A

PROJECT DESIGN REPORT

ON

"Discounting rate prediction model based on the customer's profile for Ecommerce website"

For the subject **Lab1 Project Phase 1**

Submitted in partial fulfillment of the requirement for the award of

Bachelor of Engineering

In

Computer Science and Engineering

Solapur University, Solapur

By

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Certificate

This is to certify that the project entitled

“Discounting rate prediction model based on the customer's profile for Ecommerce website”

Is submitted by

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Software Design Specification Document

Discounting rate prediction model based on the customer's profile for Ecommerce website

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Introduction

1.1 System Overview

The project aims to build a machine learning model which will predict the discount for ecommerce sites based on the customer's profile. The loyalty of the customer is taken into consideration to offer the discount. When a customer places an order on an ecommerce site, the customer will get a specific discount based on his ecommerce profile.

The process behind this includes, when order is placed by the customer at that time the data of the customer is sent to API. The Discount Prediction API will provide customer data to the Machine Learning model. ML models predict the result. Then the result is sent back to the web interface through an API.

The Ecommerce website will build as a front end for this system. A plugin will develop which will add this discount prediction API feature on ecommerce websites. While a customer adds a product to cart this plugin will activate and send data to the API and take a discounted amount and send it to an ecommerce website which will apply on product price respectively.

1.2 Definitions, Acronyms, and Abbreviations

- **RFM** = Recency Frequency Monetary Value
  - Recency – How recently did the customer purchase?
  - Frequency – How often do they purchase?
  - Monetary Value – How much do they spend? [1]
- **CUDA** = Compute Unified Device Architecture[2],[3]
- **API** = Application Programming Interface
- **ML** = Machine Learning
- **ECommerce** = Electronic Commerce or Internet Commerce

1.3 References

[1] https://en.wikipedia.org/wiki/RFM; customer_value;
[2] https://developer.nvidia.com/cuda-toolkit;CUDA toolkit;
[3] https://en.wikipedia.org/wiki/CUDA;CUDA toolkit;
[4] https://en.wikipedia.org/wiki/TensorFlow; Scikit-learn;
[5] https://www.tensorflow.org/;Tensorflow;
[6] https://en.wikipedia.org/wiki/Keras;Keras;
[7]https://www.cs.waikato.ac.nz/ml/weka/; Weka tool;
[8]https://flask.palletsprojects.com/en/1.1.x/tutorial/; Python Flask;

1.4 Document Map

Section 1: Introduction

These sections mainly focus on system overview , which includes a brief introduction of system overview and definitions used in this document and the references are mentioned which are used for the document.

Section 2: Design Considerations

This section includes assumptions, constraints, system environment and mainly focuses on design methodology used for this project.

Section 3: Architectural (High-Level Design)

This section talks about top-level design, system architecture, view system and provides base for further detailed design work.

Section 4: Low Level Design

This section talks about detailed study of each component shown in high level design.

Section 5:User Interface Design

This section discusses the common look of user interface.(Menus, popup menus etc.)

Design Considerations

2.1 Assumptions

- Consider a dataset which consists of RFM factors , Product Categories , Age , Product Brand etc.
- Design must consist of Following libraries: *Scikit-learn, keras, Tensorflow*.
- Accuracy of Client's data should be high and features mentioned above should be in data. (Client : *eCommerce site* eg. Flipkart, Amazon etc.)
- Currently assumed hardware is robust to tackle failure situations in future.
- System will always prefer profit to both customer and retailer.
- System will Compatible to all ecommerce websites.

2.2 Constraints

- The dataset on which training has to perform that should be accurate and consist of proper attributes.
- API should be in working state for 24/7.
- Considering only attributes of customer profile on an Ecommerce site which will be used as features to ML model.
- Python 3.6 and some necessary libraries like Scikit-learn 0.0[4], Tensorflow 1.12[5], Keras 2.2.5[6]etc.
- Ecommerce should have a prebuilt system that can be used to activate a plugin.

2.3 System Environment

Processor: 2.5 gigahertz (GHz) or faster processor.
RAM: 8 GB or more
Hard drive space: 48 GB for 64-bit OS or Higher
Display: 1920x1080
Operating Systems: Linux 18.04 or Higher,Windows 10
GPU: NVIDIA GTX 1050(4 gb) Compute Capability 3.5 or higher.
Language: Python 3.6
Tool: Anaconda 3-5.2.0-Linux, Anaconda3-5.2.0-Windowsx86_64, Xampp v3.2.4
Internet Connection: Internet connectivity is necessary to download some Libraries. Internet connection required during the training of the ML model.

