

# Optimize LendingClub's Profit by Predicting Borrower's Repayment Capability

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# LendingClub Overview

01

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LendingClub (LC) is a United States peer-to-peer (p2p) lending company, headquartered in San Francisco, California. LC is the world's largest p2p lending platform. Over the last 10 years, they've helped millions of people take control of their debt, grow their small businesses, and invest for the future.

## No. 01 ————— LendingClub Overview

The screenshot shows the LendingClub manual investing interface. At the top, there are navigation links: Summary, Holdings, Activity, **Invest**, Transfer, and a user profile for Joseph. Below the header, a breadcrumb navigation shows Investment Strategy, Manual Investing, and Trading Account. The main title is "Manual Investing for [REDACTED]". On the left, there's a sidebar with "Available: \$150.51", a "Build a Portfolio" section (Per Loan: \$25), and two filter sections: "Filter Loans" (Max Loan Amount Up to 40000) and "Monthly Income" (0 to >20000). The main content area displays a table of 202 loans, with 15 shown per page. The columns include: Investment (checkbox), Rate (e.g., D 4, 20.39%), Term (e.g., 36), FICO® (e.g., 685-689), Amount (\$5,000), Purpose (e.g., Other), % Funded (e.g., 99%), and Amount / Time Left (\$25, 29 days). Each loan row has a blue "Add to Order" button.

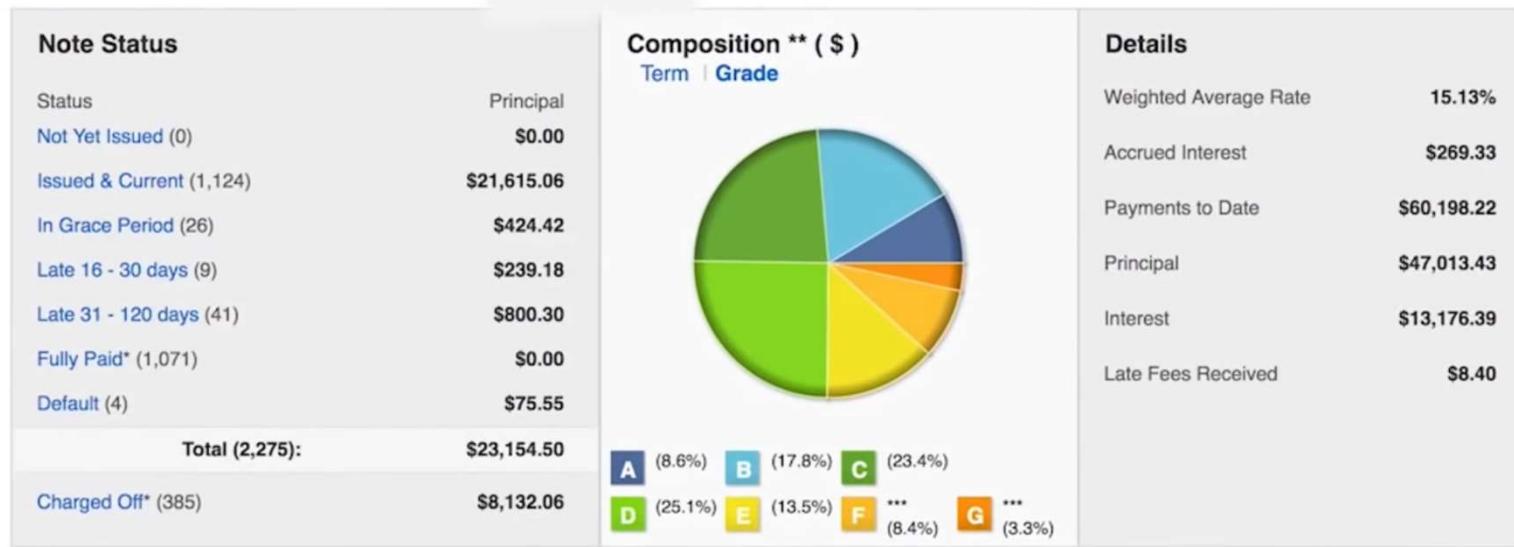
Investment	Rate	Term	FICO®	Amount	Purpose	% Funded	Amount / Time Left	
<input type="checkbox"/>	\$0	D 4	36	685-689	\$5,000	Other	99%	\$25 29 days
<input type="checkbox"/>	\$0	A 4	60	780-784	\$40,000	Home Improvement	98%	\$800 25 days
<input type="checkbox"/>	\$0	B 1	36	670-674	\$10,000	Loan Refinancing & Consolidation	74%	\$2,525 21 days
<input type="checkbox"/>	\$0	B 2	36	665-669	\$5,400	Credit Card Payoff	79%	\$1,100 28 days
<input type="checkbox"/>	\$0	A 3	36	740-744	\$5,500	Credit Card Payoff	65%	\$2,025 28 days

Investors made money from the interest on these loans. LC made money by charging borrowers an origination fee and investors a service fee.

No. 01 ————— LendingClub Overview

## Details for 5506713

### Tradeable Notes ▶



# Table of Content

02

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Investors were able to search and browse the loan listings on LC website and select loans that they wanted to invest in based on the information supplied about the borrower, amount of loan, loan grade, and loan purpose.

**No. 02** ————— **Table of Content**

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# Problems

03

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If the borrower can't pay the loan, investors won't get interests. If the investors don't get interests, LendingClub (LC) can't charged the service fee to investors. Means LC don't get their money and might costs a debt collection agencies.

//www.4thway.co.uk/guides/seven-key-peer-peer-lending-risks/

### P2P lending risk 3: losing money due to bad debts (credit risk)

Now we're halfway through the list and we've got to the most "commonplace" reason for losing money on some loans: when your borrowers aren't good enough and can't pay all your money back. This is called "credit risk".

### P2P lending risk 7: losses because you can't sell early (liquidity risk)

The ability to sell your loans early – before your borrowers repay them naturally – is not a God-given right.

Peer-to-peer lending returns are stable because most lenders hold onto loans until they're repaid. If lending became like the stock market, where people dip in and out all the time, it would start leading to similarly wild price swings. In lending, that means swings in interest earned or returns made.

## What tools does LendingClub have to deal with delinquent borrowers?

Delinquencies are a natural component of investing in Notes. When borrowers are delinquent, LendingClub makes significant efforts to contact the delinquent borrowers, collect outstanding payments, and bring the loans back to current status. LendingClub has a robust internal servicing team and works with several external collection agencies on a regular basis. We use a statistical risk model to identify which loans to outsource to external collection agencies with the goal of maximizing the returns to our investors. These third party agencies have extensive experience and sophisticated tools to track borrowers who have changed locations.

