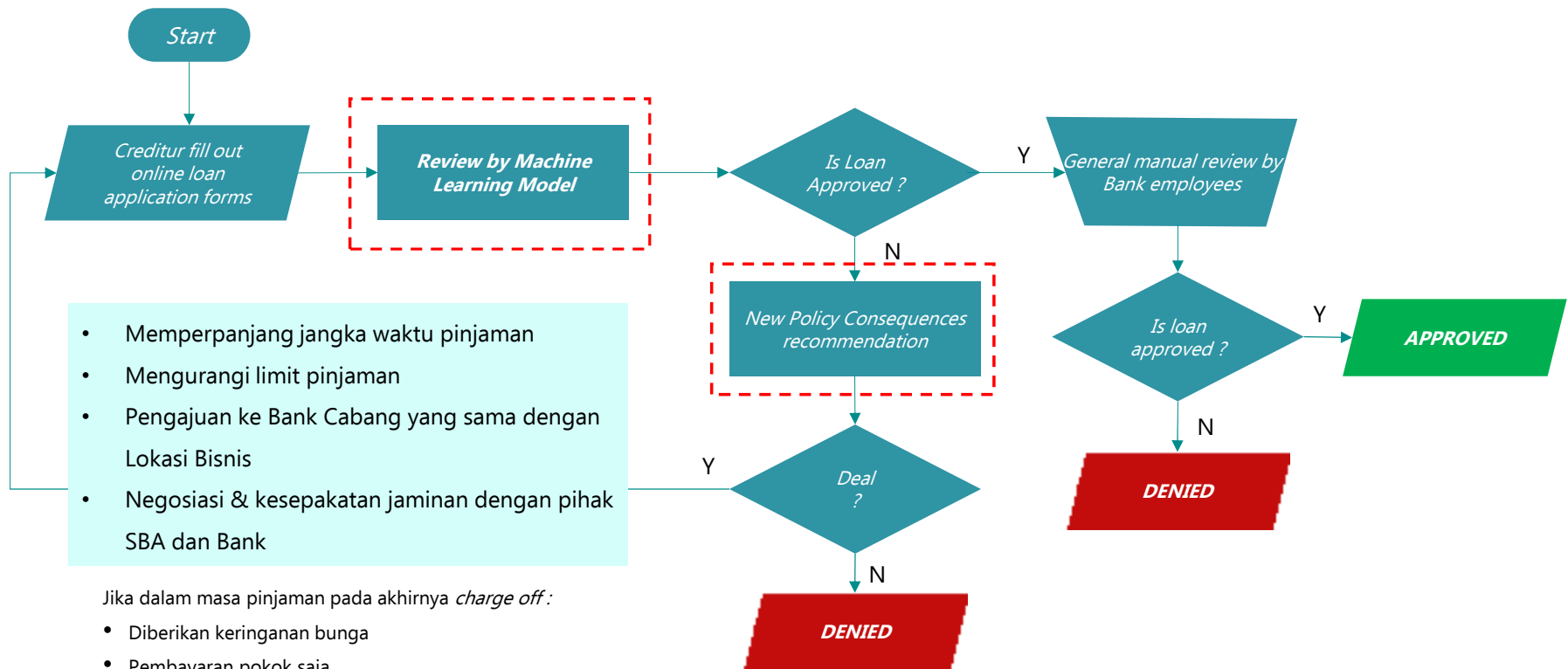
After ML Model

A clean, modern digital Small Business Loan Application Form. It features a clear input section with a "Input Small Business Data" button and a "Next" button. The form is titled "Small Business Loan Application Form" at the top.

- ✓ Meminimalisir angka resiko gagal bayar
- ✓ Mempercepat proses *review*
- ✓ Meminimalisir *human error*
- ✓ *Reduce cost*
- ✓ Kemudahan proses pengajuan pinjaman oleh debitur

Business Recommendation

Predict whether the loan be approved or denied by Model :





Thank You

[by] **/PayRangers.**