

# Design and development of Restaurant Recommendation System using Machine Learning

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**Abstract :** The main objective behind developing this project is to build a restaurant recommendation system for an individual based on their preference. We create a ranking SVM model using the machine learning algorithm with features encompassing of the parameters such as food preferences, cuisine type, staff service, ambience, noise level, average rating, and dietary restrictions etc. The ability of the algorithm and recommendation engines to recommend personalized content, based on past behavior is what we majorly aim to develop. The personalized experience is what makes the user return to the website. Users do not rate adequate restaurants to enable collaborative filtering based recommendation, which can lead to an issue. To solve this issue a hybrid approach is used where collaborative filtering technique aggregates with the content based algorithm, to provide personalized restaurant recommendation. Here Hybrid approach in Machine Learning is performed where weights of each aspect is calculated to find its orientation score. Also we use K Nearest Neighbor algorithm to group the aspects of similar meaning. Thus, content-based and collaborative approach increases the recommendation results. We also use Flask to connect the data sets to the python and finally display the output.

**IndexTerms - Recommender system, K Nearest Neighbor, Content based and Collaborative based Machine Learning, Flask.**

## I. INTRODUCTION

Recommender System, an efficient instrument that reflect an individual's outlook to identify the content more suitably. The system has been functional to various fields, however in field of research zone, service centered recommendation system plays major role. In current years, the advance rate of restaurant visiting has increased at a good rate and this makes restaurant recommendation system, a very hectic task due to the rich amount of online data. Reviews written by bloggers replaces word-of-mouth but still searching becomes a time consuming job based on user fondness. Reviews crawled from the user visiting sites are a mutual and valued source of evidence for recommendation of a restaurant, yet little courtesy has been paid on how to present reviews of a bloggers in an comprehensible format. Also it will supply users recommendation based on ratings, cuisines & companion they want to go with.

## II. Literature Survey

User behaviour can be analyzed by exploiting the user generated contents available abundantly on the internet. Recommendation system [1] is an efficient tool that manages to filter this abundant information according to the user's preference and interest. Traditional recommendation system uses Collaborative filtering technique to recommend any products or services. But the main issue faced by this technique is cold start problem which is defined as cold start user or cold start item[2], and has been captured by many researchers i.e. whereon rating information is yielded when a new user register the system or not much information is found about the new item to recommend. This gives rise to different methods and techniques associated with CF technique. Hybrid approach, where CF technique integrates with the sentiment analysis tries to resolve the issue of cold-start-problem making use of contextual information from traveler's textual reviews, thus resulting a better performance. Khan, Khairullah, et al. in [3] gives the detail study about the opinion mining. The study deals with subjectivity analysis and lexical resource generation. This study exploits opinion representation, opinion mining models and opinion components by retrieving opinions from primary sources like social networks and web blogs' Adomavicius et.al.[4] shows how contextual information added importance in providing recommendations. Three algorithmic patterns contextual pre-filtering, post-filtering and modeling were introduced to boost the contextual information in recommendation process. Also a case study is presented describing a unified approach of contextual information methods and techniques. Jannach et.al, [5] compares different models of regression and has constituted aggregation functions which analyzes differently with respect to users and items. They use Summand conclude that a support vector machine will perform better than linear least squares regression models if used for learning a combination of user and item. They also constitute that when weights are given, specific regression models performs the best. Duan et al., [6] presents how to mine the online user reviews that is used as both quantitative aspects and textual content from multi-dimensional perspectives. Online user generated reviews for the restaurant industry used as data source, which by using a sentiment analysis technique decomposes the reviews into five dimensions for measuring and capturing service quality dimensions. These dimensions are then assimilated into econometrics models to get the overall evaluation of the content generating behavior. Through sentimental analysis a notation of personal scale, based on the observation that different users gives different ratings toothier reviews to improve the polarity classification analysis, which provides personal recommendation is explained in [7]. Text reviews are used to build a user profile, but cold start problem is not concentrated. Gang et.al,[8] proposed an emerging pattern mining technique where the restaurant managers analyzes the travelers concern from emerging restaurant features wart response to improve their strategic planning, marketing and product development. Ye Hongwu et.al,[9] proposed a method for finding nearest neighbour through self-organizing-map which makes a group of nearest neighbors

