TVS CREDIT-CASE STUDY

TVS E.P.I.C Season 5 - IT Challenge Case Study

Team: Data Daddies

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GITHUB REPO OF CASE STUDY-

https://github.com/code-wizard123/tvs-credit-risk-eval

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Introduction

TVS Credit offers a wide range of loans, including Two- Wheeler Loans, Used Car Loans, Three-Wheeler Loans, Tractor Loans, Used Commercial Vehicle Loans, Business Loans, Consumer Durable Loans, and Personal Loans.

The company has already implemented digital processes and technological solutions, incorporating the latest available internal and external data. This includes utilizing mobile applications, analytics models, third-party APIs, Bureau Scores, Digital Twins, Chatbots, Voice bots, WhatsApp, and SMS
bots for various aspects of loan processing, such as lead generation, customer onboarding, risk evaluation, underwriting, loan disbursement, repayment management/ collections, repossessions/write-offs, customer service, and cross-selling.

As there is always room for improvement, we **Team Data Daddies** want to delve into this process of understanding the current loan-processing system of TVS and suggest innovative solutions to improve the current state of the system.

Problem Statement

Risk Evaluation/Underwriting:

Underwriting involves conducting research & assessing the degree of risk each applicant brings to the table.

Research Objectives:

- To understand the current risk evaluation and underwriting processes at TVS Credit.
- To identify the challenges and limitations of the existing underwriting methods.
- To propose an innovative solution that leverages technology and data for more accurate risk assessment.

Underwriting:

- The Underwriter evaluates the degree of Risk and Classify Risk.
- Principles of Underwriting include - Risk Assessment and Risk Classification.
- Underwriting is mainly done for the process of Bank Insurance, Security Services, Business IPOs, and in some cases Loan approvals.

Risk Evaluation:

- The degree of Risk represented by a person or a group to an organization is called as Risk Assessment
- Risk Assessment is the primary concern of an Underwriter, they form the backbone of any company.

Background Research

To understand the current Loan Evaluation and Approval process of TVS, we need to understand the nature of TVS Credit first.

There are two types of corporations that lend financial services like Loans, Insurance policies, Leasing, etc.

- Financial Corporations eg- Banks like Citi, HDFC, etc
- Non-Banking Financial Corporation (NBFC) eg- TVS credit, Bajaj Finserv, Mahindra & Mahindra Financial Services Limited, etc

To fully understand the nature of the Loan Approval system in India, we decided to carry out extensive research by interviewing one-on-one with officials in both Financial and Non-Banking Financial Corporations. The objective behind this was to comprehensively study about the Risk evaluation and underwriting process across various sectors and infer what are the standard Industrial practices and how TVS can benefit from some of the things that its competitors do.

- We visited Two of our local TVS retailer showrooms to gather details about the current Loan approval process and how the Risk Evaluation and Undertaking

process is carried out there, At the first one, we visited them as customers, and at the other retailer, we actually stated our purpose of visit.

- We tried to take a loan through the TVS-credit online portal and understand the online loan approval process. This was done to study the online process as well. (www.tvscredit.com)
- We visited a local Royal Enfield showroom and interviewed a salesperson who handled the loan process there.
- We interviewed a retired Baroda Bank employee, who worked there as a manager, to study the process of Risk Evaluation and Underwriting process in a bank.

Visits to TVS showrooms:

- Visited a local TVS showroom, as a customer:
- Name of showroom - TVS SUPREME GALAXY LLP

I asked the person of concern there for a Two-Wheeler loan the process is as follows-

1. They ask for the vehicle model first.
2. They said, generally for Two-Wheelers and Used Two-Wheeler loans, they do not need many documents as the approval process is relatively easy.
3. The documents required are as follows-
    a. Aadhaar Card
    b. Pan Card
    c. Light Bill
    d. Debit Card
    e. Passbook Photo
    f. Passport size Photo

SUPREME GALAXY LLP
Authorised Main Dealers : M/s. TVS MOTORS CO. LTD.
Shop No. 101-102, Om Sai Ganesh Plaza,
Near Saibaba Temple, Star Colony, Sagoan,
Manpada Road, Dombivli- East, Thane, Maharashtra-421 202
Phone.: ~~78755 37733~~
E-mail : salesdomb@supremeunr.com

TVS

1494
10.30 am to 8.30 pm

PROFORMA INVOICE

GST NO. : 27AEJFS4915F1ZV

Date : 9/9/2023

NAME : Dhruvrub

MOBILE : 9082730860

ADDRESS : Dombivli (E)

