



IJRASET

International Journal For Research in
Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 Issue: VI Month of publication: June 2021

DOI: <https://doi.org/10.22214/ijraset.2021.35093>

www.ijraset.com

Call:  08813907089

E-mail ID: ijraset@gmail.com

Machine Learning and Data Analytics based Restaurant Management System for Improving Customer Experience

Akhilesh Jaiswal¹, Himanshu Mahajan², Rutuja Chaudhari³, Prajwal Bhure⁴, Avadhoot Joshi⁵

^{1, 2, 3, 4}Final Year B.Tech CSE Dr. Vishwanath Karad MIT World Peace University, Pune

Abstract: In restaurant industry many of them do not have automated tool for monitoring the customers. Machine learning helps to predict information from the data and Data analysis will provide data in well visualized manner. This project is divided into 3 parts as descriptive learning, predictive learning and prescriptive learning.

The application is prepared using php and Data analysis using Google Data Studio and python. With this product restaurant can find their weakness focus on it and can increase the revenue after filling it up. In the project descriptive analysis focuses on customer data and sales data.

Predictive analytics focus on instore analysis and expense tracking by visualizations. Lastly, predictive analytics includes Apriori algorithm for making combos of menu and XGBoost and RandomForest Classifier algorithm. The project also includes NLP analysis on reviews given by the customers.

Keywords: Machine Learning, NLP, Random Forest, Apriori, Data Analysis.

I. INTRODUCTION

The Restaurants in the present world are facing customer distraction due service not up to the mark. Using machine learning techniques and data analytics restaurants can analyze their weakness and increase their revenue.

Lack of insight to market restaurant business, who are currently only relying on social media and banner advertising. To increase ROI (Return on Investment) We've got a solution which uses data analytics and machine learning for making decisions based on data that we collect from customers for marketing.

We will be using descriptive analytics for menu engineering. Example we want to find top selling items in our restaurant, type of cuisine more preferred by the people, per item sales and categories with max sales.

This help restaurant in increasing revenue and they can focus on weak points. We'll be also doing customer analysis like what age group of people the restaurants attract and number of times a person visited. Sales engineering will also be one our Moto in which we will providing discount preferences and finding sales quarterly.

The second analytics we will be using will be Predictive analytics. In this we will be doing Instore analytics where we will be using LSTM algorithm for prediction of outcomes like what are the daily usage of items that we need every day such as chicken, paneer, etc.

We will be doing demand forecasting where we will be using Naive Bayes theorem to predict dataset like count of men in our restaurant as visitors, make division of customers according to timeframe.

And Final Analytics we will be using is Prescriptive Analytics. In this we will be finding upselling and cross selling. This will be achieved by Apriori algorithm.

It will used to find combinations of items in an offer or combo to irradiate SoloTrip and will also help to find seasonal demands of food items. Our focus will also be in better pricing decision which we will be doing using XGBoostClassifier and Random Forest Algorithm. We will also be using NLP for Sentiment Analysis, improvement scopes in menu, services, cleanliness, staff behaviour, etc.

II. LITERATURE SURVEY

Sr No.	Name of Paper	Author	Conference Name	Journal Name	Summary
1	A Chinese Dishes Recommendation Algorithm Based on Personal Taste	NingxuanHe;MengyuanLiu;Fang Zhao;	2015 IEEE Conference	IEEE	The algorithm in this paper uses the user's ordering history to quantify one's taste by k-means clustering method and determines the number of user's favourite tastes by the BWP index. With the knowledge of the user's tastes, screen matrix is used to rank the dishes according to the user's taste in any restaurant.
2	Enhanced Sentiment Classification for Informal Myanmar Text of Restaurant Reviews	Yu Mon Aye; SintSintAung.	IEEE SERA 2018	IEEE	This paper aims to overcome the language specific problem and to enhance the sentiment classification for informal text. We address lexicon-based sentiment analysis to enhance the sentiment analysis for Myanmar text reviews and show that the enhancement of sentiment classification improves the prediction accuracy.
3	Machine Learning Based Prediction of Consumer Purchasing Decisions: The	SaaviStubseid;Ognjen Arandjelovic;	2015 IEEE Conference	ResearchGate	Purchasing decision prediction using Naïve Bayes classification and Random Forest algorithm. According to this paper Random Forest outperforms Naive Bayes classification.
4	Applicability of Machine-Learning Techniques in Predicting Customer Defection	NikenPrasasti;Hayato Ohwada	IISTMET 2014	IEEE	This paper showed different machine learning algorithms performed on the dataset to predict customer defection. It showed decision tree, random forests, neural networks, SVM and analyzed the results got after performing the results. It helped to choose the machine learning algorithm for our case.
5	Partition cost-sensitive CART based on customer value for Telecom customer churn prediction	Chuanqi Wang, Ruiqi Li, Peng Wang, Zonghai Chen	36th Chinese Control Conference	IEEE	Telecom Customer churn prediction is a cost sensitive classification problem. Most of studies regard it as a general classification problem use traditional methods, that the two types of misclassification cost are equal. And, in aspect of cost sensitive classification, there are some researches focused on static cost sensitive situation. In fact, customer value of each customer is different, so misclassification cost of each sample is different. For this problem, we propose the partition cost-sensitive CART model in this paper. According to the experiment based on the real data, it is showed that the method not only obtains a good classification performance, but also reduces the total misclassification costs effectively.

