Project Report Format

GitHub & Project Demo Link

1. INTRODUCTION

1.1. Project Overview

One of the most important factors which affect our country's economy and financial condition is the credit system governed by the banks. The process of bank credit risk evaluation is recognized at banks across the globe. "As we know credit risk evaluation is very crucial, there is a variety of techniques are used for risk level calculation. In addition, credit risk is one of the main functions of the banking community. The prediction of credit defaulters is one of the difficult tasks for any bank. But by forecasting the loan defaulters, the banks definitely may reduce their loss by reducing their non-profit assets, so that recovery of approved loans can take place without any loss and it can play as the contributing parameter of the bank statement. This makes the study of this loan approval prediction important. Machine Learning techniques are very crucial and useful in the prediction of these types of data. We will be using classification algorithms such as Decision tree, Random-forest, KNN, and XGboost. We will train and test the data with these algorithms. From this best model is selected and saved in pkl format. We will be doing flask integration, develop a web interface and IBM deployment.

1.2. Purpose

The purpose of Smart Lender System is to provide a comprehensive web based platform to manage different lenders & borrowers. Lenders can specify their loan criteria, lending terms, rate of interest, mandatory documentation and agreements etc. Borrowers can then apply for loans in the system. The loan origination software checks borrower eligibility and matches it with the lending criterion according to the algorithm. The loan is disbursed after approval of the lending terms. Smart Lending system finds algorithmic match for borrower eligibility, loan terms and conditions. It eliminates repetitive manual steps that are best executed digitally and allows human expertise to be applied where it works best. Integration with credit data sources and services such as LexisNexis or Experian lets lenders automatically and quickly verify applicant information. No lost or misplaced documents. Paper documents converted to digital images are immediately and securely accessible by the underwriter, so they can review applicant materials more quickly. The combination of decision rules and integration with credit data sources and services lets lenders automatically calculate optimum loan structures and terms.

2. LITERATURE SURVEY

2.1. Existing problem

A bank is a financial institution licensed to receive deposits and make loans needs away to verify the customer details and their documents for getting loan because they need a trustable customer with proper documents who can repay the loan amount and interest on time.A lender is an individual or a financial institution that makes funds available to a person with expectation that the funds will be repaid who needs a way to easily and quickly approve the loan for a trustworthy person because manually loan approval is a time taking process. The lender needs a way to trust the borrower’s credentials so that he can give loan to the borrower with assured repayment of the loan. A lender is a party who loans out money needs a way to automate the loan prediction process because he cannot easily trust the person. A bank manager who needs a way to predict the loan approval of a person automatically because of the difficulty in manual loan prediction as he wants to hire highly professional individuals for approving loan and security issues. A bank is money lender who needs away to lend loans to its customers securely with proper interest and repayment because being impetuous might cause a lot of damage to itself.

2.2. Reference

1. “Survey on Prediction of Loan Approval Using Machine Learning Techniques” - Ambika and Santosh Biradar/ Department of Computer Engineering, D. Y. Patil College of Engineering,Pune, India

2. “Process Evaluation and Improvement: A Case Study of The Loan Approval Process” - MAJA PUSNIK, KATJA KOUS, ANDREJ GODEC and BOASTJAN SUMAK, University of Maribor

3. “Loan Approval Prediction based on Machine Learning” - Kumar Arun, Garg Ishan, Kaur Sanmeet

4. “Loan Approval Prediction” - Shubham Nalawade, Suraj Andhe, Siddhesh Parab, Prof. Amruta Sankhe - Information Technology, Atharva College of Engineering, Mumbai

5. “Predict Loan Approval in Banking System Machine Learning Approach for Cooperative Banks Loan Approval” - Amruta S. Aphale ,Prof. Dr. Sandeep. R. Shinde Department of Computer Science and Engineering Savitribai Phule Pune University Vishwakarma Institute of Technology, Pune

3. Problem Statement Definition

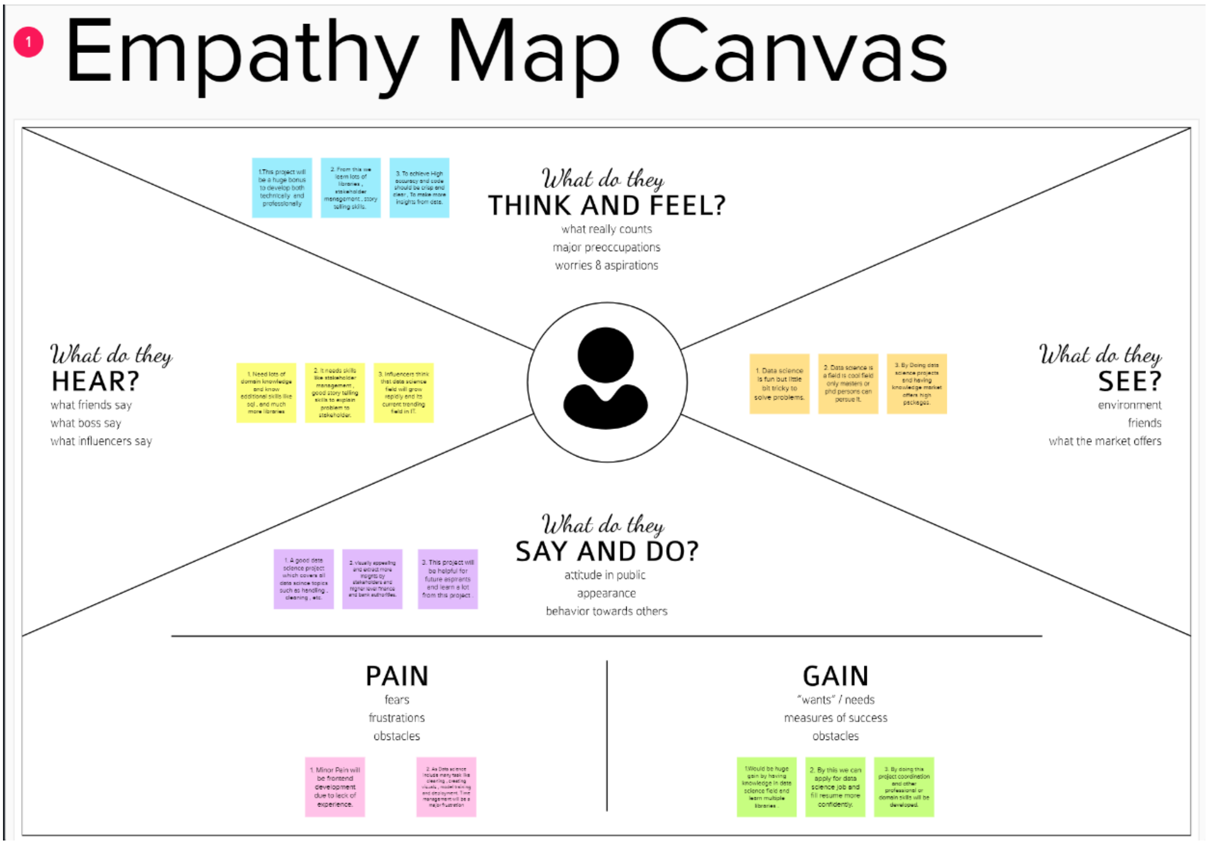
A bank is a financial institution licensed to receive deposits and make loans needs a way to verify and trust the customer details and their documents for getting loan because they need an trustable customer with proper assets, cash flow, documents and background who can repay the loan amount and interest on time. The prediction of credit defaulters is one of the difficult tasks for any bank. But by forecasting the loan defaulters, the banks definitely may reduce their loss by reducing their non-profit assets, so that recovery of approved loans can take place without any loss and it can play as the contributing parameter of the bank statement. This makes the study of this loan approval prediction important. Machine Learning techniques are very crucial and useful in the prediction of these types of data. We will be using classification algorithms such as Decision tree, Random-forest, KNN, and XGboost. We will train and test the data with these algorithms. From this best model is selected and saved in pkl format. We will be doing flask integration, develop a web interface and IBM deployment.