PIN CODE 421201

MODELS	Jupiter Std SMW			
Ex-Showroom Price	73856			
1 + 5 Years Insurance	6374			
RTO + Tax	9887			
On Road Price				
Mandatory Accessory	867			
Optional Accessory	3000			
HP Charges				
Incidental + Handling Charges*	1000			
Total Price	93,984			

HIRE PURCHASE DETAILS

	Sheme 1	Sheme 2	Sheme 3	Sheme 4
HP Company Name	DP-25000		-	Adhar card
On Road Price ®	12 X 7329	24 X 4027	-	pan card
Down Payment (R)	36 X 2,926		-	light bill
EMI			-	Debit card
Tenure (Month)			-	Passbook

photo
- passport size photo - 1

Sales Executive Name & Number : Siddhesh

For SUPREME GALAXY LLP

Finance Executive Name & Number : Jana bank

Authorised Signatory

7875837733 -

NOTE :

"Price, Specification, Equipments, etc are subject to change without notice & those prevailing at the time of delivery will only apply."

If the payment is made through D.D. / Cheques, vehicle are delivered after the realization of the same.

All loan sanction are subject to financier's discretion.

Refer to Accessory & Registration overleaf.

VEHICLE TO BE EXCHANGE	MODEL ..... EXPECTED RS..... YEAR .....

TVS NO.1 AGAIN IN CUSTOMER SATISFACTION

- helmet
- Parking cover
- Ins 1+4
- Number plate

ASSURANCE 5 YEARS WARRANTY EXTENDED WARRANTY

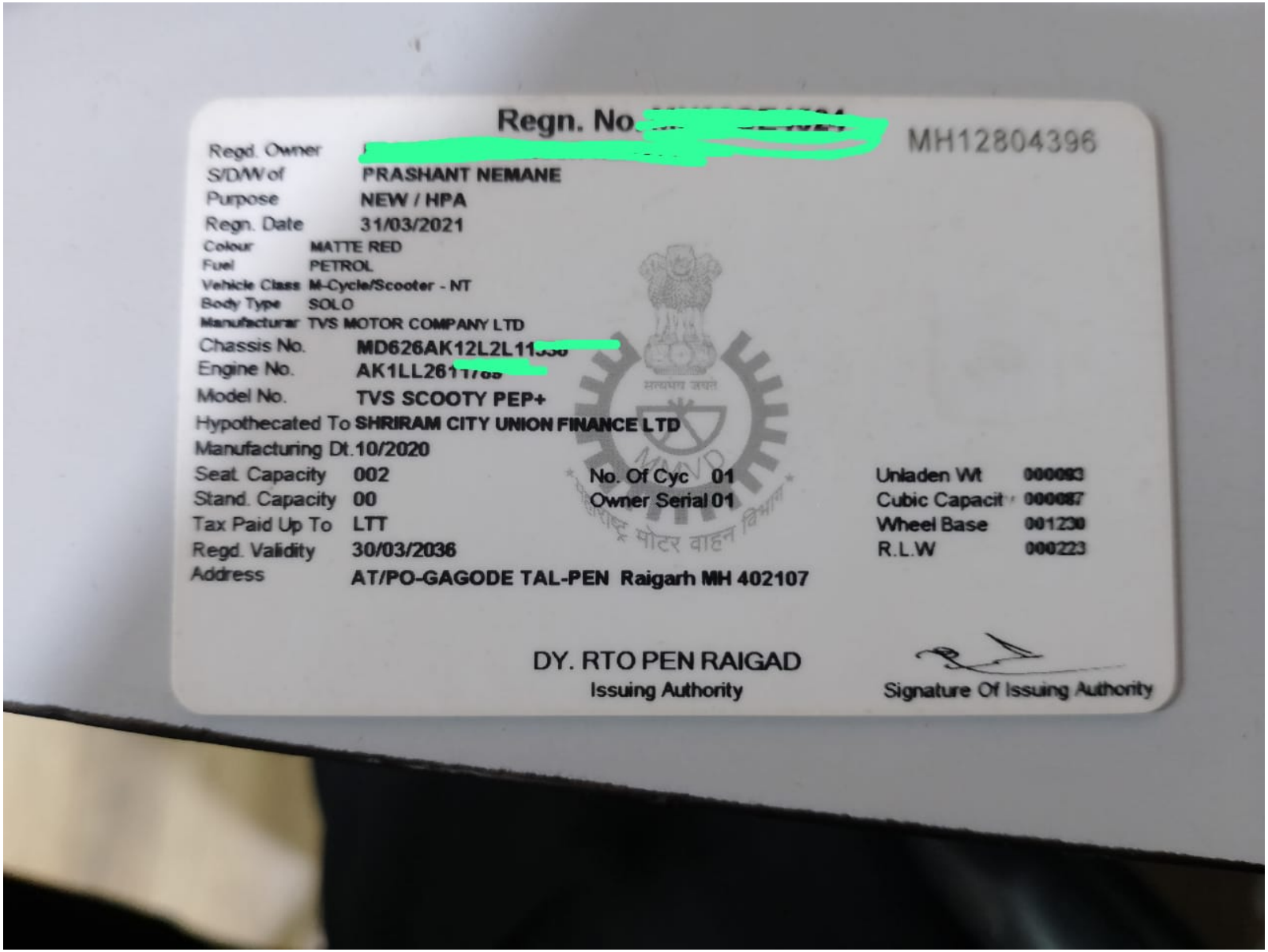
4. They said the details would be verified and they would provide a loan amount of up to 80-85% of the vehicle cost.
5. I asked them, how would they decide on the figures and what process they would follow after taking my details to which they responded by saying for relatively small loans like 2-wheeler loans they don't have an extensive verification process. Once Document verification is done, soft approval up to 80% of the model cost is granted and only if a person wants higher amounts of the loan, they would be required to submit income details are asked and their profile is passed on to the manager for scrutiny.
6. So in conclusion, For higher amounts of loans like in the case of a 4-wheeler, Income details are also asked and generally, a third person (manager/underwriter/agent) is involved in loan approvals.

