




LoanEvaluator.net

dn-ds

# What is LoanEvaluator?

A web app that predicts the probability that a given LendingClub loan will be charged-off.

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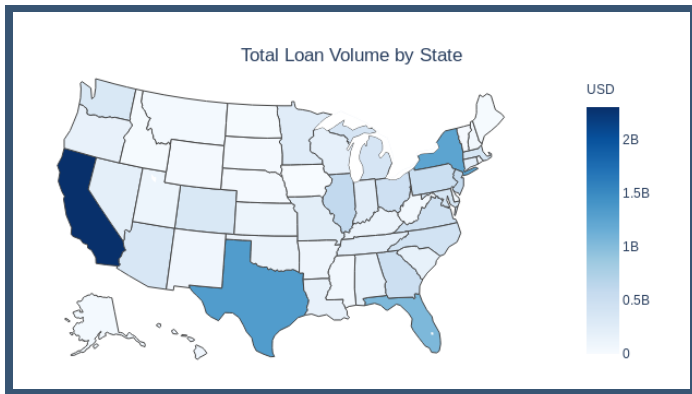
Predict the probability of charge-off of a loan from the LendingClub loan listing:

Loan Amount \$1000 to \$40000	Annual Income	Credit Utilization %
Term*	Income Verification	# Credit Lines
Interest Rate*	Employment Length	# Open Credit Lines
Monthly Installment	Home Ownership	# Mortgage Accounts
Purpose	Debt Payment to Income %*	# Derogatory Records
Subgrade*	Fico Score*	# Bankruptcies
Application Type	Earliest Credit Account e.g., Sep-2020	# Tax Liens
Initial List Status	Credit Balance	State Code e.g., IL

Make Prediction

# What is LendingClub?

A peer-to-peer lending company that directly matches borrowers and investors through an online platform. LendingClub claims to have issued loans totaling approximately \$60 billion, as of June 2020.



# The Dataset

- Downloaded from [kaggle/wordsforthewise](#)
- Size 2.5 GB
- 2.2 million rows
- 151 features
- Target variable: loan status ('Fully Paid', 'Charged-off')

**Goal: Given loan details, predict the probability of charge-off.**

# Project Outline

Exploring and Cleaning the Data



Examining Relationships Between Features and the Target



Feature Engineering



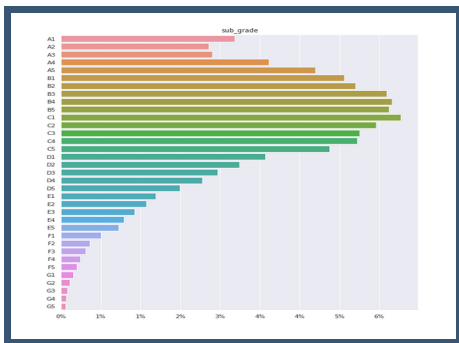
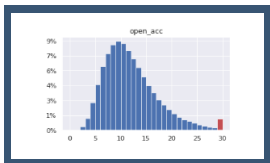
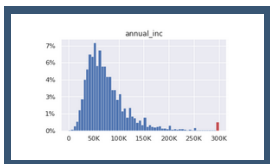
Training Machine Learning Models



Web App

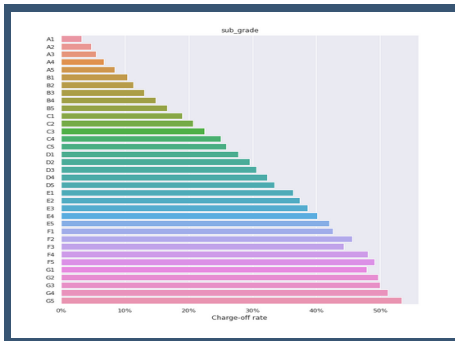
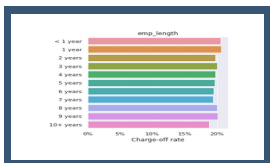
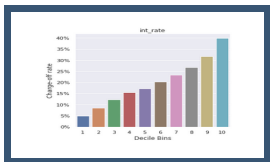
# Exploring and Cleaning the Data

- Features that are unavailable to the potential investor at the time of investment are identified and dropped.
- Features that are missing more than 30% of the values are dropped.
- Numerical and categorical features are identified and studied.
- Distribution of each feature is studied.
- A test set is put aside.