3. IDEATION & PROPOSED SOLUTION

3.1. Empathy Map Canvas

Empathy maps are a straightforward, effective technique for developing knowledge of your people. Empathy, the capacity to comprehend another person's feelings and thoughts, is the name's etymological source. When grounded in actual data and used in conjunction with other mapping techniques, they can:

- Eliminate bias from our designs and bring the team together around a single, shared knowledge of the user
- Find the gaps in our study's findings
- Find out what the user needs—needs that the user may not even be aware of
- Learn what motivates user action. Point us in the direction of genuine innovation



Empathy Map Canvas

What do they
THINK AND FEEL?
what really counts
major preoccupations
worries & aspirations

1.This project will be a huge bonus to develop both technically and professionally

2. From this we learn lots of libraries , stakeholder management , story telling skills.

3. To achieve High accuracy and code should be crisp and clear , To make more insights from data.

What do they
HEAR?
what friends say
what boss say
what influencers say

1. Need lots of domain knowledge and know additional skills like sql , and much more libraries

2. It needs skills like stakeholder management , good story telling skills to explain problem to stakeholder.

3. Influencers think that data science field will grow rapidly and its current trending field in IT.

What do they
SEE?
environment
friends
what the market offers

1. Data science is fun but little bit tricky to solve problems.

2. Data science is a field is cool field only masters or phd persons can persue it.

3. By Doing data science projects and having knowledge market offers high packages.

What do they
SAY AND DO?
attitude in public
appearance
behavior towards others

1. A good data science project which covers all data scince topics such as handling , cleaning , etc.

2. visually appealing and extract more insights by stakeholders and higher level finance and bank authorities.

3. This project will be helpful for future aspirants and learn a lot from this project .

PAIN
fears
frustrations
obstacles

1. Minor Pain will be frontend development due to lack of experience.

2. As Data science include many task like cleaning , creating visuals , model training and deployment. Time management will be a major frustration

GAIN
"wants" / needs
measures of success
obstacles

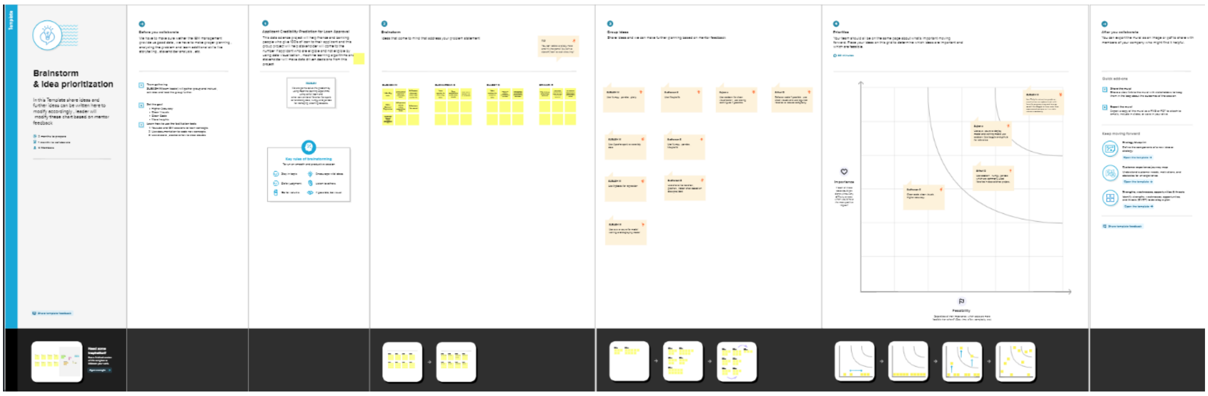
1.Would be huge gain by having knowledge in data science field and learn multiple libraries .

2. By this we can apply for data science job and fill resume more confidently.

3. By doing this project coordination and other professional or domain skills will be developed.

3.2. Ideation & Brainstorming

By posing a problem to a group of individuals or team members and engaging them in an open dialogue, the brainstorming approach allows for the generation of ideas. Agile Brainstorming is the name given to this method when it is used in agile projects since it may provide creative ideas. Our group speaks aloud each danger as it is identified. They can take notes so they won't forget a concept before their turn if an increased risk prompts a fresh thought for someone who is not yet in line.



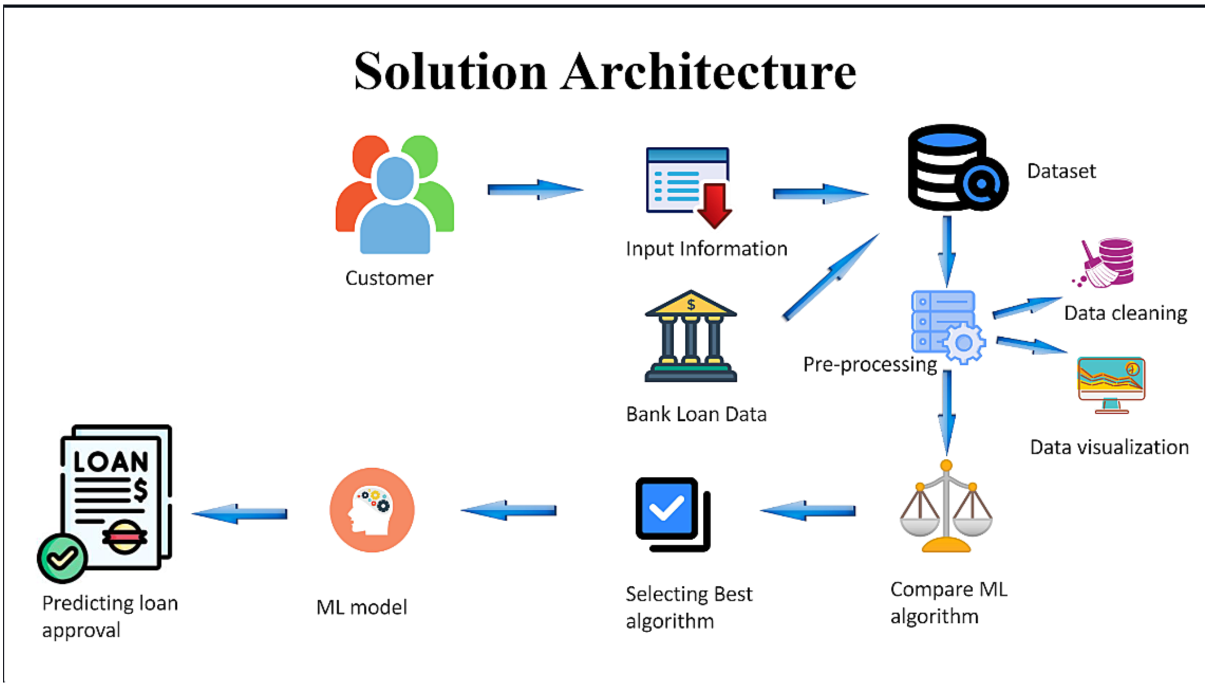
Template

Brainstorm
& Idea prioritization

In this Template share ideas and further ideas can be written here to modify accordingly , leader will modify these chart based on mentor feedback

3.3. **Proposed Solution**

The prediction of credit defaulters is one of the difficult tasks for any bank. But by forecasting the loan defaulters, the banks definitely may reduce their loss by reducing their non-profit assets, so that recovery of approved loans can take place without any loss and it can play as the contributing parameter of the bank statement. This makes the study of this loan approval prediction important. Machine Learning techniques are very crucial and useful in the prediction of these types of data. We will be using classification algorithms such as Decision tree, Random-forest, KNN, and XGboost. We will train and test the data with these algorithms. From this best model is selected and saved in pkl format. We will be doing flask integration, develop a web interface and IBM deployment.