- Visit to another local TVS showroom, stating the purpose of the case study:
- Name of showroom - TVS DRIVE (Shree Laxmi Automobiles)

At this visit, I stated my purpose that I wanted to know the process of loan approvals as a part of my case study and the manager let me interview him.

1. He showed me how the entire process takes place, if a customer wants to buy a used 2-wheeler, First the customer selects the model that he wants.
2. That particular TVS automobile has ties with **Chaplot Investments, Manba Finance, IDFC bank and Aeon credit service**.
3. Customer selects from which financial corporation they want a loan, and each corporation has its own interest rate and EMI durations. The typical interest rate is around 12-13%
4. He then calculates the Down Payment (DP) of the vehicle using this OBV APP.
5. This app takes into consideration the Kilometers run by the vehicle and the condition of the car and estimates the price of the vehicle. Then down payment is calculated as the Showroom price - OBV app's price. Also, a Loan Processing Fee is added in this DP.
6. He then asks the customer for the following documents - Aadhaar and PAN card, Light bill, Cancelled cheque, 2 passport photo , Bank statement,and Passbook.

7. He then passes this information to an Agent(underwriter) who works for the Finance company that provides the loan.
8. If the loan amount is less, getting soft approval of the loan is easy, The Agent scans the documents and checks the CIBIL score of the individual. A score above 700 is required for loan approval.
9. **CIBIL Score** is a 3-digit numeric summary of your credit history, rating, and report, and ranges from 300 to 900. The closer your score is to 900, the better your credit rating is.If you have not taken any loan in the past then your CIBIL score would be -1.
10. If a loan is relatively small as in cases of 2-wheelers, the CIBIL score would be the only main criterion, and above 700 would definitely convert to a successful loan approval.For larger amounts Income details (If salaried person then salary details otherwise Business details) are asked and the residential address may also be manually confirmed if deemed necessary.
11. After approval of loan, the following RTO issue is generated. If you look at the PURPOSE row, it is written NEW/HPA which means the customer is still under loan payment, After clearing all the loan amounts the status changes to HPT.



Regn. No. [redacted] MH12804396

Regd. Owner	[redacted]
S/D/W of	PRASHANT NEMANE
Purpose	NEW / HPA
Regn. Date	31/03/2021
Colour	MATTE RED
Fuel	PETROL
Vehicle Class	M-Cycle/Scooter - NT
Body Type	SOLO
Manufacturer	TVS MOTOR COMPANY LTD
Chassis No.	MD626AK12L2L11[redacted]
Engine No.	AK1LL261[redacted]
Model No.	TVS SCOOTY PEP+
Hypothecated To	SHRIRAM CITY UNION FINANCE LTD
Manufacturing Dt.	10/2020
Seat. Capacity	002
Stand. Capacity	00
Tax Paid Up To	LTT
Regd. Validity	30/03/2036
Address	AT/PO-GAGODE TAL-PEN Raigarh MH 402107
No. Of Cyc	01
Owner Serial	01
Unladen Wt	000093
Cubic Capacit	000087
Wheel Base	001230
R.L.W	000223

DY. RTO PEN RAIGAD
Issuing Authority

Signature Of Issuing Authority

12. After approval of the loan, the work of the Agent and TVS retailer is done. The financial corporation provides the amount to the TVS retailer and the customer has to pay the required EMI to the corporation.