Once loans become delinquent, we attempt to contact borrowers via email, phone, and letter to collect any past due payments. We often review recent credit reports to understand the current credit status of the delinquent borrowers. Depending on the circumstances, we may work with the borrowers to arrange for payment to be made immediately, structure a new payment plan, or take other appropriate action, all in an attempt to prevent the loan status from deteriorating further. For

# 01

## Characteristics?

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What are the characteristics of the borrowers who stop repaying the loan?

# 02

## How to Optimize Profit?

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How to optimize LendingClub's profit since LendingClub made money by charging borrowers and investors a fee?

# Goals

04

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Investors made money from the interest on these loans. LC made money by charging borrowers an origination fee and investors a service fee.

01

## Find Out the Main Characteristics

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Find out the main characteristics what make borrowers to stop repaying the loan.

02

## Ensure LendingClub's Profit

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Using Machine Learning Model to ensure LendingClub's profit especially for investor so we can certainly charge a service fee to them.

# Project Limitation

05

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In this project, we will focus on the range of loan amount between \$ 25 until \$ 10,000. Because, borrowers who have loan amount above \$10,000 has many consideration to be picked. Right?

The other reason that this limitation exists is to minimize unwanted errors of Machine Learning later. So, the rest of loan amount will be handled by LC's professionals.

# Dataset

06

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LendingClub dataset consists of 27 columns and 16,4337 rows.

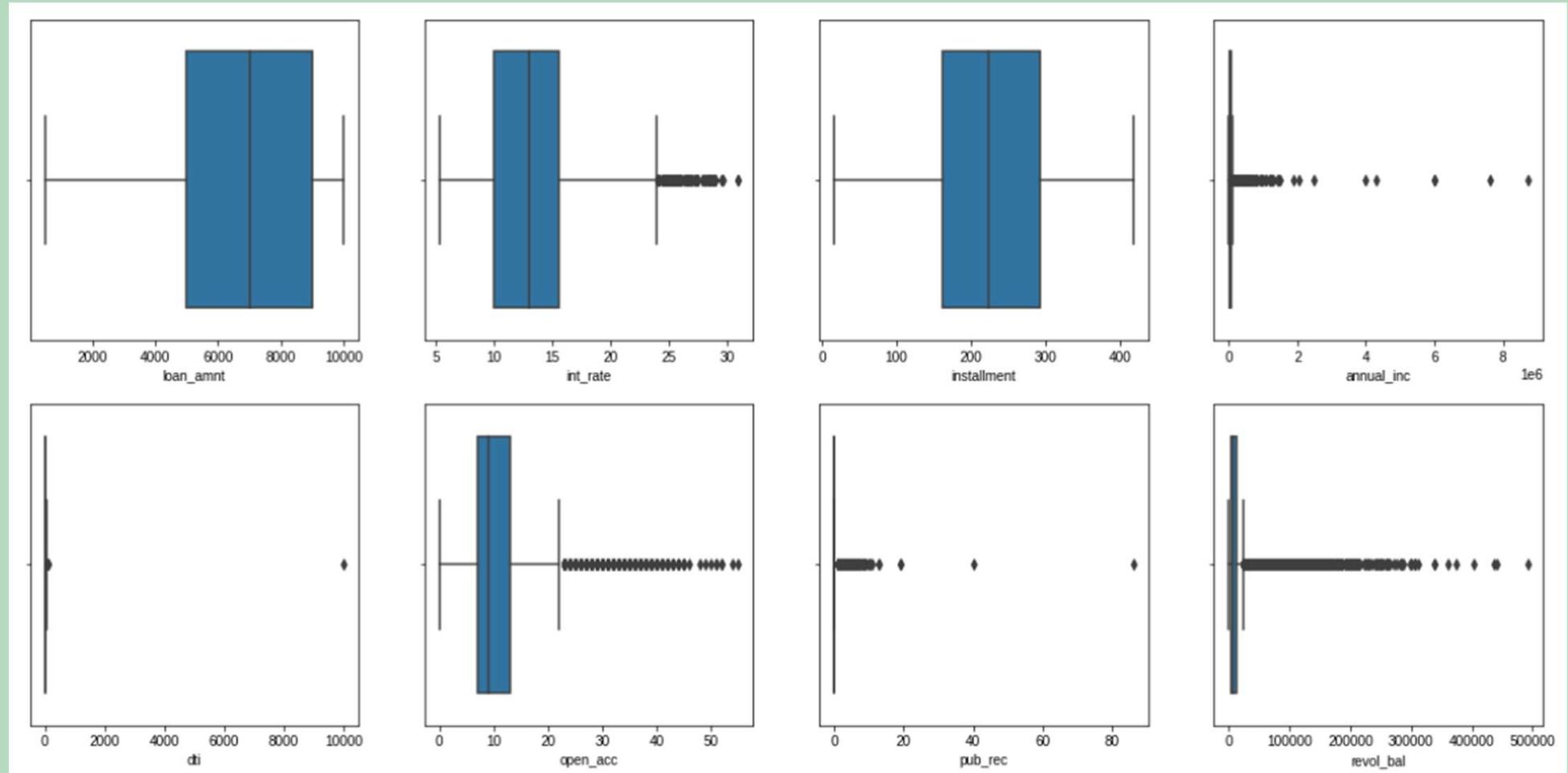
No. 06 ————— Dataset

	loan_amnt	term	int_rate	installment	grade	sub_grade	emp_title	emp_length	home_ownership	annual_inc	verification_status	issue_d	loan_stat
0	10000.0	36 months	11.44	329.48	B	B4	Marketing	10+ years	RENT	117000.0	Not Verified	Jan-2015	Fully Paid
1	8000.0	36 months	11.99	265.68	B	B5	Credit analyst	4 years	MORTGAGE	65000.0	Not Verified	Jan-2015	Fully Paid
3	7200.0	36 months	6.49	220.65	A	A2	Client Advocate	6 years	RENT	54000.0	Not Verified	Nov-2014	Fully Paid *
10	10000.0	36 months	13.11	337.47	B	B4	Sodexo	2 years	RENT	95000.0	Verified	Jun-2013	Fully Paid
12	7500.0	36 months	9.17	239.10	B	B2	Social Work/Care Manager	7 years	OWN	55000.0	Not Verified	Dec-2015	Fully Paid