2.4 Design Methodology

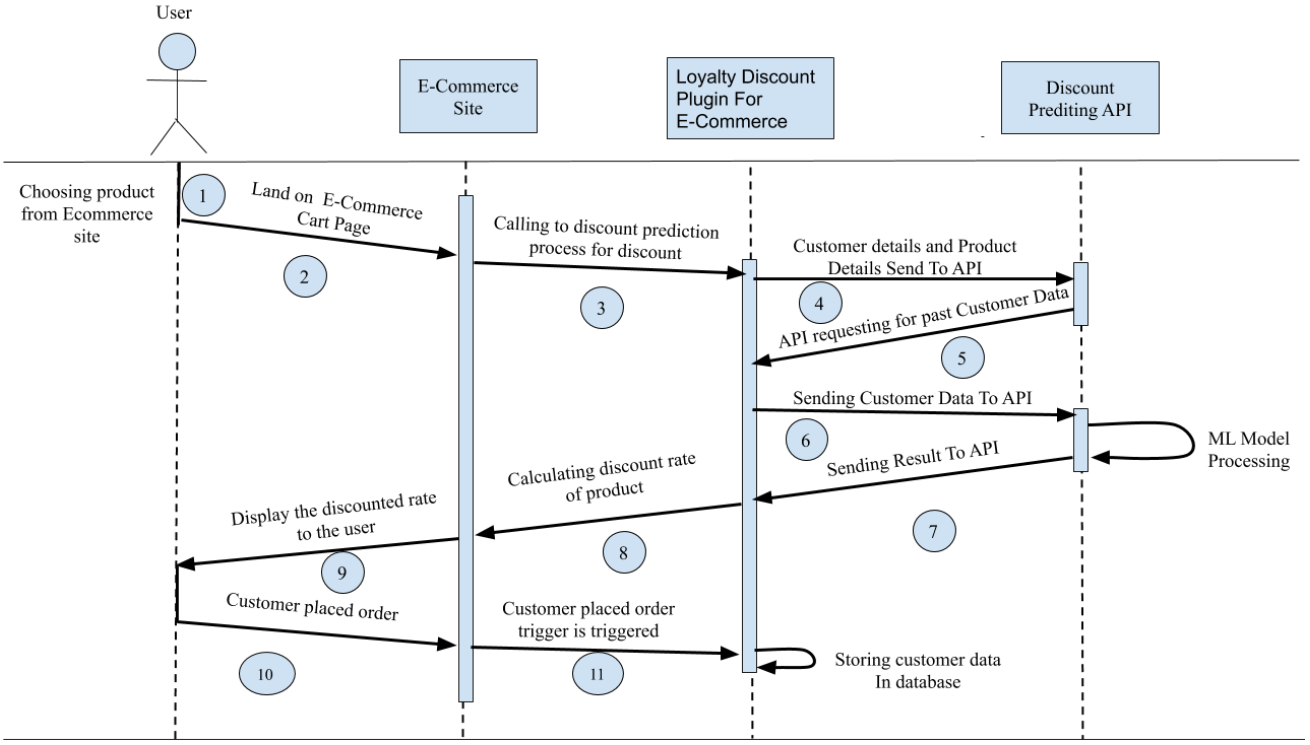


Fig 2.1 UML Sequence Diagram

Fig 2.1 shows the approach that will be used to develop this system.

A customer will visit an ecommerce site for shopping. When a customer selects some product and adds it to the cart, a call will be made to the loyalty discount plugin.

Customer required details will be sent to the API, API requests for previous transaction data(past data) to plugin for further process. The API will process data as per ML model is trained on and send customer's processed data to the ML model. ML model will predict appropriate discount for that customer. Once a result is predicted it will be sent to the plugin.

Plugin calculates the discount rate of product i.e deduct the discounted price from original price. And it will be displayed to customer. Customer will place an order, then customers' translation data will be updated in the database for future use.