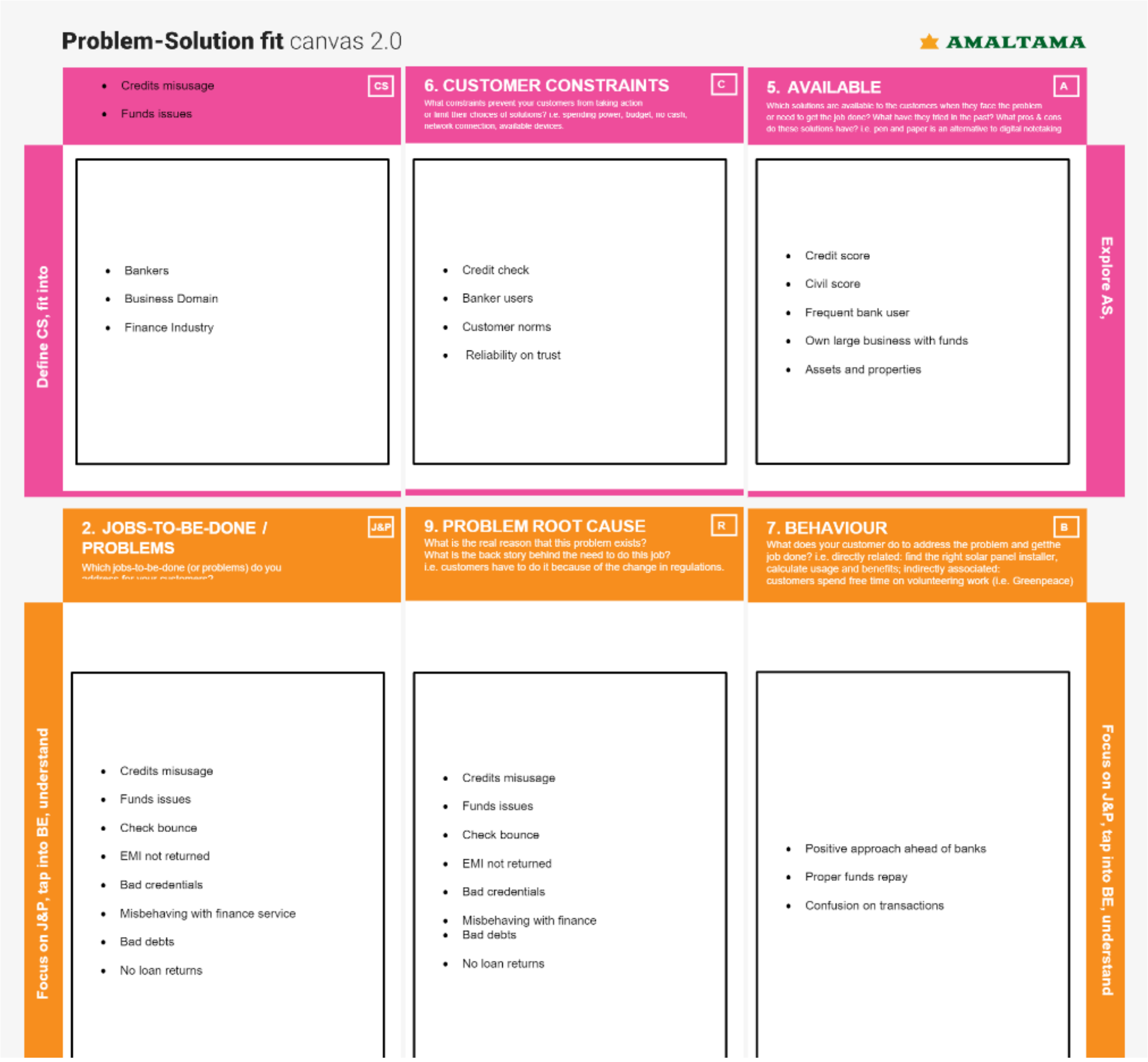


- The customer only needs to enter the details, the loan approval status is then predicted automatically and quickly. The property documents of the customer need to be submitted and the customer should agree to the terms and conditions of the bank. The loan approval will also depend on the CIBIL score of the customer. Provide captcha security.

- Automatic calculation of interest rate and repayment date based on loan amount. Varies efficient machine learning algorithms can be used to predict the loan eligibility of the customer. Provide customer ratings and reviews for understanding the customer. Adding digital signature of the customer on agreement of the terms and conditions.

- Provides data security. The customer details will not be shared to the third party. Instant Loan approval status. Easy and fast loan approval process for the customer. Approves Loan to a trustable person. Bank can find a genuine person to provide loan

3.4. Problem Solution Fit



AMALTAMA
Define CS, fit into
Explore AS,
Focus on J&P, tap into BE, understand
Focus on J&P, tap into BE, understand

Problem-Solution fit canvas 2.0

CS

- Credits misusage
- Funds issues

- Bankers
- Business Domain
- Finance Industry

6. CUSTOMER CONSTRAINTS C

What constraints prevent your customers from taking action or limit their choices of solutions? i.e. spending power, budget, no cash, network connection, available devices.

- Credit check
- Banker users
- Customer norms
- Reliability on trust

5. AVAILABLE A

Which solutions are available to the customers when they face the problem or need to get the job done? What have they tried in the past? What pros & cons do these solutions have? i.e. pen and paper is an alternative to digital notetaking

- Credit score
- Civil score
- Frequent bank user
- Own large business with funds
- Assets and properties

2. JOBS-TO-BE-DONE / PROBLEMS J&P

Which jobs-to-be-done (or problems) do you address for your customers?

- Credits misusage
- Funds issues
- Check bounce
- EMI not returned
- Bad credentials
- Misbehaving with finance service
- Bad debts
- No loan returns

9. PROBLEM ROOT CAUSE R

What is the real reason that this problem exists?
What is the back story behind the need to do this job?
i.e. customers have to do it because of the change in regulations.

- Credits misusage
- Funds issues
- Check bounce
- EMI not returned
- Bad credentials
- Misbehaving with finance
- Bad debts
- No loan returns

7. BEHAVIOUR B

What does your customer do to address the problem and getthe job done? i.e. directly related: find the right solar panel installer, calculate usage and benefits; indirectly associated: customers spend free time on volunteering work (i.e. Greenpeace)

- Positive approach ahead of banks
- Proper funds repay
- Confusion on transactions

4. REQUIREMENT ANALYSIS

4.1. Functional Requirement

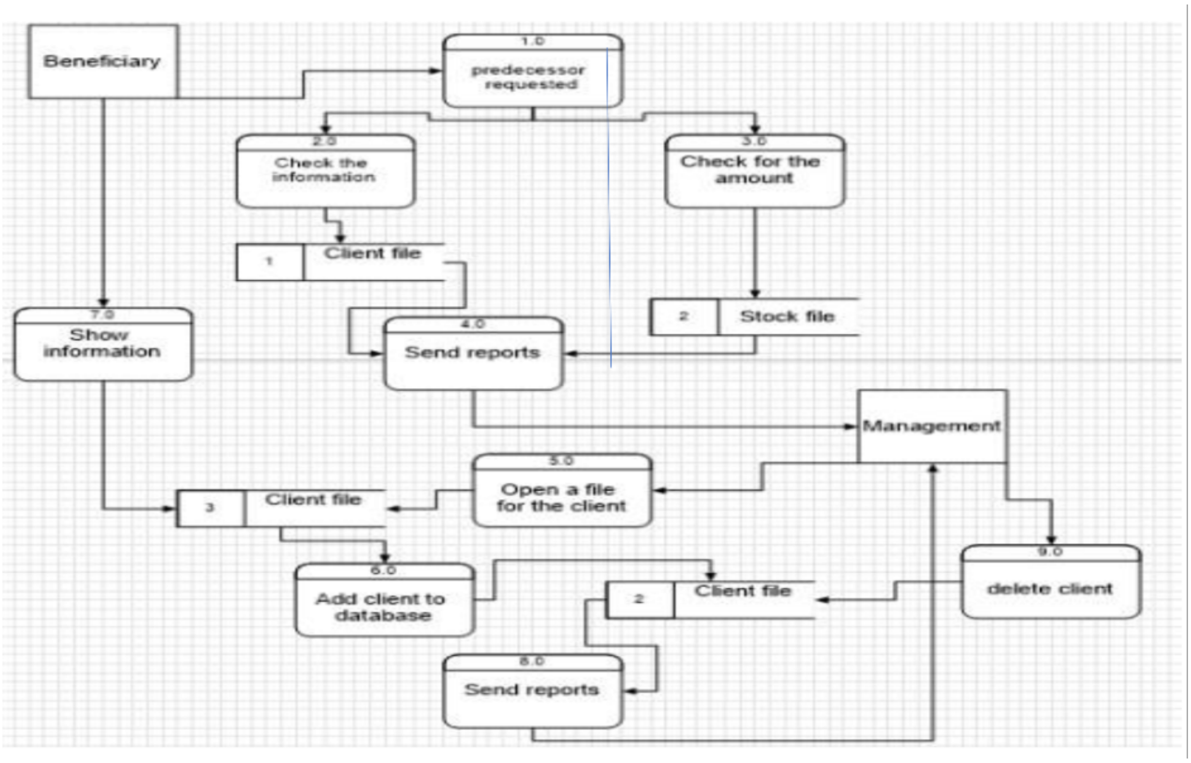
FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail Registration through LinkedIN
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	User Application	Filling of application Modification of application Verification of application
FR-4	Loan Issuance	Checking status of loan Loan Approval Loan Rejection
FR-5	Credit history analysis	Credit score auditing Income auditing
FR-6	User management	Choosing appropriate loan program for users Categorising users according to credit history.