which is first step in collaborative filtering. Association mining is used to fill vacant space. Thus they proposed combination of association mining and Soto address the issue of data sparsity. Wu Yao et.al, [10] proposed probabilistic model FLAME: was introduced addressing the problem of Personalized Latent Aspect Rating Analysis. A unified probabilistic model called Factorized Latent Aspect Model (FLAME), explains the advantages of collaborative filtering and aspect based opinion mining, combination of both solves the problem of latent aspect rating. Probabilistic model learns the user's personalized preferences on different aspects from their past reviews, and predicts user's aspect ratings on new items by collective intelligence. AK Samma et.al, [11] focus to improve the accuracy of extraction mainly by combining the different techniques from 3 different areas, i.e named Data Mining, Natural Language Processing and Ontology and generate the aspect-based opinionated summary from the customer reviews. Opinion mining for the application of restaurant searching, where reviews are mined on the basis of combination of two Naive Bays classifiers is proposed in [12]. Classifiers have different feature selection techniques: Relief-F and Chi-square. Ensemble model was compared with standard searching methods: Boolean and Boyer-Moore. Ensemble model increases the searching speed and provides highest average rank-accuracy. HN Kim et.al, [13] in this paper a unique method is proposed of designing error reflected models obtained from explicit ratings. First actual rating is predicted, then based on this model identifies the predicted error for each user. I, Size, et.al, [14] proposes a novel method to solve the issue of cold-start-problem and extraction of context from reviews to increase the recommendation quality. Aeroballistics latent relation model is introduced to integrate contextual information with recommendation algorithms. FZ Halloo et.al, [15] presents the different text classification techniques i.e., Naive Bays, Decision Tree, k-Nearest Neighbors to extract the context for context recommendation. The technique is related to stemming, minimum term frequency thresholding, weighting schema and n-gram words. Further the best technique is identified giving best classification. A Mango et.al, [16] proposed a framework of feature based opinion mining that makes use of two main lexicons features and polar words. Syntactic pattern analysis is used to extract the lexicons from the text and based on evaluated scores and lexical analysis, gives top polar words from reviews. CWK Leung et.al, [17] describes a rating inference approach to include the text reviews in Collaborative Filtering algorithms. A relative-frequency-based method is used determine the sentiment orientation and strength of opinion words and then aggregate this orientation to conclude the average sentiment used by user. Paper also solves an issue of data sparsity by integrating textual reviews into CF algorithms. Despite of the much study on context-aware recommendation system, most information retrieval system is based on query collections while browsing contextual text ignoring the textual content having opinions in the user-generated reviews. Our study aims to make personalized restaurant recommendations by analyzing the user's behavior from the restaurant reviews which identifies the user preferred features like room, food, service, etc based on context for selecting the restaurant.

- **K Nearest Neighbor** : The k-nearest neighbors (KNN) algorithm is a simple, easy-to-implement supervised machine learning algorithm that can be used to solve both classification and regression problems.
- **Python** : In this article, we will be using numpy, scipy and scikit-learn modules. We can install them using cmd command
- **Flask** : Flask is a micro web framework written in Python. It is classified as a microframework because it does not require particular tools or libraries.
- **Ajax** : AJAX is a new technique for creating better, faster, and more interactive web applications with the help of XML, HTML, CSS, and Java Script.

### III. PROPOSED WORK

A Restaurant Recommendation System is used to recommend users restaurants based on their preference. The preference is based upon user ratings, cuisines and companion. It uses KNN in Machine Learning. As the records of restaurants are not maintained with us in detail, we would like to have a database of the same. Also, your idea would help us to select a restaurant of our choice conveniently. If possible, you could also add few other modules like FSSAI license, etc. We want to reawaken the foodie within you and uplift your dining experience with a list of restaurants for you to visit based on your own expectations.

First, a flowchart and the operation of the recommender system is shown below. It starts from accepting reviews from user about the restaurant to the collaborative and content filtering. Also, an overall working of the user interaction is shown.