Architectural (High-level) Design

3.1 Overview

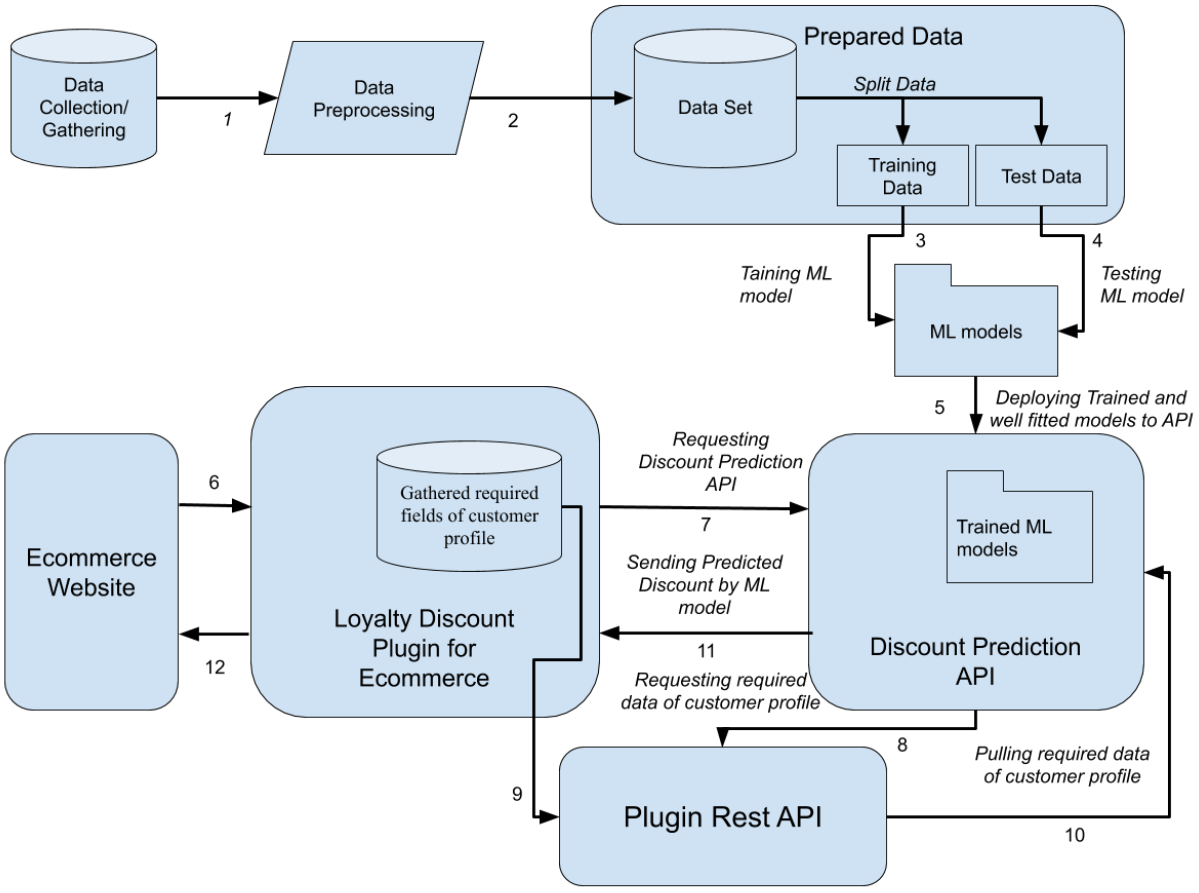


Fig.3.1 System Architecture

3.1.1 Data Collection:

Data should consist of attributes that are necessary to give a discount based on the customer's loyalty. Such datasets related to ecommerce are collected in a systematic fashion.

3.1.2 Data Preprocessing:

Real-world data is often incomplete, inconsistent, and lacking in certain behavior trends and likely contains many errors. Data processing includes transforming raw data into an understandable format.

3.1.3 Prepared Data:

After data collection and data pre-processing the prepared data will be saved in the required format (like CSV).

3.1.4 Splitting Data:

Partition of data into training data and test data. Splitting training data in Training data and validation data.

3.1.5 Machine Learning Model:

ML model built using the ML algorithm. The different algorithms are suitable to solve the problem and a model trained on the training dataset using those algorithms. The algorithm giving a good performance will be chosen.

3.1.6 Ecommerce Website and Loyalty Discount Plugin:

The plugin is used to provide discount prediction features to the ecommerce website. Customers will select products for shopping then the Loyalty discount plugin will request a discount predicting API for checking any discount is applicable for that customer. If a discount is applicable then a discounted amount will be shown to the customer for that product.

3.1.7 Loyalty Discount Plugin Rest API:

The Rest API is a part of a plugin that provides communication between the plugin database and discount prediction API or any other, like sending the required customers data to the discount prediction API. Rest API should have an authentication to identify who is accessing data. To check if the user is authenticated or not.

3.1.8 Discount Prediction API:

ML model should be deployed on flask based Discount Prediction API. When plugin requests for discount to discount prediction API. Then the attributes of the customer profile which are required for prediction of discount should be pulled by Plugin REST API. In the form of JSON. Pulled data is preprocessed as per model trained and then data is passed to the ML model. ML model predicts the discount for that customer data. API should send the result back to Plugin.