4.2. Non-Functional Requirement

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Simple and understandable UI. Easy to navigate Smooth and seamless Easy to comprehend
NFR-2	**Security**	Restricted access to data. Login verification Registration verification Upholding privacy of user
NFR-3	**Reliability**	Backup to prevent data loss Negation of data loss due to lag.
NFR-4	**Performance**	Web based application. Requires minimum Intel Pentium 4 processor, 4 GB RAM, 1280x1024 screen with application window size 1024x680

5. PROJECT DESIGN

5.1. Data Flow Diagrams



5.2. Solution & Technical Architecture

1. First the Model is trained with the obtained dataset. The data set is given by IBM.

2. Next the dataset will be pre-processed and then the data would be split to train and test data.

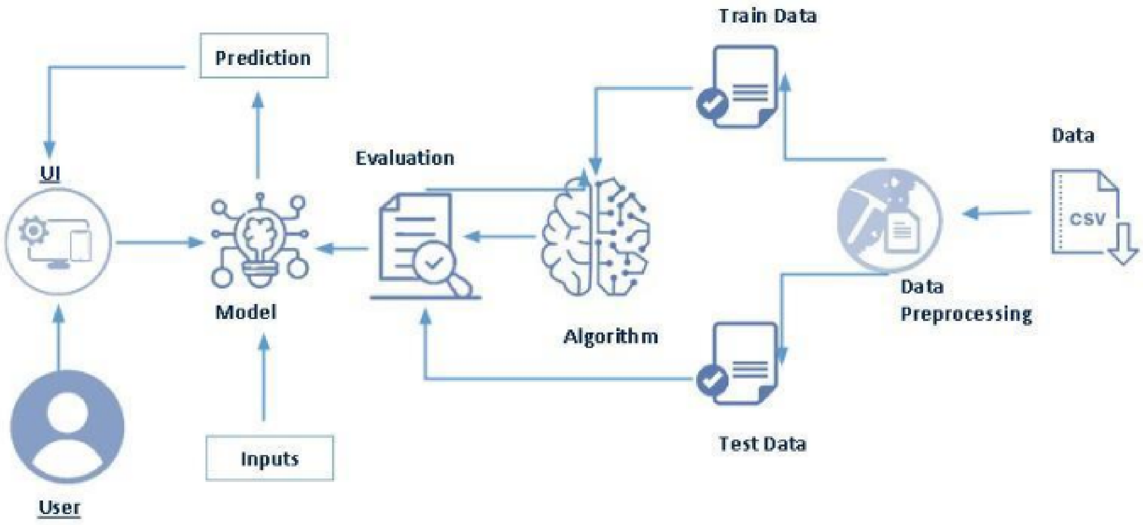
3. Then then model would be saved as a PKL file

4. A website would be created for the interaction and Flask would be used to integrate the model and website

5. The User would give the input, the inputs would be processed and then the prediction would be made.

6. After the prediction is made the output would be given as “Eligible” or “Not Eligible”

7. This can be scaled even more as an API and integrated into the Mobile banking application, making it even more convenient for the customer to know the eligibility.



5.3. User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Web user)	**Forms**	USN – 1	As a user, I can enter the data which I have and also the data which the website asks to me	Submit the required data for prediction	**High**	Sprint – 1
	Prediction	USN – 2	As I have given the data into the webpage, now the data can be predicted for the loan avail	Pre-processing is done and data is scaled in Backend and sent to the model for prediction	**High**	Sprint – 3
	Deployment of the Webpage in Cloud	USN – 3	As a user, I require global access to the web page as a user	I can get to the Webpage using the provided Web address	**Medium**	Sprint – 4
	Deployment of AI model in the cloud	USN – 4	Model would be running on the Cloud	I can access the model through the web address where I typed my data that's been set up on the IBM cloud.	**Medium**	Sprint – 4

	Model building	USN – 5	I require an ML model that can categorise Credit defaulters	I can use the ML model to classify the Credit defaulters	**High**	Sprint – 2
	User Interface building	USN – 6	As a User, I need a medium to enter my data	I can use the webpage which uses Flask at the backend to integrate with the ML Model created	**Medium**	Sprint – 3

6. PROJECT PLANNING & SCHEDULING

6.1. Sprint Planning & Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	3	High	SUBASH M
Sprint-1		USN-2	As a user, I will receive confirmation email once I have registered for the application	3	High	SUJEET C SRIHARI R
Sprint-1		USN-3	As a user, I can register for the application through Facebook	1	Low	SUBASH M SRIHARI R
Sprint-1		USN-4	As a user, I can register for the application through Gmail	2	Medium	SUBASH M SUDHARSAN S

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Login	USN-5	As a user, I can log into the application by entering email & password	3	High	SUJEET C SRIHARI R
Sprint-1	Dashboard	USN-6	As a user, I should be able to access the dashboard with everything I am allowed to use.	2	Medium	SUBASH M SRIHARI R
Sprint-1	Registration	USN-7	As a user, I can register for the application by entering my email, password, and confirming my password.	3	High	SUBASH M SUDHARSAN S

Sprint-1		USN-8	As a user, I will receive confirmation email once I have registered for the application	3	High	SUBASH M SUDHARSAN S
Sprint-1		USN-9	As a user, I can register for the application through Facebook	1	Low	SUJEET C SRIHARI R
Sprint-1		USN-10	As a user, I can register for the application through Gmail	2	Medium	SUBASH M SUDHARSAN S
Sprint-1	Login	USN-11	As a user, I can log into the application by entering email & password	3	High	SUBASH M SUDHARSAN S SUJEET C SRIHARI R
Sprint-1	Dashboard	USN-12	As a user, I should be able to access the dashboard with everything I am allowed to use.	2	Medium	SUBASH M SRIHARI R

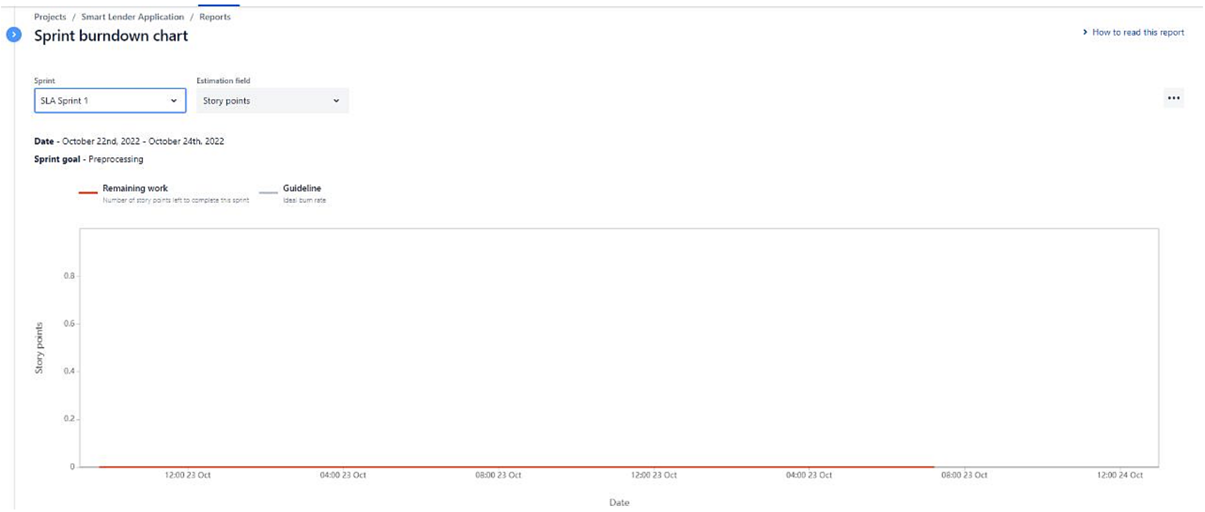
Sprint	**Functional Requirement (Epic)**	**User Story Number**	**User Story / Task**	**Story Points**	**Priority**	**Team Members**
Sprint-2	Register	USN-13	As a loan approval officer, I should be able to register myself as one using unique email and password.	5	Medium	SUBASH M SUDHARSAN S
Sprint-2	Login	USN-14	As a loan approval officer I should be able to login myself as one using unique email and password.	5	Medium	SUBASH M SUDHARSAN S
Sprint-3	Automated analysis of credit history	USN-15	As a loan approval officer, I can access the dashboard where I feed application for loan prediction.	10	High	SUBASH M SUDHARSAN S
Sprint-3		USN-16	As a loan approval officer, I can get a decision followed by some details for the decision when I feed an application for loan prediction.	15	High	SUJEET C SRIHARI R

