Artificial Intelligence

Term Project

on

Predictive Shopping item Modelling

Machine Learning Model

By

Yash Rajendra Tiwari

yrtiwari@uwm.edu

Introduction

In the world of AI, prediction holds a lot of importance, be it in stock market price prediction or what will happen in future. The project that I have been working on is based on prediction.

Shopping cart item prediction, sound quite interesting. Imagine a scenario when you only need to remember to check your phone and not care about what items that are left in your fridge. This is something predictive shopping item modelling aims.

In predictive shopping item modelling, prediction is made to determine the item that the user might need in the next 7 day of span. Acting as user for past three months, and collecting data, I was able to observe quite a lot about my own shopping patterns and the item that I bought which gave a lot of insight that help build this project.

In all, this project aims to use Machine Learning Algorithm to create a system where prediction could be made about the items that the user might need in next few days.

Machine Learning:

Coming right on point, Machine Learning. Wiki says, "Machine learning (ML) is the scientific study of algorithms and statistical models that computer systems use to perform a specific task without using explicit instructions, relying on patterns and inference instead. It is seen as a subset of artificial intelligence."

This definition quite nicely answers the question of WHY, in this project. Evolving day after day, with tons of data available online Machine Learning has become a big deal, to say in computer science.

This project utilizes some of the algorithm available to generate a model that would help in reaching this project's GOAL of predicting shopping items.

Machine Learning Algorithm such as Logistic Regression, Decision Tree, Naïve Bayes, and Artificial Neural Network are used in this project.

Machine Learning Algorithm:

1. Logistic Regression:
   A concise and to the point definition is provide by Wiki, "In statistics, the logistic model (or logit model) is used to model the probability of a certain class or event existing such as pass/fail, win/lose, alive/dead or healthy/sick."
   This definition in whole answers the question of Why I used this in my project.
   Predicting binary outcome is the first level of this project, Yes and No.
2. Decision Tree:
   "A decision tree is a decision support tool that uses a tree-like model of decisions and their possible consequences, including chance event outcomes, resource costs, and utility. It is one way to display an algorithm that only contains conditional control statements." The use

od decision tree was to model a way of creating range of values that could predict this projects outcome.

3. Naïve Bayes:
   "In machine learning, naïve Bayes classifiers are a family of simple "probabilistic classifiers" based on applying Bayes' theorem with strong (naïve) independence assumptions between the features. They are among the simplest Bayesian network models."

   I choose Naïve Bayes and decision tree algorithm to work with another case where retail owner could predict the possible buying option of user based on understanding the products bought with customer's previous visit.

4. Artificial Neural Network:
   "Artificial neural networks (ANN) or connectionist systems are computing systems vaguely inspired by the biological neural networks that constitute animal brains.[1] Such systems "learn" to perform tasks by considering examples, generally without being programmed with task-specific rules."
   To add a touch of deep learning to this project, I choose ANN to work with. Although the result observed were quite disappointing, yet ANN gave a fair fight considering the dataset available.

Shopping Bills:

The essence of this project are the shopping bills, based on which the whole project is modelled. Shopping bills contains a ton of information based on which quite complex and powerful machine learning model can be built.

Looking on the knowledge that these bills provide in this project, and by using basic machine learning model I was able to provide a prediction based on the pattern observed. This directly proves how important these bills are for this project.

Difficulties:
1. Though important, these bills add a lot of complexity to the project. The text recognition API provided by Firebase MLKit API had to do a lot to get the text extracted.
2. Understanding text after it is being extracted was another task that this project has, based on the types of bill different search and structural variation had to be added so that the output result means what it supposes to. Event though this task is not considered in the project, having an idea provides an insight of how difficult this prediction modelling can get.
3. Another problem is that, the items listed are in abbreviations and that too different for different store. This makes the search more complex and difficult.

Performance of the Machine Learning Model:

1. Logistic Regression Model:
   Based on the sigmoid function Logistic Regression Model was able to perform pretty well, given that the dataset was modelled correctly.
   Having the ability to predict item's need in coming item is difficult even if the dataset is as perfect as it can. Logistic Model worked well for both predicting item and providing insight to retail owner about the buying habits of users.
2. Decision Tree Model:
   To start with, Decision Tree was the only model that performed in a way that this project aimed event though the accuracy was quite low. This showed that this problem could be solved, by making few changes. The main performance that I was interested was of predicting habits, for example if user buy milk and bread will he/she buy onion or eggs? Having an accuracy of 90% shows the strength of this algorithm in binary classification.
3. Artificial Neural Network:
   ANN didn't work as planned, I tried working with various hidden layers, number of inputs, epochs, batch size and yet the outcome probability was not satisfactory in either of the cases.
4. Naïve Bayes:
   This Model worked very solid in the second case by having an average accuracy of 90% through out even though the train size of the model was reduced, which shows that Naïve Bayes would stand first in the second scenario of understanding relational buying of customers.

Dataset:

1. Starting with just date, didn't worked as overfitting caused the model to get confused and provided an accuracy that seemed decent though was not good.
2. Understanding the dataset and the way these Machine Learning model work with these dataset was the key concept.
3. Adding on the weight was the gold, it provided with the prediction with pretty well accuracy and logic, even though the test set was not actually from the dataset.

What's the Future?

Right now, to avoid unnecessary complication I focused on one goal, prediction. Taking this project forward, I would consider providing predication on which market particular user will go.

This project doesn't the quantity characteristic which can turn around the prediction in many ways, this is the end goal.

Utilizing each and every feature available on the bills and creating a more refined model is the end game of this project for me.

Conclusion

Working with a set of Machine Learning algorithm and measuring their performance and providing necessary prediction was the aim, that I believed is achieved to some extent. More modification is certainly possible as mentioned in above section.

Taking user perspective, having a application that would predict what will you buy is to far best outcome of downloading it. On the other hand, retailer understanding their customer is more important that selling items. This project in whole touches the best of two world and provide its own unique way of solution.