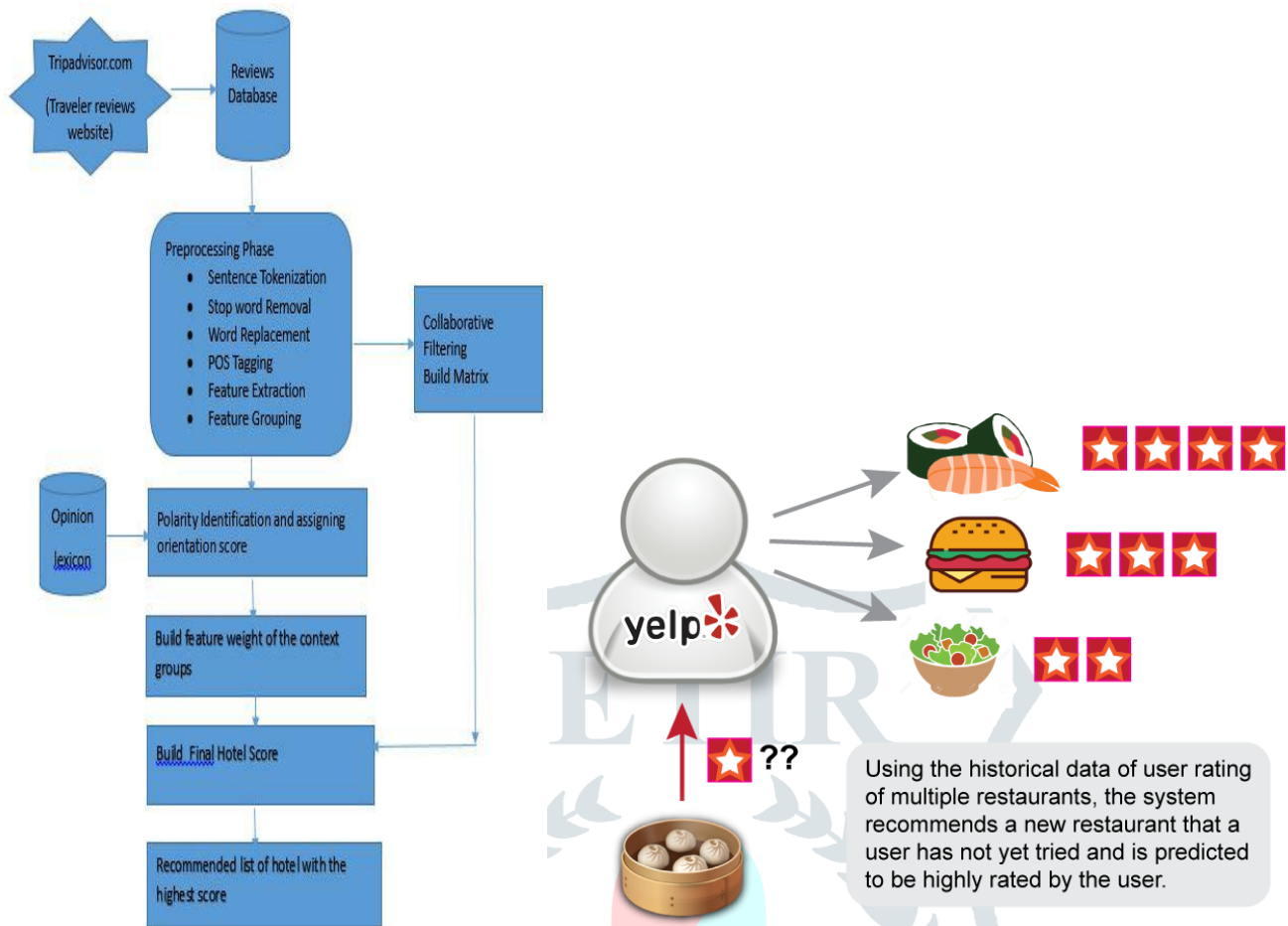


Fig.1: Flow Chart for Recommendation System

Fig.2: Overall Working

#### IV. Results and Discussion

The paper proposed a new restaurant recommender system that uses K nearest neighbors is a simple algorithm that stores all available cases and classifies new cases based on a similarity measure. The Flask will connect the backend datasets to python which then will implement in the front end graphical user interface.