Sprint-4	Register	USN-17	As an admin, I should be able to register myself as one using unique email and password.	2	Medium	SUBASH M SUDHARSAN S SUJEET C SRIHARI R
Sprint-4	Login	USN-18	As an admin I should be able to login myself as one using unique email and password.	2	Medium	SUBASH M SRIHARI R
Sprint-4	Dashboard	USN-19	As a admin, I should be able to access the dashboard with everything I am allowed to use.	2	Medium	SUBASH M SUDHARSAN S

6.2. Sprint Delivery Schedule

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	28	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	10	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	25	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	6	19 Nov 2022

6.3. Reports from JIRA



Projects / Smart Lender Application / Reports

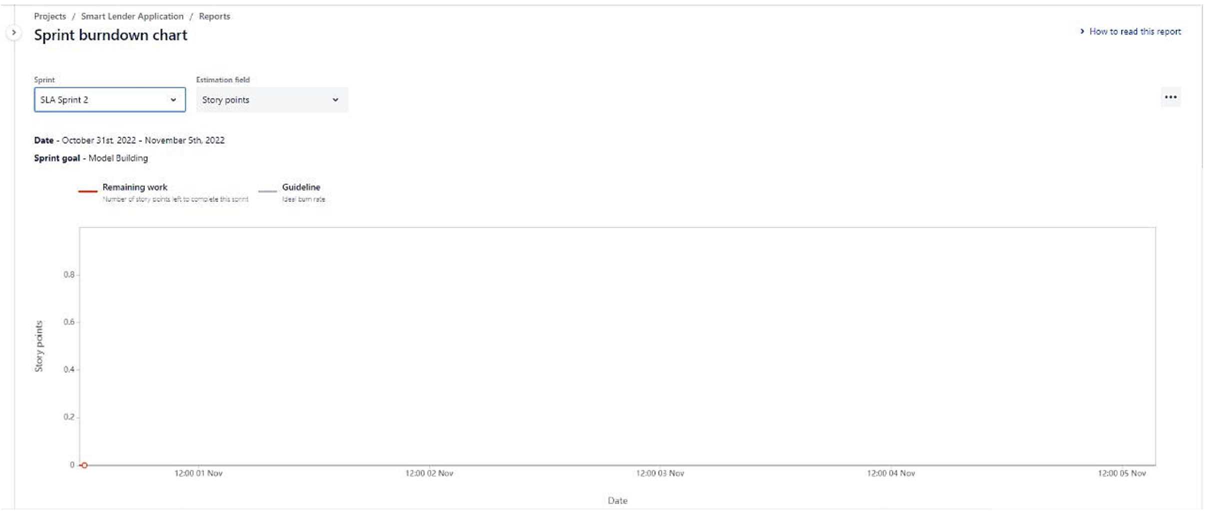
Sprint burndown chart

Sprint: SLA Sprint 1

Estimation field: Story points

Date - October 22nd, 2022 - October 24th, 2022

Sprint goal - Preprocessing



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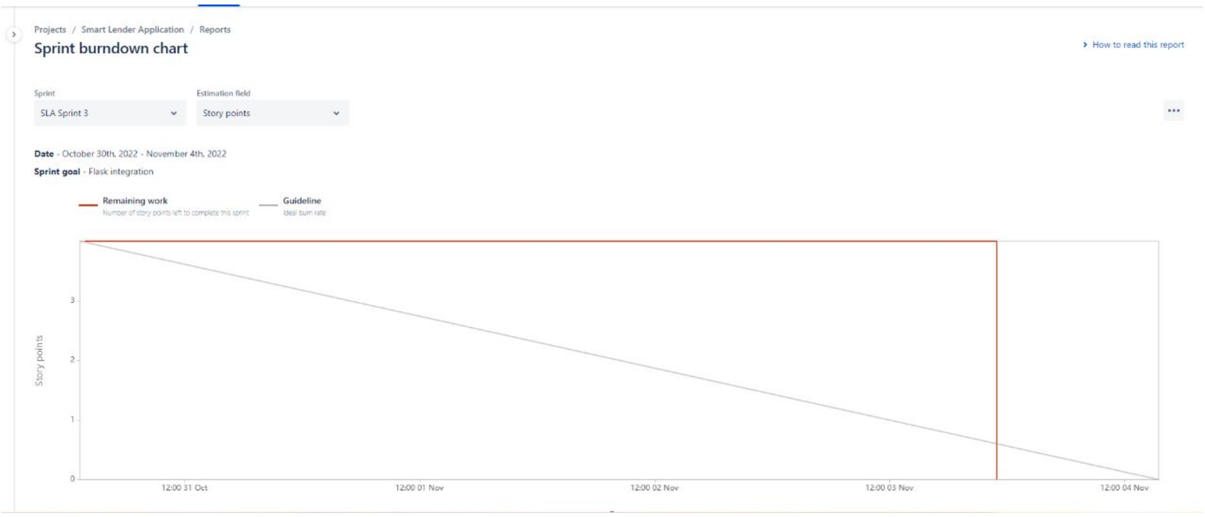
Sprint burndown chart

Sprint: SLA Sprint 2

Estimation field: Story points

Date - October 31st, 2022 - November 5th, 2022

Sprint goal - Model Building



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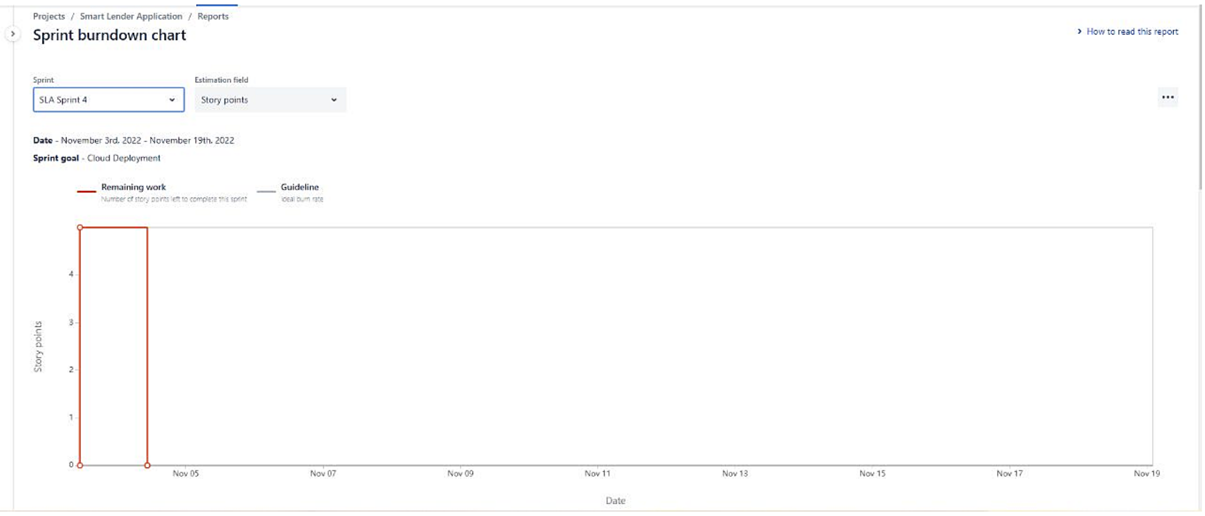
Sprint burndown chart