No. 06 ————— Dataset

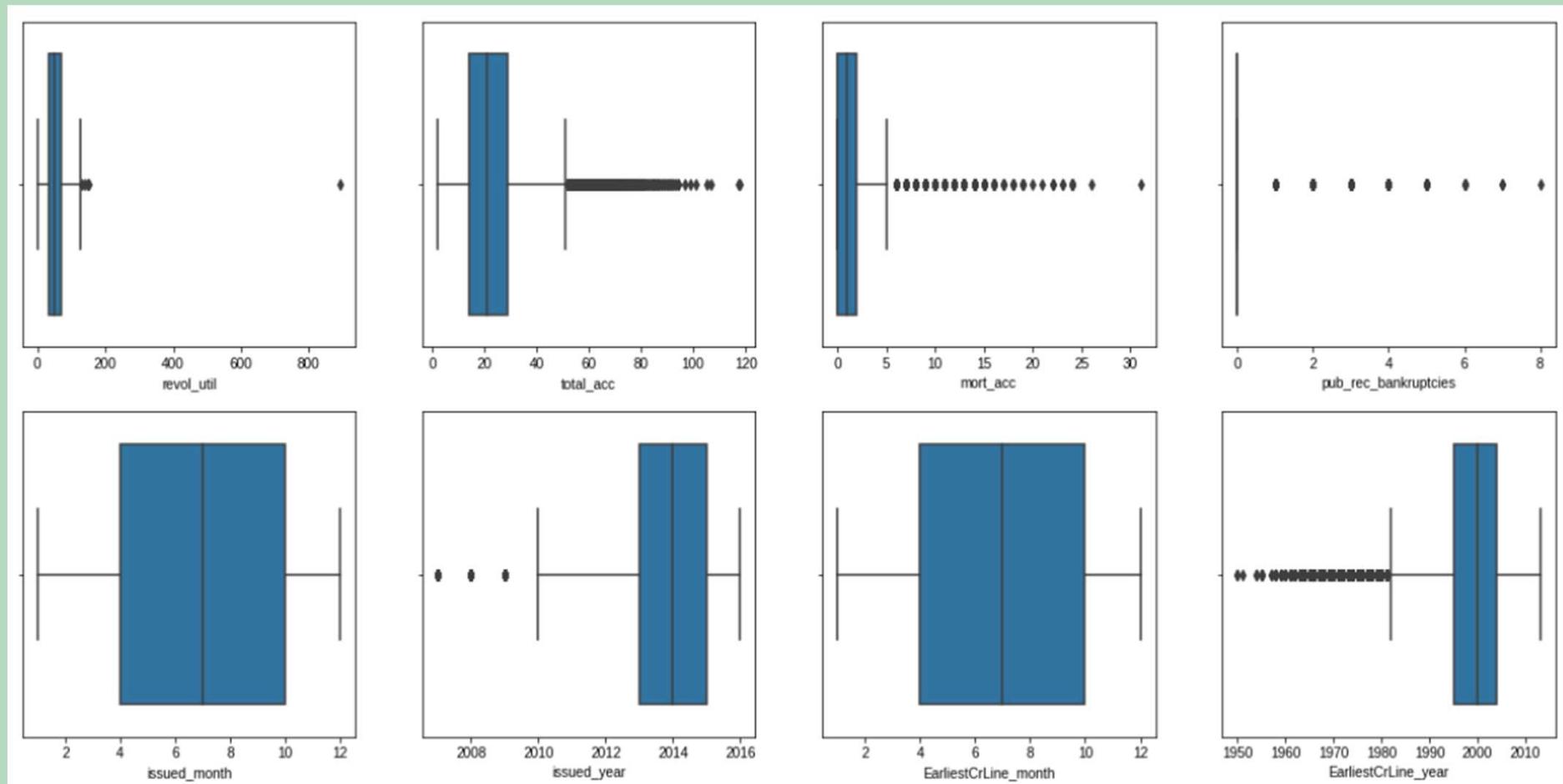
	Column	Dtype	Null	Null (%)	nUnique	Unique	Description
0	loan_amnt	float64	0	0.00	368	[10000.0, 8000.0, 7200.0, 7500.0, 9200.0, 7350...]	The listed amount of the loan applied for by t...
1	term	object	0	0.00	2	[ 36 months, 60 months]	The number of payments on the loan. Values are...
2	int_rate	float64	0	0.00	524	[11.44, 11.99, 6.49, 13.11, 9.17, 6.62, 6.99, ...]	Interest Rate on the loan
3	installment	float64	0	0.00	19765	[329.48, 265.68, 220.65, 337.47, 239.1, 282.48...]	The monthly payment owed by the borrower if th...
4	grade	object	0	0.00	7	[B, A, D, C, E, F, G]	LC assigned loan grade
5	sub_grade	object	0	0.00	35	[B4, B5, A2, B2, A3, D1, C2, C1, A1, C5, B3, D...	LC assigned loan subgrade
6	emp_title	object	12495	7.60	83379	[Marketing, Credit analyst , Client Advocate, ...]	The job title supplied by the Borrower when ap...
7	emp_length	object	10586	6.44	11	[10+ years, 4 years, 6 years, 2 years, 7 years...]	Employment length in years. Possible values ar...
8	home_ownership	object	0	0.00	6	[RENT, MORTGAGE, OWN, OTHER, NONE, ANY]	The home ownership status provided by the borr...
9	annual_inc	float64	0	0.00	13588	[117000.0, 65000.0, 54000.0, 95000.0, 55000.0,...]	The self-reported annual income provided by th...
10	verification_status	object	0	0.00	3	[Not Verified, Verified, Source Verified]	Indicates if income was verified by LC, not ve...
11	issue_d	object	0	0.00	115	[Jan-2015, Nov-2014, Jun-2013, Dec-2015, Apr-2...	The month which the loan was funded
12	loan_status	object	0	0.00	2	[Fully Paid, Charged Off]	Current status of the loan
13	purpose	object	0	0.00	14	[vacation, debt_consolidation, credit_card, ot...	A category provided by the borrower for the lo...
14	title	object	678	0.41	26652	[Vacation, Debt consolidation, Credit card ref...	The loan title provided by the borrower
15	dti	float64	0	0.00	4125	[26.24, 22.05, 2.6, 12.04, 28.21, 10.81, 7.47,...]	A ratio calculated using the borrower's total ...
16	earliest_cr_line	object	0	0.00	639	[Jun-1990, Jul-2004, Sep-2006, Dec-1990, Apr-1...	The month the borrower's earliest reported cre...
17	open_acc	float64	0	0.00	54	[16.0, 17.0, 6.0, 5.0, 13.0, 12.0, 10.0, 9.0, ...]	The number of open credit lines in the borrowe...
18	pub_rec	float64	0	0.00	16	[0.0, 1.0, 2.0, 3.0, 4.0, 8.0, 5.0, 6.0, 10.0,...]	Number of derogatory public records
19	revol_bal	float64	0	0.00	32194	[36369.0, 20131.0, 5472.0, 4702.0, 17838.0, 64...	Total credit revolving balance
20	revol_util	float64	170	0.10	1141	[41.8, 53.3, 21.5, 64.4, 54.9, 22.9, 37.2, 0.0...	Revolving line utilization rate, or the amount...
21	total_acc	float64	0	0.00	100	[25.0, 27.0, 13.0, 26.0, 35.0, 23.0, 36.0, 7.0...	The total number of credit lines currently in ...
22	initial_list_status	object	0	0.00	2	[w, f]	The initial listing status of the loan. Possib...
23	application_type	object	0	0.00	3	[INDIVIDUAL, JOINT, DIRECT_PAY]	Indicates whether the loan is an individual ap...
24	mort_acc	float64	20887	12.71	27	[0.0, 3.0, 4.0, 6.0, nan, 5.0, 2.0, 1.0, 7.0, ...]	Number of mortgage accounts.
25	pub_rec_bankruptcies	float64	349	0.21	9	[0.0, 1.0, nan, 2.0, 3.0, 5.0, 4.0, 6.0, 7.0, ...]	Number of public record bankruptcies
26	address	object	0	0.00	163893	[0174 Michelle Gateway\nMendozaberg, OK 22690,...]	The state provided by the borrower in the loan...