The proposed pothole detection KNN algorithm is designed and implemented taking into account the limited computing capacity of existing systems. Experimental results potentially show that the proposed algorithm can correctly classify new cases as per availability of the data. Sometimes there are conditions where error is occurred. Also a Cold Start problem is faced. Hence, we try not to repeat such errors and see a perfectly working system.

Implementation Details:

- Software and tools: Python 3.7.0 , Microsoft Excel, Google Chrome.
- Editor: Notepad++, Sublime Text 3.0

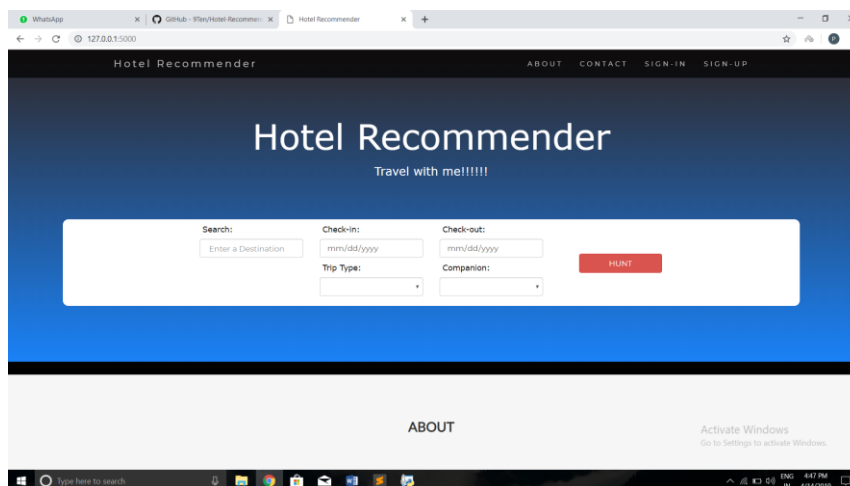


Fig.3 : Website GUI

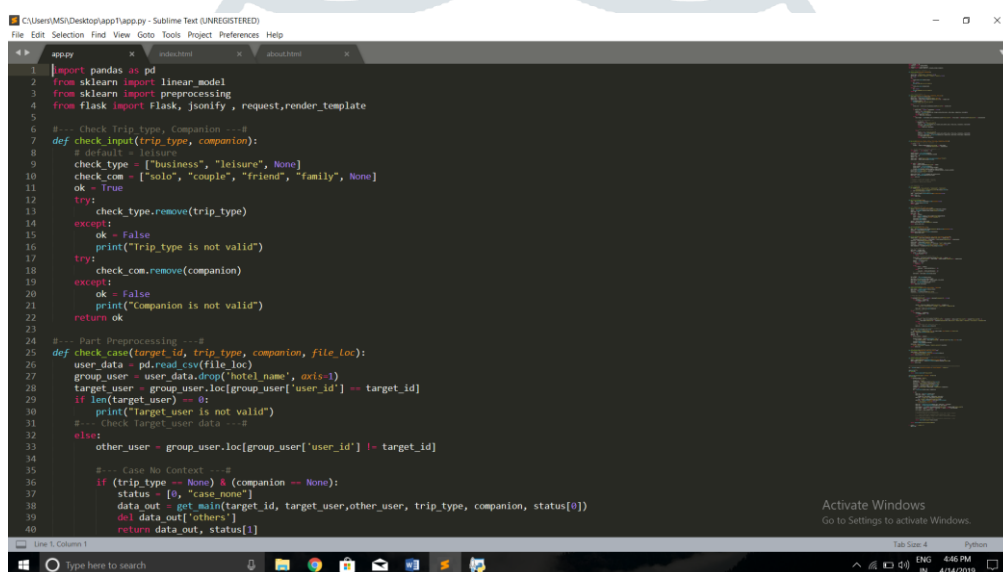


Fig.4 : Implemented Website

### V. Conclusion and Future Scope

The paper is concluded with the main Objective of the project along with the system overview. Mainly project is designing a Recommendation System Based on Hybrid Approach. Approach is K Nearest Neighbor. Therefore content and hybrid based Recommendation system is developed which defines context group as type of traveler, user ratings and cuisines & companion preference.