Sprint: SLA Sprint 3

Estimation field: Story points

Date - October 30th, 2022 - November 4th, 2022

Sprint goal - Flask integration



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Sprint burndown chart

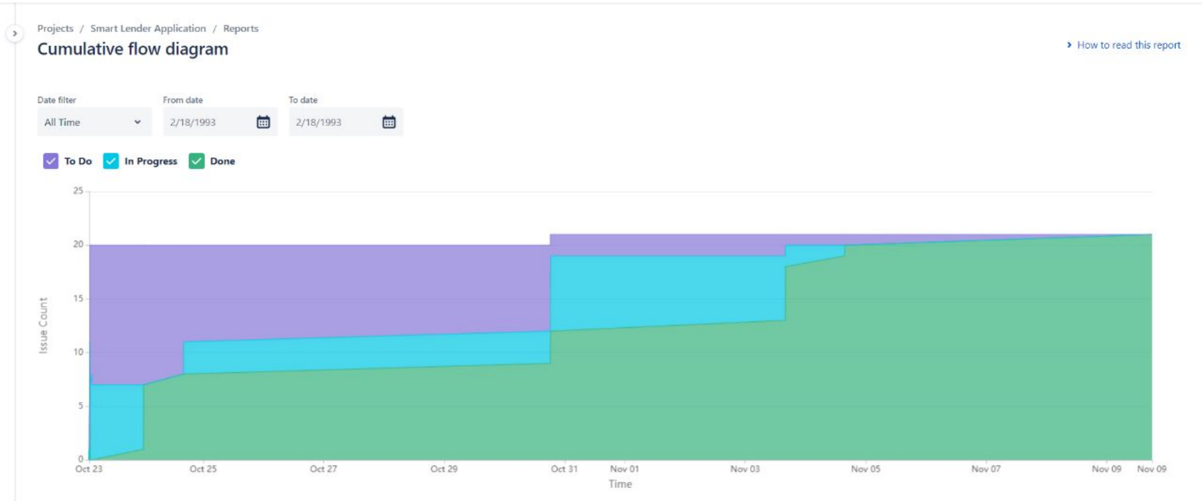
› How to read this report

Sprint: SLA Sprint 4

Estimation field: Story points

Date - November 3rd, 2022 - November 19th, 2022

Sprint goal - Cloud Deployment



Projects / Smart Lender Application / Reports

Cumulative flow diagram

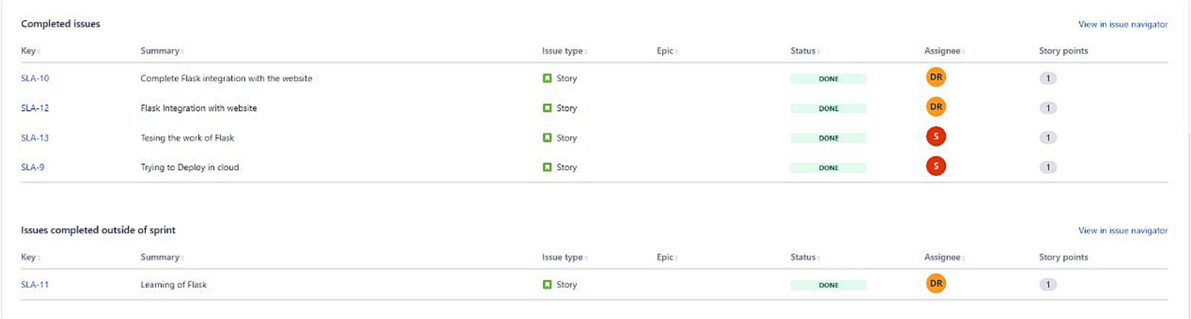
› How to read this report

Date filter: All Time

From date: 2/18/1993

To date: 2/18/1993

☑ To Do ☑ In Progress ☑ Done



Completed issues

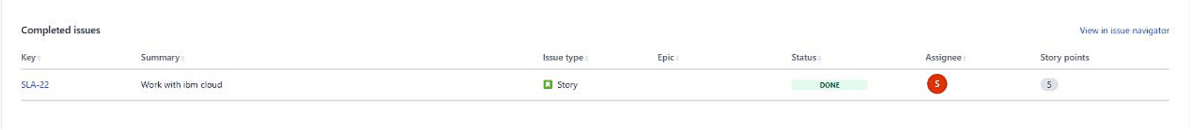
View in issue navigator

Key	Summary	Issue type	Epic	Status	Assignee	Story points
SLA-10	Complete Flask integration with the website	Story		DONE	DR	1
SLA-12	Flask Integration with website	Story		DONE	DR	1
SLA-13	Tesing the work of Flask	Story		DONE	S	1
SLA-9	Trying to Deploy in cloud	Story		DONE	S	1

Issues completed outside of sprint

View in issue navigator

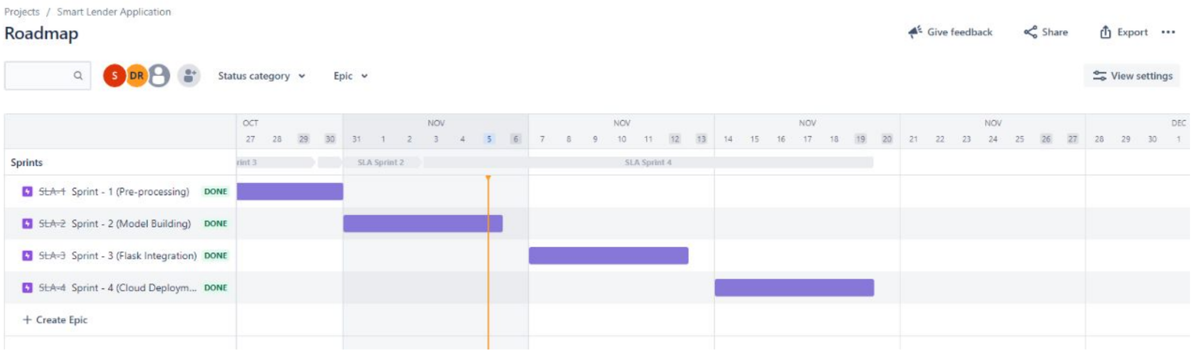
Key	Summary	Issue type	Epic	Status	Assignee	Story points
SLA-11	Learning of Flask	Story		DONE	DR	1



Completed issues

View in issue navigator

Key	Summary	Issue type	Epic	Status	Assignee	Story points
SLA-22	Work with ibm cloud	Story		DONE	S	5

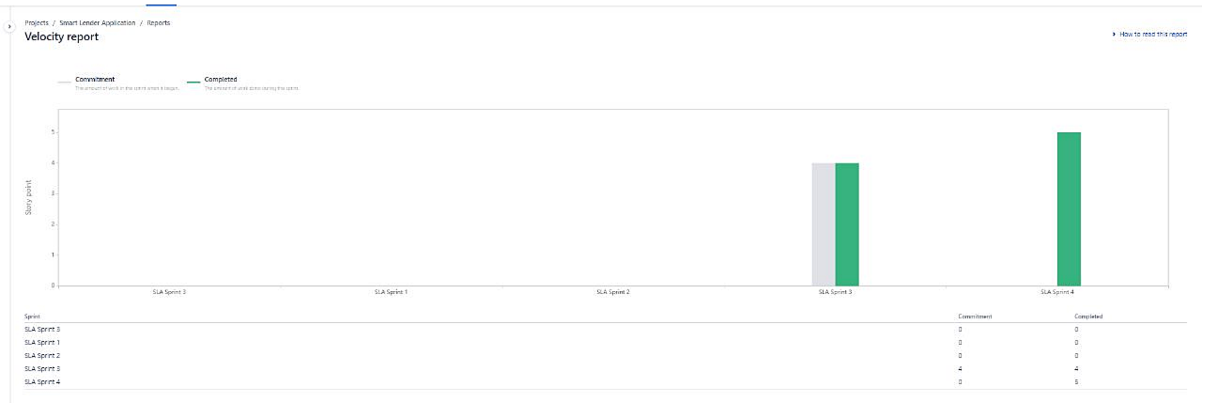


Projects / Smart Lender Application

Roadmap

Sprints

- ~~SLA-1~~ Sprint - 1 (Pre-processing) DONE
- ~~SLA-2~~ Sprint - 2 (Model Building) DONE
- ~~SLA-3~~ Sprint - 3 (Flask Integration) DONE
- ~~SLA-4~~ Sprint - 4 (Cloud Deploym... DONE



Projects / Smart Lender Application / Reports

Velocity report

Sprint	Commitment	Completed
SLA Sprint 3	0	0
SLA Sprint 1	0	0
SLA Sprint 2	0	0
SLA Sprint 3	4	4
SLA Sprint 4	0	5

