**[ Project Code: PLNB ]**

**Personal Loan acquisition using Naive Bayes Classifier based Learning Model**

**Project Duration : 23-March-2025 ~~ 13-April-2025**

**Submission Information : (via) Google Forms**



**Objective:**

There is a bank with an expanding customer base. The vast majority of these customers are liability customers (depositors) with varied deposit amounts. The number of clients who are also borrowers (asset customers) is fairly modest, and the bank is keen on swiftly increasing this base in order to bring in more loan business and, as a result, generate more money through loan interest. The management wants to look into ways to convert its liability customers to personal loan customers (while keeping them as depositors).

Last year, the bank executed a campaign for liability customers that resulted in a solid conversion rate of more than 9% success. This has prompted the retail marketing department to develop campaigns to improve target marketing in order to raise success ratios with a limited budget.

The department wishes to create a model that will assist them in identifying possible clients who are more likely to purchase the loan. This will boost the success ratio while decreasing the campaign's cost.

Training Data Description: The **attribute** Information is given as follows.

The dataset contains various attributes of bank customers and whether they accepted a personal loan offered during the bank's previous campaign. It includes the following features:

* ID: Unique identifier for each customer.
* Age: Customer's age in completed years.
* Experience: Number of years of professional experience.
* Income: Annual income of the customer in thousands of dollars ($000).
* ZIP Code: Home address ZIP code of the customer.
* Family: Family size of the customer.
* CCAvg: Average monthly spending on credit cards in thousands of dollars ($000).
* Education: Level of education classified as 1: Undergrad; 2: Graduate; 3: Advanced/Professional.
* Mortgage: Value of house mortgage if any, in thousands of dollars ($000).
* Personal Loan: Binary attribute indicating whether the customer accepted the personal loan offered during the last campaign (1: Accepted, 0: Not Accepted).
* Securities Account: Indicates if the customer has a securities account with the bank (1: Yes, 0: No).
* CD Account: Indicates if the customer has a certificate of deposit (CD) account with the bank (1: Yes, 0: No).
* Online: Indicates if the customer uses internet banking facilities (1: Yes, 0: No).
* CreditCard: Indicates if the customer uses a credit card issued by the bank (1: Yes, 0: No).

1. Based on the dataset (described earlier), you will write a program to learn a **Gaussian Naive Bayes Classifier.**
2. Compare the results with the results generated by the Naive Bayes classifier learning algorithm from a pre-created package such as scikit-learn.

***Note:*** *The program can be written in C / C++ / Java / Python programming language from scratch. No machine learning /data science /statistics package / library should be used.*

**DataSets:**

Filename: loan.csv

**Tasks to be done:**

1. In the dataset given the features are continuous,hence use Gaussian Naive Bayes for solving this problem.
2. Randomly split the dataset as 80/20 split i.e., 80% for training and 20% for testing.
3. Naive Bayes Classifier Model:

a. Implement naive bayes algorithm in your code and mention the same in the report. Do NOT use scikit-learn for this part.

b. Test the implementation of the Classifier from scikit-learn package.

1. Classification Report:
2. Create a classification report in tabular form.
3. You need to calculate precision, recall, f1-score and accuracy of the model.

***Submission Details:***

1. ZIPPED Code Distribution having your code (without using any standard libraries), code using standard libraries, and code using some generative AI tool in [Google Forms](https://docs.google.com/forms/d/e/1FAIpQLSfwh7TrVxtpwz6vfw2Oxn3Rxebd6V9AHMfPaKf67CXEQ8jV6w/viewform?usp=header)
2. A brief (2-3 page) report/manual of your work

(with your hyperparameter tuning results also presented in that report)

**Submission Guidelines:**

1. You may use one of the following languages: C/C++/Java/Python.
2. Your Programs should run on a Linux Environment.
3. You are **not** allowed to use any library apart from these (Also explore all these libraries if doing in Python, or equivalent of these):

import numpy # linear algebra

import csv # data processing, CSV file I/O

import pandas # data processing, CSV file I/O

from sklearn.model\_selection import train\_test\_split

from sklearn.metrics import accuracy\_score

from sklearn.metrics import classification\_report

from sklearn.model\_selection import KFold

from sklearn.tree import DecisionTreeClassifier # sklearn Decision Tree

from sklearn.naive\_bayes import MultinomialNB # sklearn Naive Bayes

from sklearn.naive\_bayes import GaussianNB # sklearn Naive Bayes

import operator

from math import log

from collections import Counter

Your program should be standalone and should **not** use any *special purpose* library for Machine Learning for the naive bayes algorithm. Numpy and Pandas may be used. And, you can use libraries for other purposes, such as generation and formatting of data.

1. You should submit the program file and README file and **not** the output/input file.
2. You should name your file as <RollNo\_ProjectCode.extension>.

(e.g., *23XXXXXXX\_DCDT.zip* for code-distribution and *23XXXXXXX\_DCDT.pdf* for report)

1. The submitted program file *should* have the following header comments:

# Roll Number : Name

# Project Number

# Project Title

1. Submit through [Google Forms](https://docs.google.com/forms/d/e/1FAIpQLSfwh7TrVxtpwz6vfw2Oxn3Rxebd6V9AHMfPaKf67CXEQ8jV6w/viewform?usp=header) only.  
   Link to our Course page: https://cse.iitkgp.ac.in/~aritrah/course/theory/FADML/Spring2025/

***You should not use any code available on the Web. Submissions found to be plagiarised or having used ML libraries (except for parts where specifically allowed) will be awarded zero marks.***

**For any questions about the assignment, contact the following TA:**

**Aritra Hota ( Email:** [**aritra828207@gmail.com**](mailto:aritra828207@gmail.com) **)**