III. PROJECT REQUIREMENTS

A. Resources

1) Reusable Software Components

- a) Database interaction module.
- b) The charts components to display various graphs in admin can also be reused.
- c) Machine learning models.

2) Software Requirements

- a) Linux server or XAMPP environment
- b) PHP 7+
- c) MYSQL 5.5+
- d) Python 3
- e) Any browser (Chrome, Firefox, Safari, etc.)

3) Hardware Requirements

Tablet & Laptop with 2gb of RAM (Recommended)

B. Functional Specification

- 1) *Interfaces:* The application will be implemented in HTML, CSS, JavaScript, PHP, Python language using jQuery, Bootstrap, Charts.js, Data Range Picker as technologies and Sublime Editor and Jupyter Notebook will be used as IDE for website application development while implementing.
- 2) *External Interfaces Required:* This website application can be used online, on any iPads, Android tablets or laptops.
- 3) *Internal Interfaces Required:* Since this application is a website application and is a responsive website, it can be operated in Microsoft Edge, Google Chrome, Mozilla Firefox, and Apple Safari.
- 4) *Communication Interfaces:* Internet access.

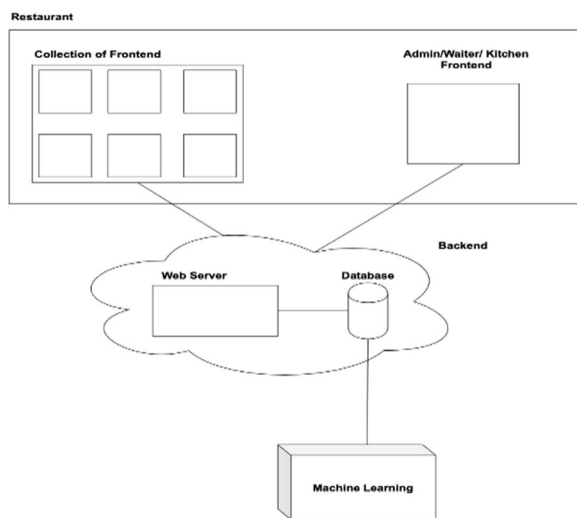


Fig. 1 System Architecture

IV. IMPLEMENTATION

- 1) We used pHP, HTML, CSS, JavaScript in frontend.
- 2) Web app is created on the CodeIgnitor platform.
- 3) Google Data Studio is live data fetching and displaying chart tool. It fetches information from JDBC connection with MySQL database.
- 4) Chart.js is used to create charts.
- 5) ML algorithms are performed in python language and platform used to code is Jupyter Notebook.

A. *Descriptive Analytics*

Finding patterns in current condition to improve

1) *Menu Engineering*

- a) Top selling items, Type of cuisine more preferred, etc.
- b) Per Item Sales
- c) Categories with max sales
- d) categories, products, sales items

2) *Customer Analysis*

- a) What age group we attract, Customers generally come with members(family/friends/solitary)?
- b) What type of status(independent/dependent/kids) we attract?
- c) What is average spending of customers in hotel?
- d) Top paying customers
- e) Percentage of repeated visitors
- f) sales, customers

3) *Sales Engineering*

- a) Discount preference Product on product, %discount
- b) Like for like sales/ growth in sales per day/week/month/3 month/6 month/year Predictive Analysis
- c) Revenue from each category per day/week/month/3 month/6 month/year
- d) Percentage change in price vs Percentage change in revenue

B. *Predictive Analytics*

1) *Instore Analytics*

- a) What are daily usage ingredients, what ingredient in what quantity, what can be stored in bulk and what not, what will be weekly use of ingredients, etc.

2) *Demand Forecasting*

- a) Count of Men Visit, Women Visit, Division of customer visits according to time frame (Rush Hours identification)
- b) Average sales per day/week/month/3 month/6 month/year sales

C. *Prescriptive Analytics*

1) *Upselling & Cross Selling*

- a) Combination of items in an offer/combo to irradiate SoloTrip(Apriori), What season demands what foodstuff.
- b) Sale items

2) *Better Pricing decisions*

- a) Identification/Benefit of Price Sensitive Customer (customers who give high profit to hotel should be encouraged/ Loyalty Strategy) (XGBoostClassifier, RandomForestClassifier)
- b) sales, customers (loyalty points)
- c) Upmarket Items/Luxury items for customers (higher the price for luxury items)
- d) Price Sensitivity of customers (what price they are willing to pay for a commodity)
- e) Percentage of repeated visitors
- f) Percentage increase in sales due to Loyalty Strategy/Rewards