No. 06 ————— Dataset



P —— 05

No. 06 ————— Dataset



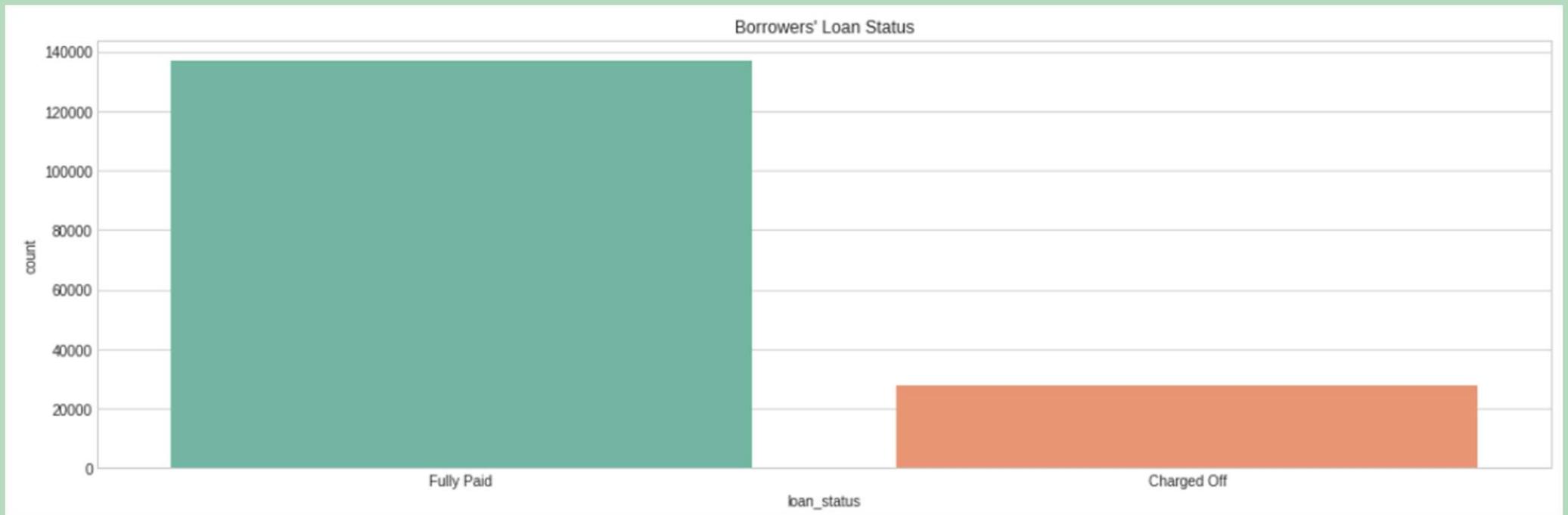
# Exploratory Data Analysis

07

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Firstly, this dataset is from [Pierian Data](#) which contains loan amount, loan term, interest rate, installment, grade, home ownership, purpose of the loan, loan\_status, and many more. Basically, this dataset is available from [their site](#) which anyone can scrape from there.