Exploring the online TVS-credit portal

- The online portal exactly demands the same details/documents as the offline retailers ask.
- The details are evaluated and they would then assign you a local Dealer location where you have to manually visit for the next process in loan approval.
- Both the TVS retailers I visited stated that it is always better to visit the offline retailer because the online process directs you to nearby retailer location itself.

Visiting Local Royal Enfield retailer

- Visited Royal Enfield Showroom - Pooja Motors
- I stated my purpose of visit and the salesperson there guided me through their loan approval process.

1. Following documents are asked after customer selects their vehicle model.
    a. KYC
    b. Aadhaar and PAN card
    c. Light Bill
    d. Take Live photos for updating their Biometric
2. Soft approval of 85% of the model cost is provided once these documents are verified and the customer has CIBIL score above 750.
3. If the CIBIL score is -1 , customers can only get 50 % approval and their down payment is also relatively high.
4. If the CIBIL score is between 600-700 or the customer wishes for higher loan amounts, income details are asked for getting loan approvals.

5. After getting approval, customer closing process is done and invoice is generated.

Interviewing former Bank Manager

- Interviewed a retired Baroda Bank employee, who once held a managerial post.
- Asked him questions regarding Risk evaluation and the underwriting process.

1. For higher personal loans and to avail Insurance policies like Health policy, Risk Evaluation is done by the underwriter of that company.
2. 4 elements of Risk Evaluation are - risk identification, risk assessment, risk action management, risk reporting and monitoring.
3. If someone wants for example Health Insurance, then the underwriter looks into their age, habits(smoking, drinking, etc.), criminal records, medical records, and occupation.
4. Premium rates are then applied according to the class of risk the customer represents.
5. Many metrics are taken into consideration before Risk is classified into mainly 4 categories-
    a. Preferred State.
    b. Standard State.
    c. Sub-standard State.
    d. Declined State.
6. Metrics include the calculation of Customer current ratio, Quick ratio, Cash ratio, Liquidity ratio, leverage ratio, efficiency and profitability ratio, etc.
7. For Car loans, they check Earning per month, Capacity ratio (Monthly debt / Gross monthly income), Repaying capacity, CIBIL score.

Solution

Lets analysis our Background Research and draw conclusions:

- The online process of availing Loan through TVS credit portal is almost never preferred among customers due to the fact that you have to physically visit a local dealer nearby after filling the details for the process of Biometric updation (i.e the company may ask for Live photo of the loan availer for their records and verification) or for re-verification of documents. Thus Loan approval becomes a 2 step process.
- Even the two TVS retail showrooms we visited, advised us to not use the online portal as they would later be redirected to local dealer such as the one we visited.
- There is zero to very little risk assessment of any sort done , when Loan amounts are less. Generally this is true for 2-wheelers, Used 2-wheelers and other similar loans. Thus after such loans are given, there is sometimes a need to re-assess those individual who have been given a loan to ensure that they are not carrying a Default Risk.
- Loans default will cause huge loss for the banks, so there is a need to pay much attention on this issue and apply various method to detect and predict default behaviors of customers.

Our solutions to these problems:

- The online process can be proven sustainable if the work of KYC/Biometric and in-person assessment is done online.
- To tackle this issue , we aim to built an Automated KYC system and a Video based Customer Assessment for lending purposes. The Video based customer assessment can be used to verify important documents and cross-check any biometric details.
- Sometimes underwriter/agent needs to manually assess the risk with the loan availer before approving. Our video based assessment solution can simplify this process.

- We also aim to built automatic Aaadhar and PAN card verification system. This can be donee using some third party APIs.
- We aim to integrate this auto-verification part with the current TVS credit webpage so that loan process becomes simple and one-step.
- To tackle the issue of individuals carrrying a Default Risk, we aim to build a Default Risk Predictor model.
- This model would be used internally by loan officers at a company like TVS Credit to disqualify or at least re-assess loan terms of customers flagged by this form as potential default risks.
- We aim to integrate this model into the main TVS Credit webpage where frequently, loan payers can be made to give in their details ,to assess whether they are a risk to the company.
- The process of calculating Down Payment can be automated as well , for this we aim to build vechicle price predictor model which takes in input such as Year of vechicle model, kilometers driven , launch price and output current price. This will also help customers to estimate price of used vechicles.

Case Study Implementations

We have a general idea of how we will implement above mentioned Solutions, but due to time contraints for this proposal round submission, we implemented few of the above solutions. We aim to provide complete solution for the Finale and integrate all together on a web portal like TVS - credit.