3) *Customer Feedback Analysis (NLP)*

- a) Sentiment Analysis, improvement scopes in menu, service, cleanliness, staff behavior, etc.
- b) Outside data

- 4) Staff Optimization
 - a) Managing Staff strategically according to rush Hours.
 - b) waiters, sales

V. RESULT AND ANALYSIS

A. Explanation: how experiment has been performed

- 1) The web application has different logins. Manager, waiter and chef all have different logins. They can login with their specific logins.
- 2) Manager will be having all the permissions to edit and add to database. He Can view the dashboard of charts.
- 3) Waiter will have access to POS tab where he can take orders, add customers and manage bill.
- 4) Chef screen will have all the orders listed and will have permission to check if order is prepared or not.
- 5) Using all this actions data will be created and stored in tables.
- 6) Using this data different charts will be prepared that will be visible on the manager’s dashboard.
- 7) Using this data different ML algorithms will be performed, and output will be generated.
- 8) There will be a form to accept customer’s review. The data stored from the form will be fetched for NLP. Using NLP valuable information can be gathered for manager’s purpose.

B. Discuss Results

- 1) Created a fully functional web application.
- 2) Prepared charts using Google Data Studio and integrated on the web application.
- 3) ML algorithms performed and generated outputs.

C. Analysis of the Results

- 1) Performed Apriori algorithm on the sales data from which we got combos of orders and the basis of support. The combos can be used to design menu or provide offers to increase the revenue.
- 2) NLP is performed on reviews data from which we can get most used words in positive and negative reviews in form of the Word Cloud. The manager can check the reviews just by typing the word and he will get all the reviews related to that word.

Model Name	Accuracy	ROC AUC Value
GaussianNB	0.48	0.506494
RandomForestClassifier	0.66	0.642857
XGBoostClassifier	0.62	0.592532

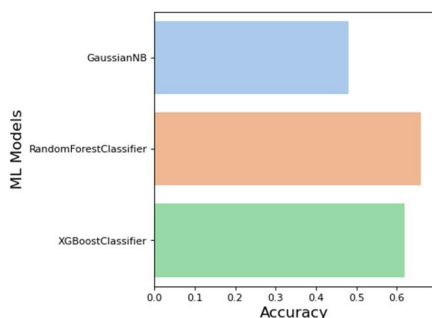


Fig. 2 Accuracy Scores

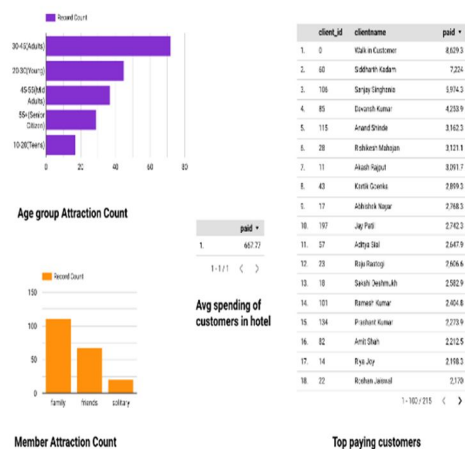


Fig. 3 Customer analysis dashboard

VI. CONCLUSION AND FUTURE SCOPE

We have worked on the designing of the system. By this the conceptual idea and the overall project plan and the understanding has improved a lot and the actual implementation issues have come upfront to solve them before the implementation phase.

This proposed can handle classification in an efficient manner and achieved better accuracy than the approach of without considering intensifier. For future work, we are going to test with larger dataset and need to improve the performance of Machine learning algorithms and NLP of data we collected. As more machine learning methods get fits to project, they can be added to it. May convert the project in Django for easy integration of ML outputs in the web application. The project can be used by more and more restaurants with requirement of PC.



REFERENCES

- [1] NikenPrasasti;Hayato Ohwada, Applicability of Machine-Learning Techniques in Predicting Customer Defection, 2014 International Symposium on Technology Management and Emerging Technologies
- [2] NingxuanHe;MengyuanLiu;Fang Zhao; A Chinese Dishes Recommendation Algorithm Based on Personal Taste, 2015 IEEE 2nd International Conference on Cybernetics (CYBCONF)
- [3] Yu Mon Aye;Sint Sint Aung; Enhanced Sentiment Classification for Informal Myanmar Text of Restaurant Reviews, 2018 IEEE 16th International Conference on Software Engineering Research, Management and Applications (SERA)
- [4] SaaviStubseid; Ognjen Arandjelovic; Machine Learning Based Prediction of Consumer Purchasing Decisions: The Evidence and Its Significance, AAAI Conference on Artificial Intelligence
- [5] Kuan-Yu Lin;Chih-HunChen;Zhe-MingZhang;Sheng-ChuanOu; NFC-based mobile application design restaurant ordering system APP, 2018 IEEE International Conference on Applied System Invention (ICASI)



10.22214/IJRASET



45.98



IMPACT FACTOR:
7.129



IMPACT FACTOR:
7.429



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089  (24*7 Support on Whatsapp)