3.2 Rationale

This project is about developing a Machine Learning model which predicts the discounts for Ecommerce sites based on fields of customer profile (such as RFM factor, customer transaction history, etc). An API is built, which will communicate between Ecommerce site and ML Model. Discount prediction plugin will develop to provide the discount prediction features to Ecommerce site that is the reason for choosing the above architecture.

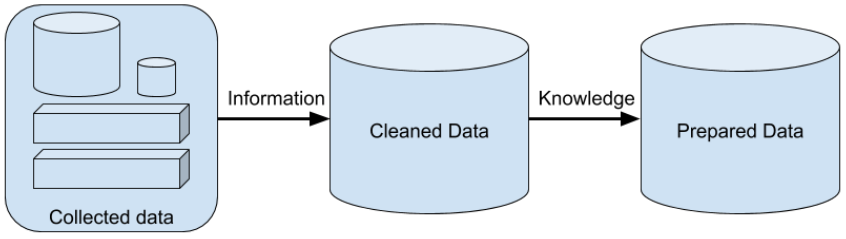
Low Level Design

4.1 Machine Learning Model

4.1.1 Data Exploration:

The different datasets related to e-commerce explored and the suitable dataset having all required features will be chosen.

4.1.2 Data Preprocessing:



Data Preprocessing

Once the dataset obtained then we need efficient data from that, so it is necessary to clean it by handling missing and noisy data. And by analyzing that data find the features which affect more on prediction of discount. The dataset will be obtained after preprocessing.

4.1.3 Model Building:

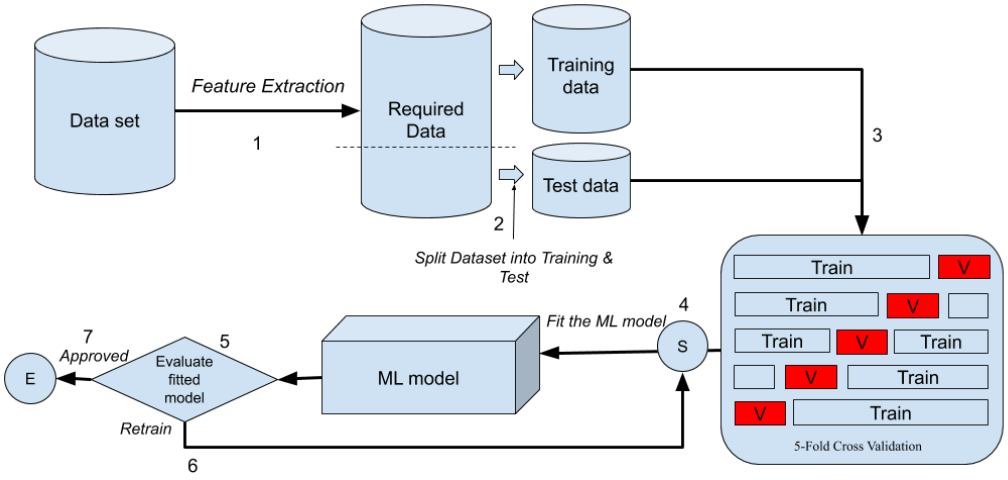


Fig.3.2 ML model Overview

Before starting with ML model building, the data will be analysed using the Weka[7] tool and different algorithms applied over it and checked for accuracy of each algorithm. Based on that, choosing the proper algorithm to build the ML model.

To obtain the required data feature extraction process will be used. The proper split of the dataset will be used as training data and testing data. The stratified sampling and cross validation will be used to make use of all data for training and testing.