- We built the Automated KYC verification and the Video based Customer Assessment model mentioned in our solution above. The code for the model is

provided in the Main Github folder of our project, along with video of how our Solution works. The implementation details are mentioned below:

Technologies Used**:**

Front-end

- *Reactjs*
- *React-bootstrap*
- *Peerjs* for peer to peer video call
- *Socket.io-client* for Realtime updates
- *Navigator API* for Webcam and GPS access
- *LocationIQ API* for Reverse Geolocation
- *Faceapi.js for* Face detection and Recognition

Back-end

- Nodejs
- Expressjs
- MongoDB Atlas
- Socket.io
- Multer

The application contains two modules, one is Automated KYC system and the other is Video based Customer Assessment for lending purposes.

Module - 1

- Prompt user to upload documents for KYC.
- Matching faces in Photo ID and Live Image using SSDMobileNet and FaceRecognition model from Faceapi.js
- Storing KYC document and current location in database for future reference

Module - 2

- Connecting Agent and Customer via video call.
- Allow Agent to Verify Customer through Face and Geolocation verification against the documents provided during KYC.
- Upload / Download Documents between the users.

- We built the Default Risk Predictor model mentioned in the Solution section above. The code for the model is provided in the Main Github folder of our project, along with video of how our Solution works. The implementation details are mentioned below:

Data Collection

The data used to train our Default Risk Predictor Model is taken from TVS' own dataset.

https://www.kaggle.com/datasets/sjleshrac/tvs-loan-default?datasetId=805501

ML Models Used

To start identifying high-impact variables on default risk, a random forest was constructed using the sklearn RandomForestClassifier in order to determine the important features in the dataset from the feature_importances_ attribute. The features that had relatively high impact on the "default" column result were then used for all the ML models developed from this dataset.

Logistic Classification, Decision Tree, Random Forest, Gradient-Boosted Trees (GB), XGBoost ML models based on the algorithms above were all evaluated against one another.

Findings

Once the above ML models were created, they needed to be evaluated in a standard way, to get an overall "score" of how good the model was for minimizing default risk while making the same or more money from lending overall. Additionally, the data was imbalanced, with two classes (defaulter or non-defaulter) that have a ratio of approximately 1:50 in the dataset provided, corresponding to ~2% default rate. So using a cost function that prioritizes accuracy - that is, the model correctly identifies as many items as possible - has the unfortunate result of simply classifying **all** the loan customers as non-defaulters because this will result in ~98% accuracy rate of the classification model.

Instead, a deeper dive into the economic costs of loans defaulting vs. being repaid was required. The results were that each default loan was worth approximately 5 non-default loans, given the total amount lost by a default loan and the total profit on a non-default loan - to see the calculations of the loan values and the ratio, see here. This result guided the creation of a scoring function of - scoring = d1 - 5*d2

where d1 is the number of defaulters correctly identified by the model and d2 is the number of customers who were identified as a default risk who did not actually default. This function was later modified to increase the coverage of the defaulters by adding an accuracy multiplier (which weights the function so that given the same overall score, if more defaulters are correctly identified, then the one with greater coverage is "better" to the model). This can be seen as giving the final scoring function: scoring = (d1/d_total)*(d1 - 5*d2)

where d-total is the total number of defaulters in the dataset. This equation was particularly useful in guiding the construction fo the random forests and gradient-boosted trees.

The ML models based on the algorithms were all evaluated against one another, and the results of that comparison showed the gradient-boosted trees maximizing the scoring function compared to the other models, and therefore giving the greatest economic gain (profit) to the lender.

The in-dept analysis of above model is given in a ppt provided along with this report.

There is video also provided displaying how this model is integrated using flask with a frontend website which takes in input and gives the risk value of the loan payer.

Impacts and Outcomes

The solutions mentioned above can be implemented with the main TVS -credit site that can help to ease out the online process of loan assessment and document verifications. This leads to faster loan approvals and manual intervention is reduced.

Reverification of documents and KYC process becomes automated and can be done via online means through our automated kyc and video assessment model.

Default Risk assessment of current loan payers can be done , this will lead to correct identification of defaulters and there loan payment assessment can be done. The manual process of Underwriters in this case will lessen.

Loan defaulters cost a huge amount of money to banks , if their numbers are reduced , Banks can have more trust NBFC organisations like TVS

Implementation of car price prediction model will help attract new customers who wants Used Vechicle loans and the process of calculting Down Payment is automated without need of manual intervention.

References:

- tvscredit.com For online Loan processing process.
- https://www.kaggle.com/datasets/sjleshrac/tvs-loan-default?datasetId=805501 TVS dataset for our default risk prediction model