7. CODING & SOLUTIONING

7.1. GUI using Flask

```
from flask import Flask, render_template,request

import numpy as np
import pandas
import pickle
import requests


# NOTE: you must manually set API_KEY below using information retrieved from your IBM Cloud account.
API_KEY = "Q92Y8v43ZM8xvzwRyRC9g5P1NKFv-AnXGtnDVSR4Fq6B"
token_response = requests.post('https://iam.cloud.ibm.com/identity/token', data={"apikey": API_KEY, "grant_type": 'urn:ibm:params:oauth:grant-type:apikey'})
mltoken = token_response.json()["access_token"]


header = {'Content-Type': 'application/json', 'Authorization': 'Bearer ' + mltoken}


app = Flask(__name__)
model = pickle.load(open(r'rdf.pkl','rb'))
@app.route("/", methods=['GET', 'POST'])
def home():
return render_template("home.html")
@app.route("/predict",methods=['POST','GET'])
def predict():
if request.method == 'POST':
project_name=request.form['full-name']
print(project_name)
```

```
return render_template("predict.html",project_name=project_name)

@app.route("/success",methods=['POST','GET'])
def evaluate():
input_feature = [int(x) for x in request.form.values()]
print(input_feature)
# input_feature=[np.array(input_feature)]
print(input_feature)
names = ['Gender', 'Married', 'Dependents', 'Education', 'Self Employed', 'Applicant Income', 'Coapplicant Income', 'Loan Amount', 'Loan_Amount_Term', 'Credit_History', 'Property_Area']

# NOTE: manually define and pass the array(s) of values to be scored in the next line
payload_scoring = {"input_data": [{"fields": [names],
"values": [input_feature]}]}

response_scoring = requests.post(
'https://us-south.ml.cloud.ibm.com/ml/v4/deployments/a05131f3-dcb8-46cd-bf08-1c2ecf28cc86/predictions?version=2022-11-13',
json=payload_scoring,
headers={'Authorization': 'Bearer ' + mltoken})
predictions = response_scoring.json()
prediction = predictions['predictions'][0]['values'][0][0]
print("Scoring response")
print(response_scoring.json())

print(prediction)



# data = pandas.DataFrame(input_feature, columns=names)

# print(data)

# prediction=model.predict(data)

# print(prediction)

# prediction = int(prediction)

# print(type(prediction))

loan=1

if (prediction == 0):

loan=0

return render_template("success.html",result = "Loan will Not be Approved",loan=loan)

else:

return render_template("success.html",result = "Loan will be Approved",loan=loan)

return render_template("success.html")



if __name__ == "__main__":

app.run(debug=True)
```

7.2. **Loan Prediction Model**

vigensh

```
import os, types
import pandas as pd
from botocore.client import Config
import ibm_boto3


def __iter__(self): return 0


# @hidden_cell
# The following code accesses a file in your IBM Cloud Object Storage.
It includes your credentials.
# You might want to remove those credentials before you share the
notebook.
client_5158bfd5065b40c4b6cf7e02a60cf879 =
ibm_boto3.client(service_name='s3',
ibm_api_key_id='Rob46tTNo97O_Wdw9cPUe7whW_akOBfAuD9qWugyZBTB',
ibm_auth_endpoint="https://iam.cloud.ibm.com/oidc/token",
config=Config(signature_version='oauth'),
endpoint_url='https://s3.private.us.cloud-object-
storage.appdomain.cloud')


body =
client_5158bfd5065b40c4b6cf7e02a60cf879.get_object(Bucket='ibmsmartlend
er-donotdelete-pr-fn1gcvrcmxp1mg',Key='test.csv')['Body']
# add missing __iter__ method, so pandas accepts body as file-like
object
ifnot hasattr(body, "__iter__"): body.__iter__ = types.MethodType(
__iter__, body )


test = pd.read_csv(body)
test.head()
body =
client_5158bfd5065b40c4b6cf7e02a60cf879.get_object(Bucket='ibmsmartlend
er-donotdelete-pr-fn1gcvrcmxp1mg',Key='train.csv')['Body']
# add missing __iter__ method, so pandas accepts body as file-like
object
```

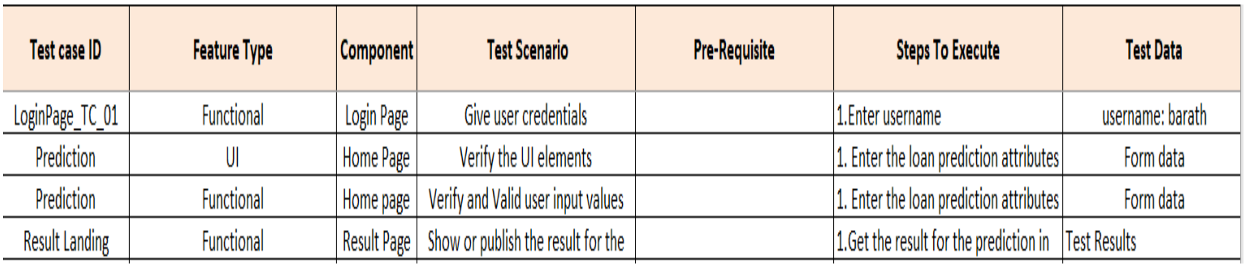
```
   ifnot hasattr(body, "__iter__"): body.__iter__ = types.MethodType(
   __iter__, body )



   train= pd.read_csv(body)
   train.head()

import pandas as pd

import numpy as np

from sklearn.preprocessing import MaxAbsScaler

from sklearn.tree import DecisionTreeClassifier

from sklearn.ensemble import RandomForestClassifier

from sklearn.neighbors import KNeighborsClassifier

from sklearn.ensemble import GradientBoostingClassifier

from sklearn.metrics import confusion_matrix

from sklearn.metrics import classification_report

from sklearn.model_selection import cross_val_score

from sklearn.metrics import f1_score

import pickle

scaler = MaxAbsScaler()

train_y = train.iloc[:,-1]

train_x = train.drop('Loan_Status',axis=1)


test_y = test.iloc[:,-1]

test_x = test.drop('Loan_Status',axis=1)

x = pd.concat([train_x,test_x],axis=0)

y = pd.concat([train_y,test_y],axis=0)

train_x = scaler.fit_transform(train_x)

test_x = scaler.transform(test_x)
```

```
dt = DecisionTreeClassifier()

dt.fit(train_x,train_y)

y_pred = dt.predict(test_x)

print("**** Decision Tree Classifier ****")

print('Confusion Matrix')

print(confusion_matrix(test_y,y_pred))

print('Classification Report')

print(classification_report(test_y,y_pred))

pipinstallibm_watson_machine_learning

fromibm_watson_machine_learningimportAPIClient

importjson

wml_credentials={

"apikey":"Q92Y8v43ZM8xvzwRyRC9g5P1NKFv-AnXGtnDVSR4Fq6B",

"url":"https://us-south.ml.cloud.ibm.com"

}

wml_client = APIClient(wml_credentials)

wml_client.spaces.list()

SPACE_ID="e0110185-f0c8-4302-9c8f-86950f64071c"

wml_client.set.default_space(SPACE_ID)

wml_client.software_specifications.list(100)

importsklearn

sklearn.__version__

MODEL_NAME='Model_building_SL'

DEPLOYMENT_NAME='loan approval api'

DEMO_MODEL=dt

software_spec_uid =
wml_client.software_specifications.get_id_by_name('runtime-22.1-py3.9')

model_props = {
```

```
wml_client.repository.ModelMetaNames.NAME: MODEL_NAME,

wml_client.repository.ModelMetaNames.TYPE: 'scikit-learn_1.0',

wml_client.repository.ModelMetaNames.SOFTWARE_SPEC_UID: software_spec_uid

}

model_details = wml_client.repository.store_model(

model=DEMO_MODEL,

meta_props=model_props,

training_data=train_x,

training_target=train_y

)

model_details

model_id=wml_client.repository.get_model_id(model_details)

model_id

deployment_props = {

wml_client.deployments.ConfigurationMetaNames.NAME:DEPLOYMENT_NAME,

wml_client.deployments.ConfigurationMetaNames.ONLINE: {}

}

deployment = wml_client.deployments.create(

artifact_uid=model_id,

meta_props=deployment_props

)
```