With this, we will be implementing effectively the website for Restaurant Recommendation System using Machine Learning algorithm. It is acclaimed that this project will be useful to the people once it gets published. We create a ranking SVM model using the machine learning algorithm with features encompassing of the parameters such as cuisine type, food preferences, staff service, noise level, ambience, dietary restrictions and average rating etc. We aim to develop the ability of the algorithm and recommendation engines to recommend personalized content based on past behavior. It will create an impact on the users across Mumbai to fulfill their sensory buds.

accuracy\_1

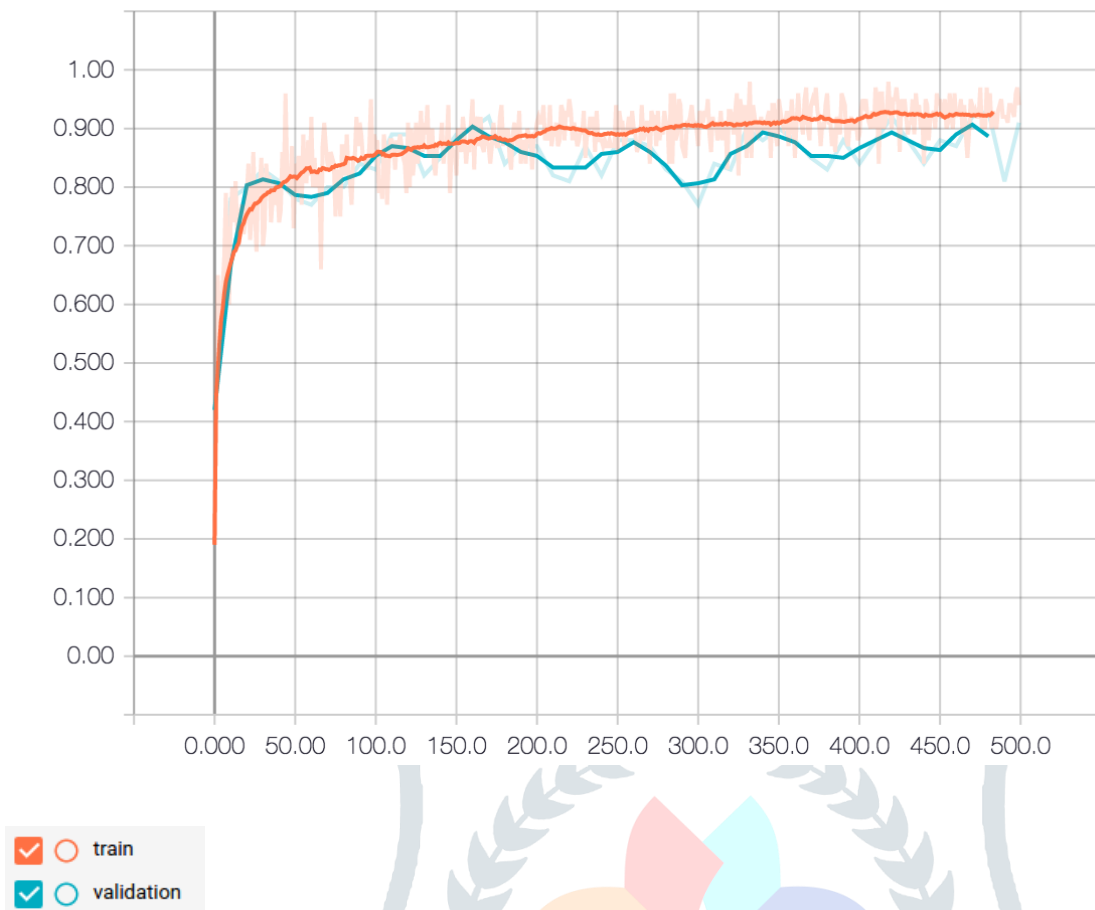


Fig.5: Accuracy Graph

In the future, the system:

1. We can cover entire Mumbai in restaurants.
2. The website will later have its own app.

Driving social benefits such as:

1. It can save time for selecting the right restaurant.
2. Based on overall ranking system, hence better recommendations achieved.

## VI. Acknowledgements

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