# Examining Relationships Between Features and the Target

- The potential usefulness of each numerical feature is determined by calculating charge-off rates for binned data, and by considering the Pearson and the Spearman correlation coefficients.
- The charge-off rate for each category of categorical features is determined. The gathered data helped determine the appropriate encoding (ordinal or one-hot) for the features.



# Feature Engineering

- New features are engineered. Some perform better than some existing features.
- The most important features are determined and ranked:

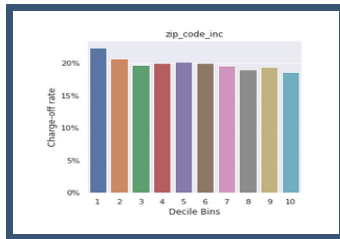
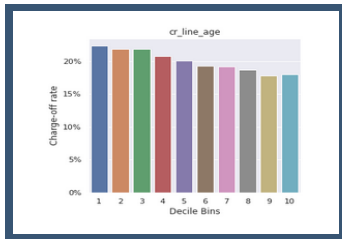
**Sub grade**

**Interest rate**

**Term**

**Borrower's FICO score**

**Borrower's debt payment-to-income ratio.**





# Training Machine Learning Models

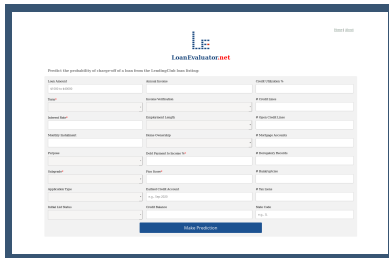
- The dataset is imbalanced: 80-20% split.
- Evaluation metrics used: **Precision-Recall AUC, ROC AUC.**
- A pipeline is created to perform the tasks of imputation, scaling, encoding categorical features, and feature engineering.
- Four models are considered:
  - Logistic Regression**
  - Random Forest**
  - Linear Discriminant Analysis**
  - K-Nearest Neighbors.**
- Overfitting is estimated using cross-validation.

# Training Machine Learning Models (continued)

- Models are ranked by cross-validation score.
- Top models are selected, and their hyperparameter are tuned using a grid search.
- Final model: **Logistic Regression, with L2 regularization**.  
Test set ROC AUC score: **0.71**.
- The Regression model has the added advantage that it is naturally well-calibrated in terms of output probabilities.
- Training was done on an AWS EC2 c5.9xlarge instance.

# Web App

- When loan details are submitted, the information is preprocessed using jQuery and PHP, and then passed onto the machine learning model.
- The model processes the data and returns a prediction.
- The machine learning model is deployed on an AWS EC2 t2.micro instance using the Flask framework.



The screenshot shows the LoanEvaluator.net web application. At the top, there is a logo and the text "LoanEvaluator.net". Below this, a heading reads "Predict the probability of charge-off of a loan from the Loan/Eval Data Set". The form is organized into three columns of input fields. The first column includes fields for "Loan Amount", "Loan Term", "Interest Rate", "Monthly Payment", "Down Payment", "Loan-to-Value Ratio", "Debt-to-Income Ratio", "Credit Score", and "Loan Status". The second column includes fields for "Borrower Information", "Employment Length", "House Ownership", "Debt-to-Income Ratio", "Loan-to-Value Ratio", "Debt-to-Income Ratio", "Loan-to-Value Ratio", "Debt-to-Income Ratio", and "Loan Status". The third column includes fields for "Loan Amount", "Loan Term", "Interest Rate", "Monthly Payment", "Down Payment", "Loan-to-Value Ratio", "Debt-to-Income Ratio", "Loan-to-Value Ratio", "Debt-to-Income Ratio", and "Loan Status". At the bottom of the form is a blue button labeled "Make Prediction".



# Main Tools and Packages Used

