

Domain Background

This project aims to design a machine learning model that can optimize the best offer for a group of customers based on their preferences and behaviors. The data source for this project is a simulated dataset from Starbucks, the world’s largest coffeehouse company and a leader in customer loyalty programs.

Starbucks launched its rewards program and mobile app to collect and analyze data about its customers and their purchasing habits. The data contains information about how customers respond to different types of promotional offers, such as buy-one-get-one (BOGO), discount, and informational offers.

Each customer has some hidden and observable traits that affect their purchasing patterns and offer preferences. The data also records various events that customers produce, such as receiving, opening, and completing offers, as well as making purchases. The data does not track specific products, but only the amounts of each transaction or offer. The offers can be delivered through various channels, such as email, mobile, social, and web.

Problem Statement

The goal of this project is to build a machine learning model that can predict if a customer will accept an offer. The model will use the simulated data from Starbucks to learn the patterns and preferences of the customers and predict how they will react to various offers. The model will help Starbucks increase its revenue and customer loyalty by providing personalized and relevant offers to the customers.

The following libraries are used:

- `pandas`
- `numpy`
- `scikit`
- `matplotlib`

Solution Statement

The data of the three main files mentioned in Datasets and Inputs sections will be cleaned, transformed and denormalized to describe an offer.

I will rely on the model accuracy and F1 scores to test & verify the model. Many machine learning algorithms (logistic regression, random forest and gradient boost) will be tried and then the best performing one will be picked. Hyperparameters tuning to be applied to achieve the best accuracy and F1-score.

Datasets and Inputs

The dataset consists of 3 main files

1. profile.json: Rewards program users (17000 users x 5 fields)

Column	Datatype	Description
gender	categorical	M, F, O, or null
age	numeric	missing value encoded as 118
id	string/hash	

Column	Datatype	Description
became_member_on	date	format YYYYMMDD
income	numeric	

2. portfolio.json: Offers sent during 30-day test period (10 offers x 6 fields)

Column	Datatype	Description
reward	numeric	money awarded for the amount spent
channels	list	web, email, mobile, social
difficulty	numeric	money required to be spent to receive reward
duration	numeric	time for offer to be open, in days
offer_type	string	bogo, discount, informational
id	string/hash	

3. transcript.json: Event log (306648 events x 4 fields)

Column	Datatype	Description
person	string/hash	
event	string	offer received, offer viewed, transaction, offer completed
value	dictionary different values depending on event type	
offer id (value)	string/hash	not associated with any "transaction"
amount (value)	numeric	money spent in "transaction"
reward (value)	numeric	money gained from "offer completed"
time	numeric	hours after start of test

Predictive Model Results

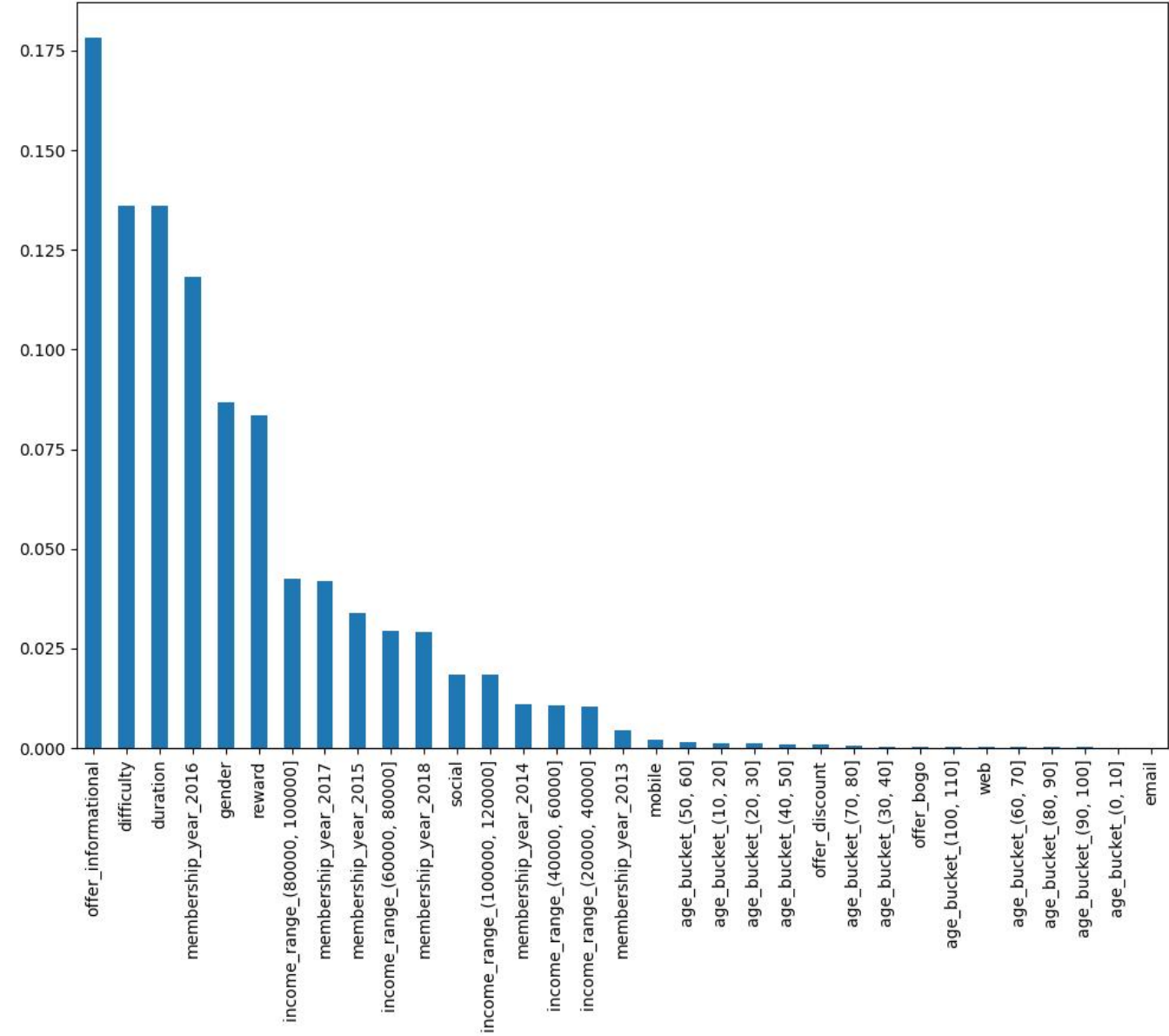
After tuning the hyperparameters, **The Gradient Boosting Model**, using the below hyperparameters slightly outperforms the others:

- learning_rate: 0.1
- max_depth: 5
- n_estimators: 50

Algorithm	F1 Score	Accuracy Score
Logistic Regression	0.7587440097274873	0.778906659674882

Algorithm	F1 Score	Accuracy Score
Random Forest	0.7615290826938249	0.7820529627687467
Gradient Boosting	0.7578039330360407	0.7828395385422129

Summary and Feature Importance



offer_informational is the most important feature used by the Gradient Boosting model
difficulty offer difficulty reflects the amount spent by the customer
duration reflects the duration of the offer membership_year_2016 customers joined in 2016

Passing only the top important features to the Gradient Boosting model can result in more accuracy and F1 score results