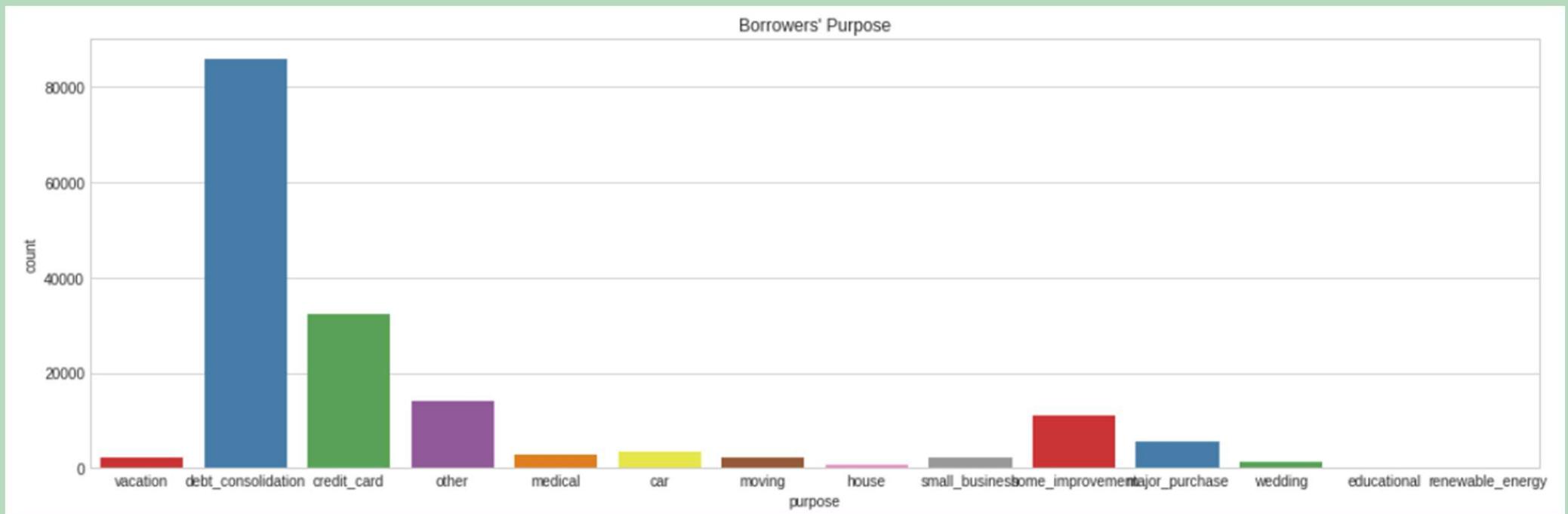
No. 07 ————— Exploratory Data Analysis



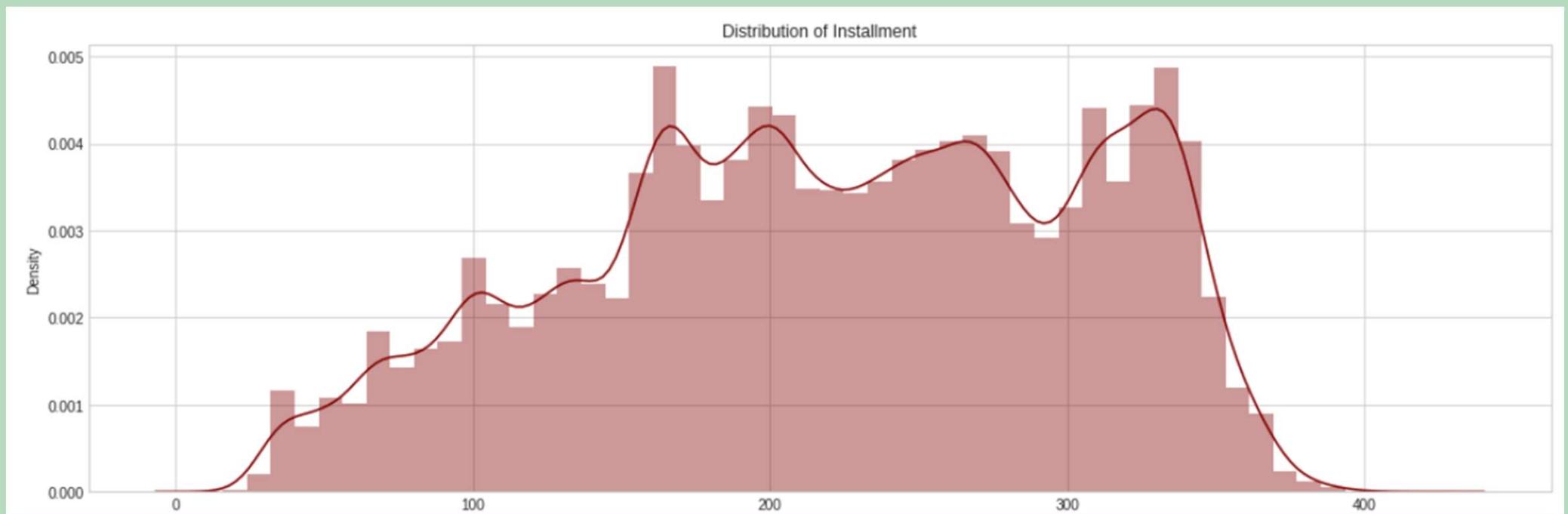
No. 07 ————— Exploratory Data Analysis



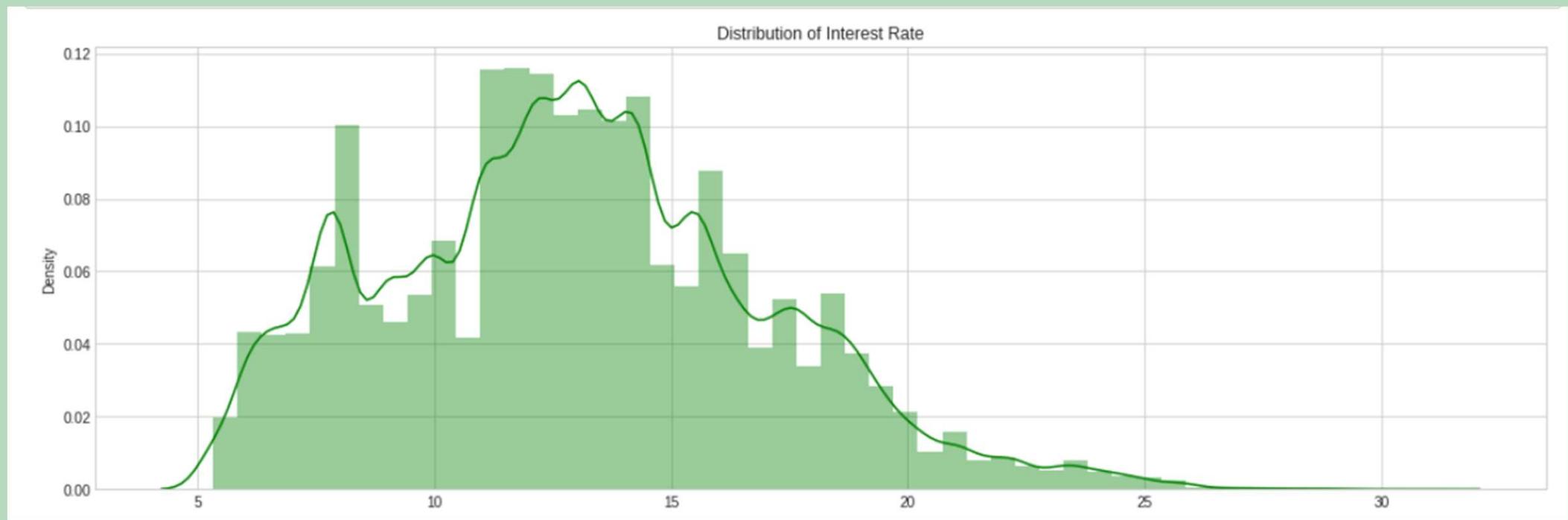
No. 07 ————— Exploratory Data Analysis



No. 07 ————— Exploratory Data Analysis



No. 07 ————— Exploratory Data Analysis

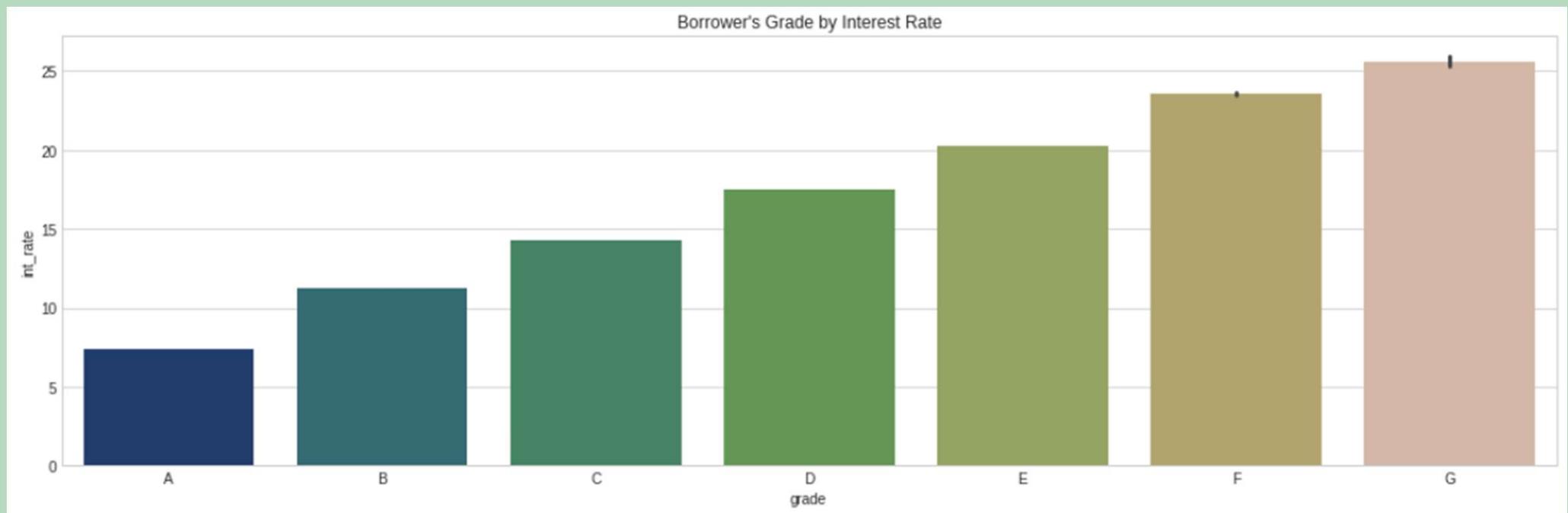


P ————— 05

No. 07 ————— Exploratory Data Analysis



No. 07 ————— Exploratory Data Analysis



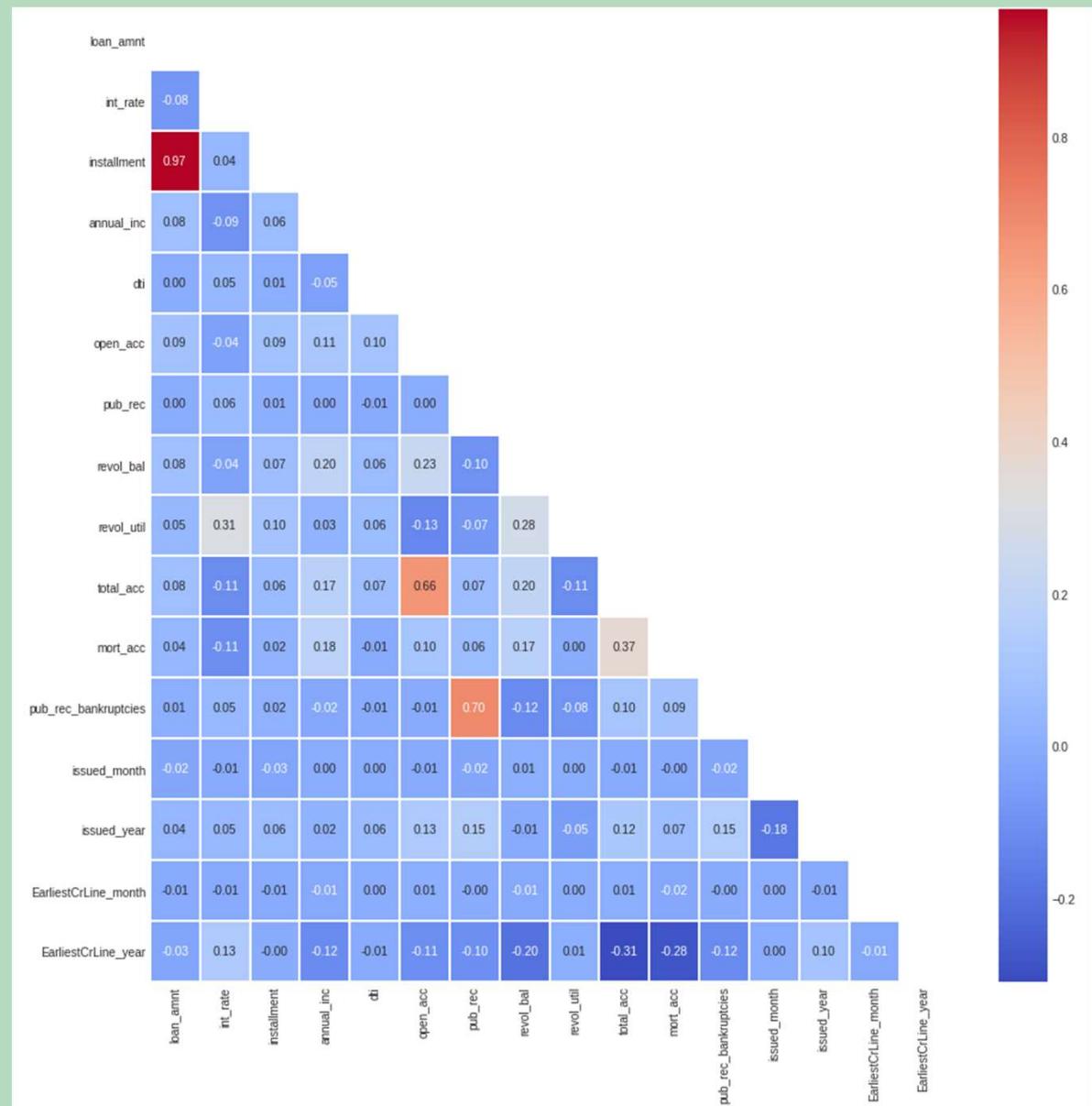
# Machine Learning Modelling

08

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No. 08 ————— Machine Learning Modelling



	Precision Score
<b>Logistic Regression</b>	0.895764
<b>Tuned Logistic Regression</b>	0.896274
<b>SVC</b>	0.834360
<b>Tuned SVC</b>	0.831588
<b>Random Forest</b>	0.839162
<b>Tuned Random Forest</b>	0.897117
<b>XGBoost</b>	0.838876
<b>Tuned XGBoost</b>	0.837845

	TruePositive	TrueNegative	FalsePositive	FalseNegative
<b>Logistic Regression</b>	17763	3463	2067	9575
<b>Tuned Logistic Regression</b>	17679	3484	2046	9659
<b>SVC</b>	17197	2116	3414	10141
<b>Tuned SVC</b>	19134	1655	3875	8204
<b>Random Forest</b>	26729	407	5123	609
<b>Tuned Random Forest</b>	14937	3817	1713	12401
<b>XGBoost</b>	26714	399	5131	624
<b>Tuned XGBoost</b>	27023	300	5230	315

# The Best Model

09

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Firstly, this dataset is from [Pierian Data](#) which contains loan amount, loan term, interest rate, installment, grade, home ownership, purpose of the loan, loan\_status, and many more. Basically, this dataset is available from [their site](#) which anyone can scrape from there.

# Conclusions

10

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Firstly, this dataset is from [Pierian Data](#) which contains loan amount, loan term, interest rate, installment, grade, home ownership, purpose of the loan, loan\_status, and many more. Basically, this dataset is available from [their site](#) which anyone can scrape from there.