4.2 Discount Prediction ML model API(flask API):

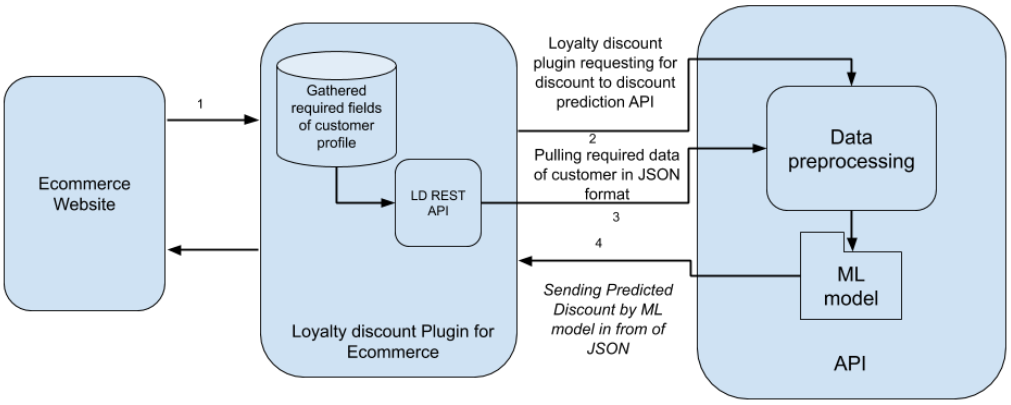


Fig 3.3 Discount Prediction ML model API Low Level Architecture

The Flask[8] API will be used for communication between ML models and ecommerce sites. As the Flask is easy to set up. Deploying a ML model on API for providing the feature of discount prediction to ecommerce sites.

1. Requests to the flask will contain customer details and product details.
2. Flask API will send a request to loyalty discount plugin for customer data.
3. The plugin will send the data back to API.
4. API will process data as per ML model is trained.
5. After that pass data to the ML model.
6. ML model predicts a discount.
7. Then the flask API will send the predicted discount result back to the plugin.

4.3 Plugin Development:

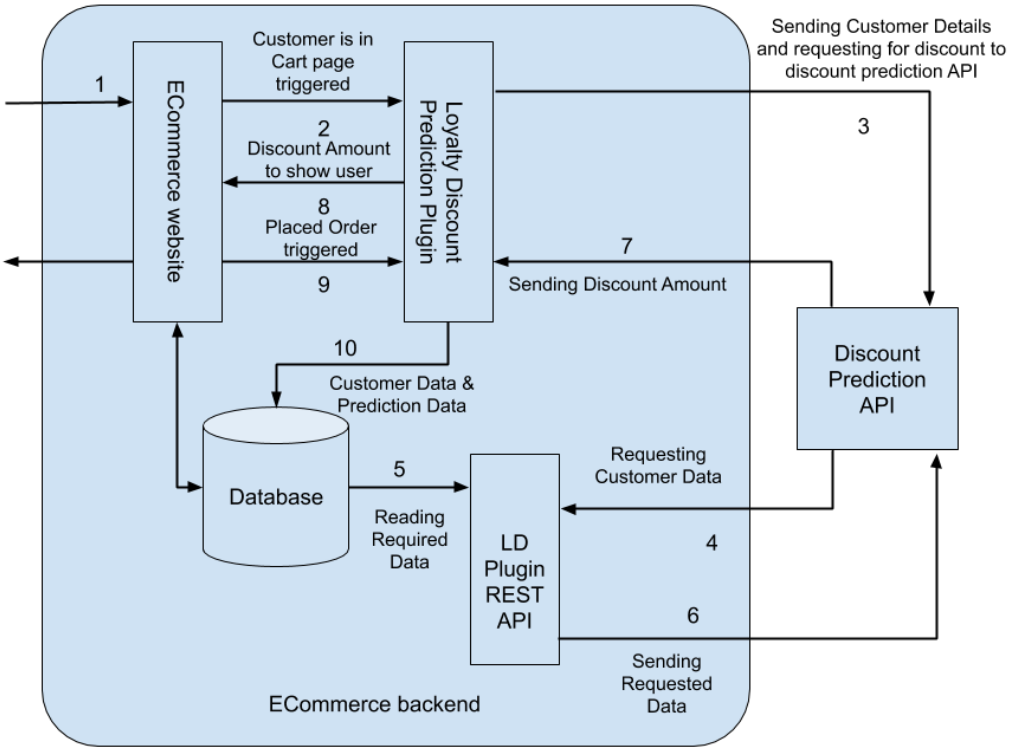


Fig 3.4 Custom Plugin Development

1. Customers will land on a website and look for products for shopping.
2. When a customer will add a product to the cart and go to the cart page, a call will made to the loyalty discount plugin.
3. Then a loyalty discount plugin will request a discount prediction API for predicting discounts on products added into the cart by passing data which will contain customer details.
4. After receiving a request from a plugin, the discount prediction API will request for the past transaction data of the customer to the plugin Rest API.
5. The plugin Rest API will fetch the details of past transactions of the customer which will be maintained in some database and that data will be retrieved in the plugin REST API.
6. Plugin REST API will send requested data to the discount prediction API.
7. The Discount prediction API will process data and will send the predicted results to the plugin.
8. The plugin will calculate and send a discounted amount to the ecommerce site which will be the final price of that product for that customer.
9. Customer will place an order on an ecommerce site.
10. After successful completion of the transaction, customer details along with transaction details will update in the database for future discount prediction.