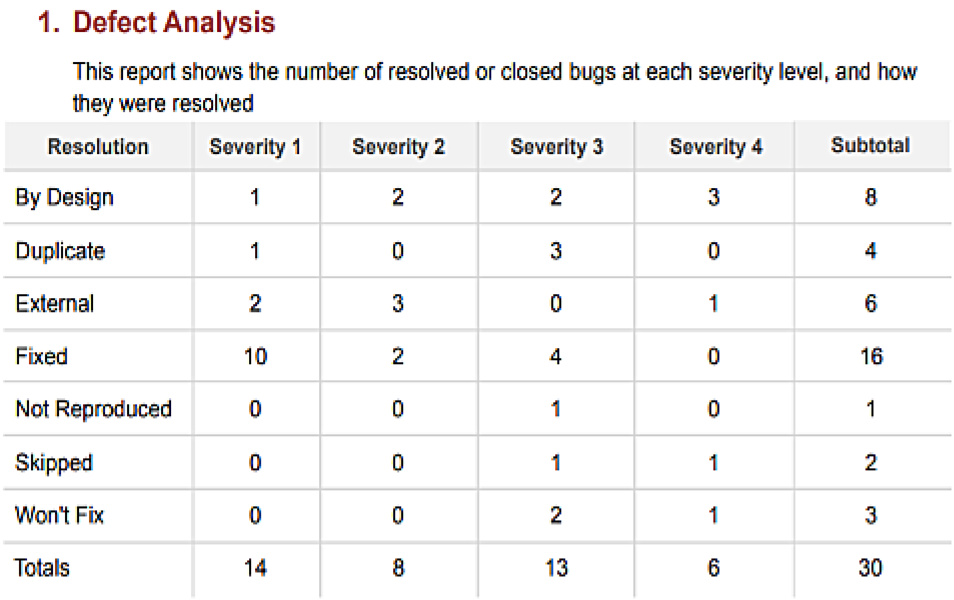
8. TESTING

8.1. Test Cases



Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data
LoginPage_TC_01	Functional	Login Page	Give user credentials		1.Enter username	username: barath
Prediction	UI	Home Page	Verify the UI elements		1. Enter the loan prediction attributes	Form data
Prediction	Functional	Home page	Verify and Valid user input values		1. Enter the loan prediction attributes	Form data
Result Landing	Functional	Result Page	Show or publish the result for the		1.Get the result for the prediction in	Test Results

8.2. User Acceptance Testing

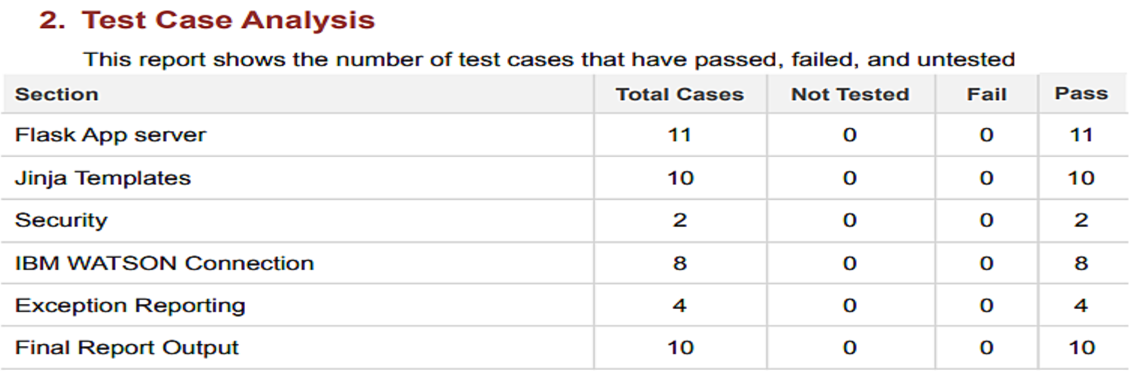


1. Defect Analysis

This report shows the number of resolved or closed bugs at each severity level, and how they were resolved

]

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	1	2	2	3	8
Duplicate	1	0	3	0	4
External	2	3	0	1	6
Fixed	10	2	4	0	16
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	1	2
Won't Fix	0	0	2	1	3
Totals	14	8	13	6	30



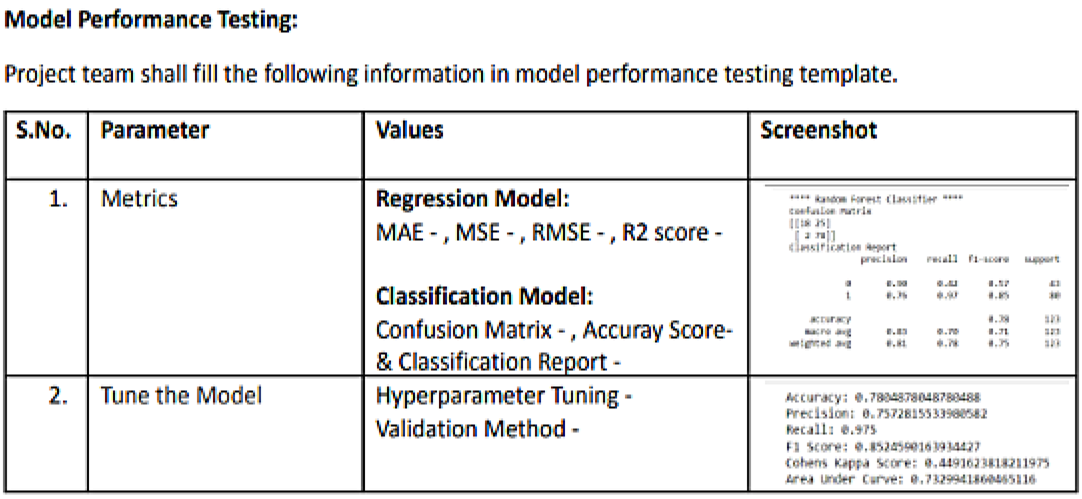
2. Test Case Analysis

This report shows the number of test cases that have passed, failed, and untested

Section	Total Cases	Not Tested	Fail	Pass
Flask App server	11	0	0	11
Jinja Templates	10	0	0	10
Security	2	0	0	2
IBM WATSON Connection	8	0	0	8
Exception Reporting	4	0	0	4
Final Report Output	10	0	0	10

9. RESULTS

9.1. Performance Metrics



Model Performance Testing:

Project team shall fill the following information in model performance testing template.

S.No.	Parameter	Values	Screenshot
1.	Metrics	**Regression Model:** MAE - , MSE - , RMSE - , R2 score - **Classification Model:** Confusion Matrix - , Accuray Score- & Classification Report -	**** Random Forest Classifier **** confusion matrix [[18 25] [2 78]] classification Report precision recall f1-score support 0 0.90 0.42 0.57 43 1 0.76 0.97 0.85 80 accuracy 0.78 123 macro avg 0.83 0.70 0.71 123 weighted avg 0.81 0.78 0.75 123
2.	Tune the Model	Hyperparameter Tuning - Validation Method -	Accuracy: 0.7804878048780488 Precision: 0.7572815533980582 Recall: 0.975 F1 Score: 0.8524590163934427 Cohens Kappa Score: 0.4491623818211975 Area Under Curve: 0.7329941860465116

10. ADVANTAGES & DISADVANTAGES

Pros:-

- Provide a better user experience to improve the speed and accuracy of loan applications
- Process a larger number of loan applications with existing resources
- Eliminate sources of human error for faster, better-quality evaluation decisions
- Establish predictable, repeatable, and auditable processes that support compliance
- Reduce delays and costs associated with paper processes
- Analyze process and loan performance with the goal of continually improving efficiency and profitability

11. CONCLUSION

Smart Lender offers all the operational efficient processes involved in the end-to-end Credit Loan Origination, Assessment and Management. Considering the labor-intensive task of Lending, Commercial Loan Origination is made easy with SmartLender driven by best market practice processes.

12. FUTURE SCOPE

The future seems to be highly promising. Few years down the lane, banks will be serving fewer clients physically while having a deeper relationship with them. Robots will serve as a means to store data and could work alongside humans which will help them to work more efficiently (Jeet, 2015). There will be robot advisors in the future banks which will help people to make correct financial decisions and prevent them from making unsound decisions. The future banking may be completely replaced by platforms run by robots. As mentioned in the article “Robotics in Banking, 2015”, the Robotic Process Automation or what Andrew Burgess, an outsourcing advisor, calls “robotic software agents”, does not depend on arms and legs but has a powerful impact when it comes to repetitive processes that are rules-based and frequent. Banks can entertain queries all through the day and night using this Robotic Process Automation, which will in effect prove to be considerably economic than remunerating an employee.

13. **APPENDIX**

GitHub Link : https://github.com/IBM-EPBL/IBM-Project-18527-1659686397

Project Demo Link : https://drive.google.com/file/d/1BFL6R5QBNH78QBnjcaQtwV96XlC4bUcd/view?usp=share_link