# Recommendations

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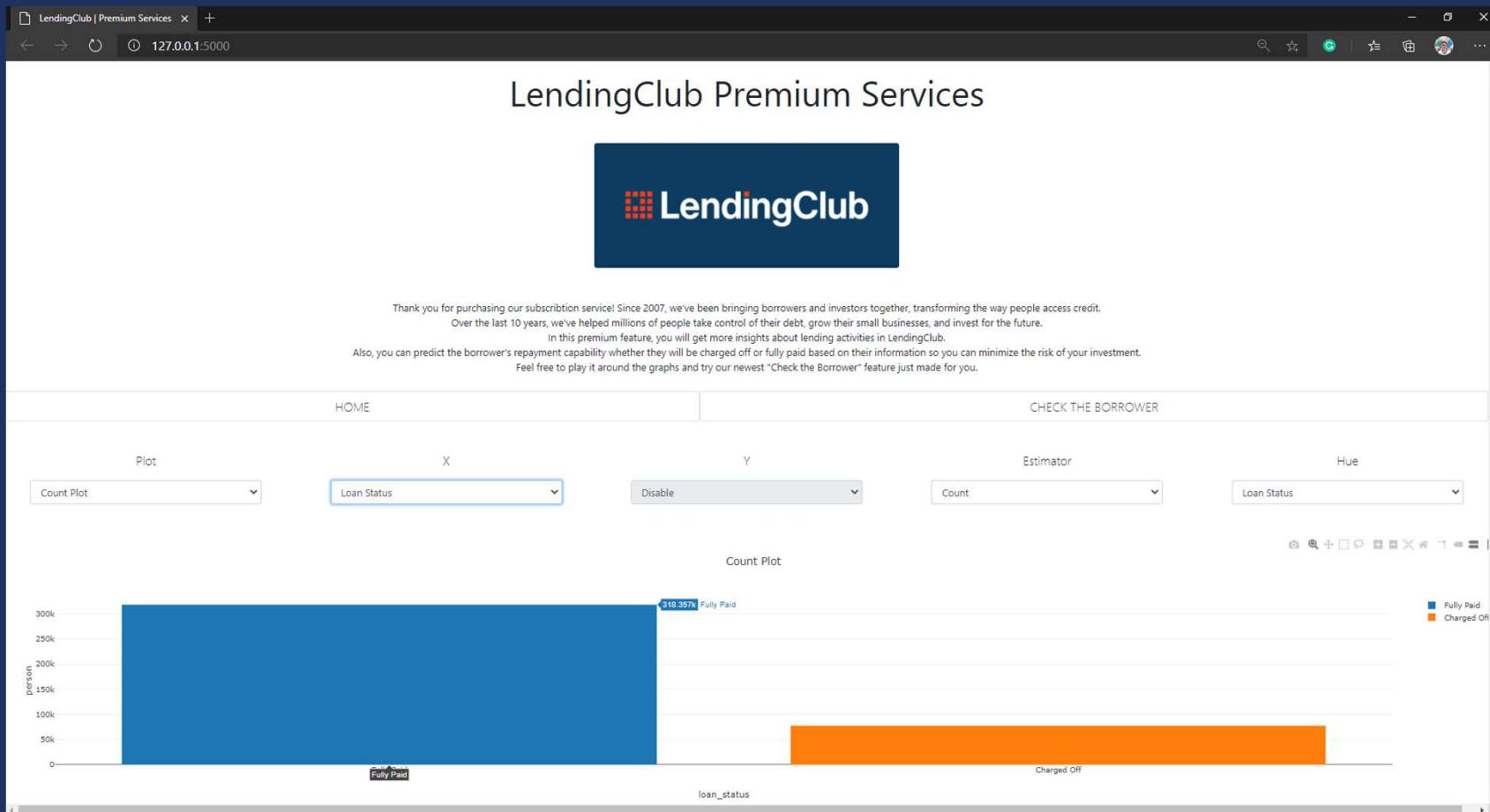
# Dashboard

12

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Firstly, this dataset is from [Pierian Data](#) which contains loan amount, loan term, interest rate, installment, grade, home ownership, purpose of the loan, loan\_status, and many more. Basically, this dataset is available from [their site](#) which anyone can scrape from there.

No. 12 ————— Dashboard



## No. 12 ————— Dashboard

LendingClub Premium Services

LendingClub

Thank you for purchasing our subscription service! Since 2007, we've been bringing borrowers and investors together, transforming the way people access credit. Over the last 10 years, we've helped millions of people take control of their debt, grow their small businesses, and invest for the future.

In this premium feature, you will get more insights about lending activities in LendingClub. Also, you can predict the borrower's repayment capability whether they will be charged off or fully paid based on their information so you can minimize the risk of your investment. Feel free to play it around the graphs and try our newest "Check the Borrower" feature just made for you.

HOME      CHECK THE BORROWER

**TRANSACTION HISTORY**

This is some transaction history of the borrowers when borrowing the money in LendingClub.

	loan_amnt	term	int_rate	installment	grade	sub_grade	emp_title	emp_length	home_ownership	annual_inc	verification_status	issue_d	loan_status	purpose	title	dti	earliest_cr_line	open_acc	pub_rec	revol_bal	revol_util	total_acc	initial_list_status	app
0	10000.0	36 months	11.44	329.48	B	B4	Marketing	10+ years	RENT	117000.00	Not Verified	Jan-2015	Fully Paid	vacation	Vacation	26.24	Jun-1990	16.0	0.0	36369.0	41.8	25.0	w	INDI
1	8000.0	36 months	11.99	265.68	B	B5	Credit analyst	4 years	MORTGAGE	65000.00	Not Verified	Jan-2015	Fully Paid	debt_consolidation	Debt consolidation	22.05	Jul-2004	17.0	0.0	20131.0	53.3	27.0	f	INDI
2	15600.0	36 months	10.49	506.97	B	B3	Statistician	< 1 year	RENT	43057.00	Source Verified	Jan-2015	Fully Paid	credit_card	Credit card refinancing	12.79	Aug-2007	13.0	0.0	11987.0	92.2	26.0	f	INDI
3	7200.0	36 months	6.49	220.65	A	A2	Client Advocate	6 years	RENT	54000.00	Not Verified	Nov-2014	Fully Paid	credit_card	Credit card refinancing	2.60	Sep-2006	6.0	0.0	5472.0	21.5	13.0	f	INDI
4	24375.0	60 months	17.27	609.33	C	C5	Destiny Management	9 years	MORTGAGE	55000.00	Verified	Apr-2013	Charged off	credit_card	Credit Card ReFinance	33.95	Mar-1999	13.0	0.0	24584.0	69.8	43.0	f	INDI

**CHECK THE BORROWER'S REPAYMENT CAPABILITY**

Please insert the borrower's information below.

