LoanEvaluator.net

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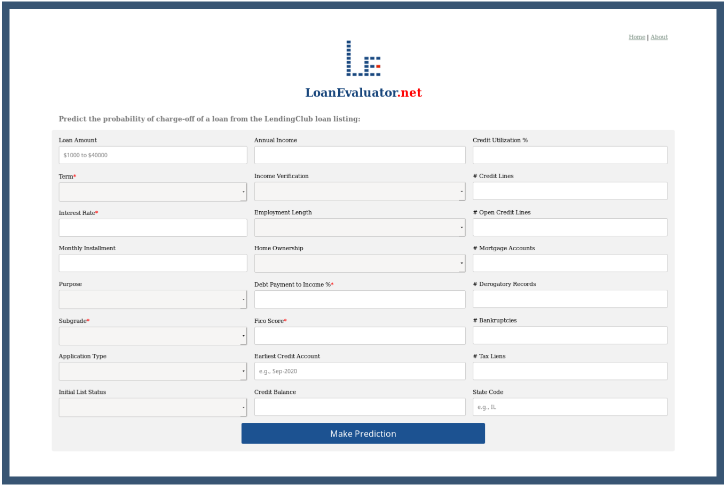
What is LoanEvaluator?

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



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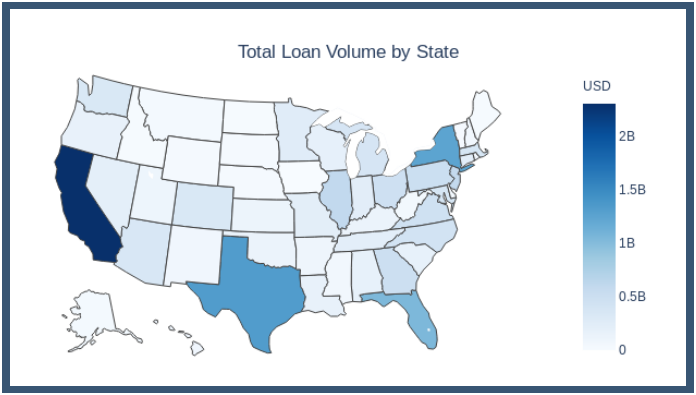
Predict the probability of charge-off of a loan from the LendingClub loan listing:

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

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.

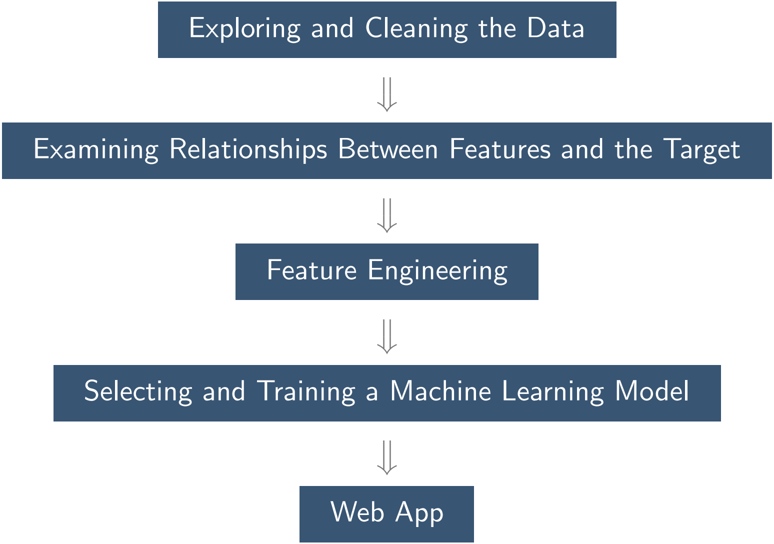


The Dataset

- 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

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Examining Relationships Between Features and the Target

⇓

Feature Engineering

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Selecting and Training a Machine Learning Model

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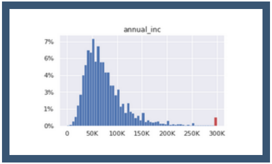
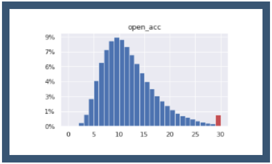
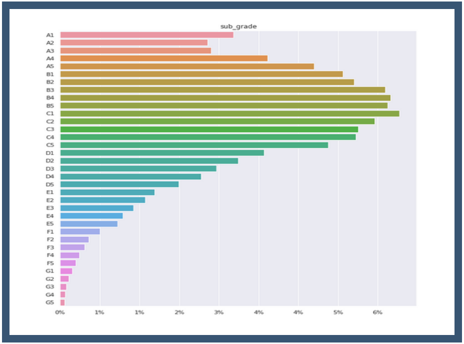
Web App

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.

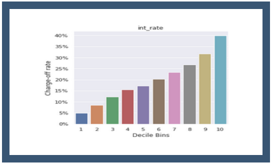


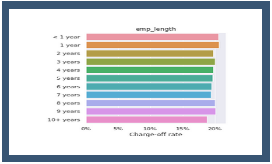


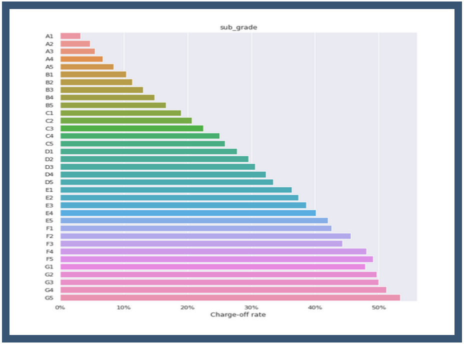


Examining Relationships Between Features and the Target

- 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.



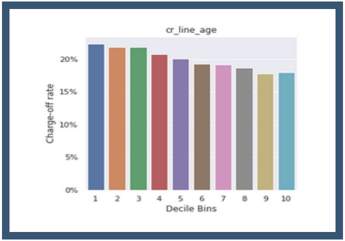


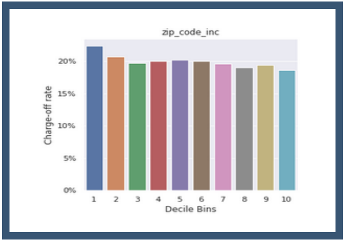


Feature Engineering

- 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.





Selecting and Training a Machine Learning Model

- 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:

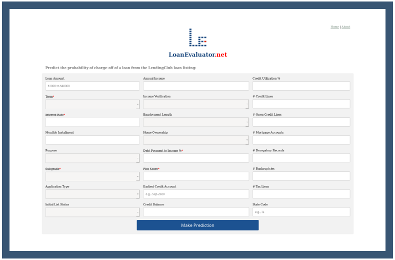
  Logistic Regression
  Random Forest
  Linear Discriminant Analysis
  K-Nearest Neighbors.
- Overfitting is estimated using cross-validation.

Selecting and Training a Machine Learning Model (contd.)

- 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.



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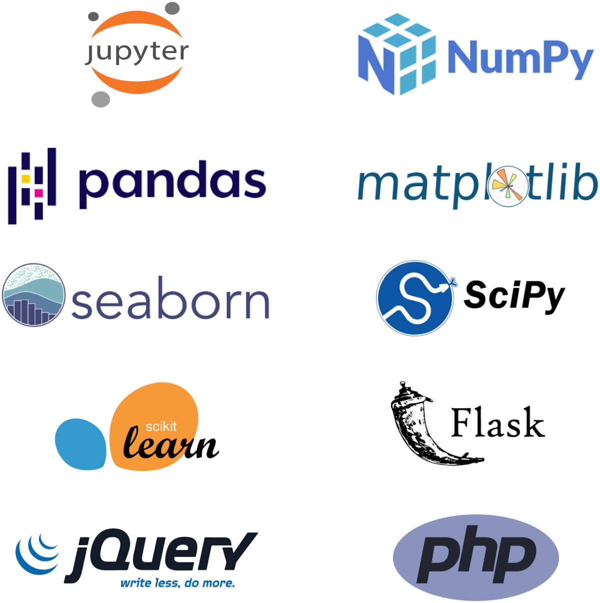
Main Tools and Packages Used


jupyter
NumPy
pandas
matplotlib
seaborn
SciPy
scikit
learn
Flask
jQuery
write less, do more.
php