Loan Amount: e.g. 36275, or 725, or 10000
Term: 36 months or 60 months

## No. 12 ————— Dashboard

The screenshot shows a web browser window titled "LendingClub | Premium Services" with the URL "localhost:5000/invest". The page displays a form for inputting various financial and personal information to predict repayment capability. The fields include:

- Issue Date: e.g. Jan-2015, or Apr-2011, or Jul-2007
- Purpose: e.g. Debt Consolidation, or Refinance Car, or Purchase a House
- Debt-to-income Ratio: e.g. 26.24, or 12.79, or 55.53
- Earliest Credit Line: e.g. Feb-1982, or Apr-1980, or Jul-2010
- Open Account: e.g. 9 or 51 or 76
- Derogatory Public Record: e.g. 0 or 40 or 86
- Revolving Balance: e.g. 36369.0 or 20131.0 or 29244.0
- Revolving Utilization Rate: e.g. 41.8 or 53.3 or 128.1
- Total Credit Line Account Recently: e.g. 1 or 66 or 151
- Initial List Status: Whole or Fractional
- Application Type: Individual or Joint or Direct Pay
- Mortgage Account: e.g. 0 or 12 or 32
- Public Record Bankruptcies: e.g. 0 or 3 or 8
- Address: e.g. 0174 Michelle Gateway Mendozaberg, OK 22690

At the bottom of the form is a green button labeled "Predict Repayment Capability".

No. 12 ————— Dashboard

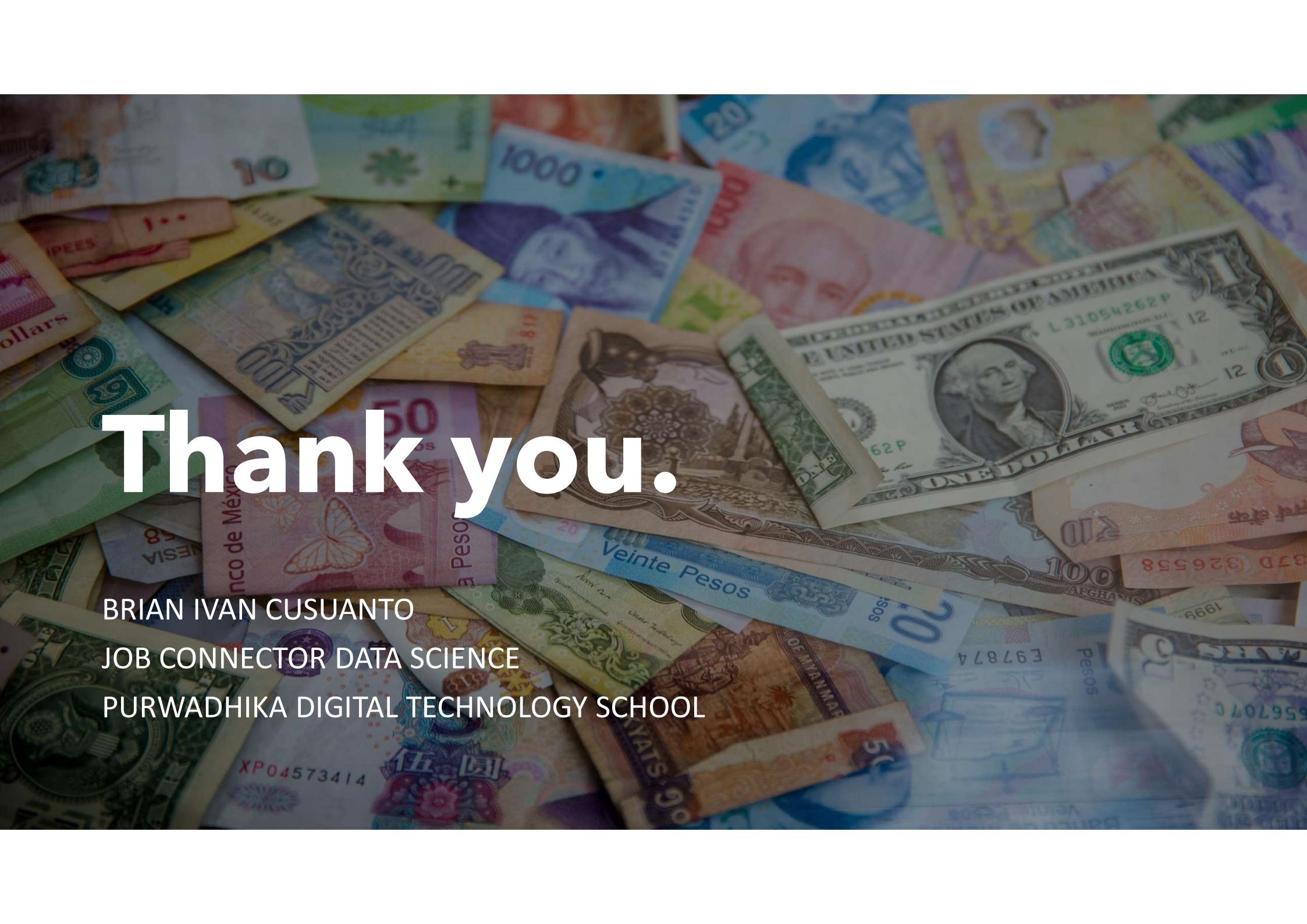
The screenshot shows a web browser window with two tabs: 'LendingClub | Premium Services' and 'Untitled7.ipynb - Colaboratory'. The main content is a dashboard titled 'CHECK THE BORROWER'.

**BORROWER'S REPAYMENT CAPABILITY**

Loan Amount: 24375.0  
Loan Term: 60months  
Interest Rate: 17.27  
Installment: 609.33  
Grade: C  
Sub Grade: C5  
Employment Title:  
Employment Length: 9 years  
Home Ownership: MORTGAGE  
Annual Income: 55000.0  
Verification Status: Verified  
Issue Date: Apr-2013  
Purpose: credit\_card  
Debt-to-Income Ratio: 33.95  
Earliest Credit Line: Mar-1999  
Number of Open Credit Lines: 13.0  
Number of Derogatory Public Records: 0.0  
Total Credit Revolving Balance: 24584.0  
Revolving Line Utilization Rate: 69.8  
Total Number of Credit Lines: 43.0  
Initial List Status: f  
Application Type: INDIVIDUAL  
Mortgage Account: 1.0  
Number of Public Record Bankruptcies: 0.0  
Address: Luna Roads, Greggshire, VA 11650

**Repayment Capability :**  
52.06% Fully Paid

Predict Again | Back to Home



# Thank you.

BRIAN IVAN CUSUANTO  
JOB CONNECTOR DATA SCIENCE  
PURWADHIKA DIGITAL TECHNOLOGY SCHOOL