A

PROJECT REPORT

ON

"Restaurant Recommendation system using Machine Learning"

SUBMITTED TO

SHIVAJI UNIVERSITY, KOLHAPUR

IN THE PARTIAL FULFILLMENT OF REQUIREMENT FOR THE AWARD OF DEGREE BACHELOR OF ENGINEERING IN COMPUTER SCIENCE AND ENGINEERING

SUBMITTED BY

KAMBLE HEMA KISHOREKUMAR	15CMPN17
KARVEKAR VRUSHALI MOHAN	15CMPN21
GHATAGE RUTUJA MOHAN	16MHTRCMPN67
TEZAD KOMAL DEEPAK	16DSCPMN11

UNDER THE GUIDANCE OF

PROF. U. A. NULI

DKTE

Promoting Excellence in
Teaching, Learning & Research

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

DKTE SOCIETY'S TEXTILE AND ENGINEERING INSTITUTE,

ICHALKARANJI

(AN AUTONOMOUS INSTITUTE)

ACCREDITED WITH 'A+' GRADE BY NAAC

An ISO 9001-2015 Certified

SHIVAJI UNIVERSITY, KOLHAPUR

2018-2019

D.K.T.E. SOCIETY'S TEXTILE AND ENGINEERING INSTITUTE, ICHALKARANJI
(AN AUTONOUMOUS INSTITUTE)
(A+ Grade Accreditation by NAAC)
(ISO 9001:2015 CERTIFIED)
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

CERTIFICATE

THIS IS TO CERTIFY THAT, PROJECT WORK ENTITLED

"Restaurant Recommendation System using Machine Learning"

IS A BONAFIDE RECORD OF PROJECT WORK CARRIED OUT IN THIS COLLEGE BY

KAMBLE HEMA KISHOREKUMAR	15CMPN17
KARVEKAR VRUSHALI MOHAN	15CMPN21
GHATAGE RUTUJA MOHAN	16MHTRCMPN67
TEZAD KOMAL DEEPAK	16DSCPMN11

IS IN THE PARTIAL FULFILLMENT OF AWARD OF DEGREE BACHELOR IN COMPUTER SCIENCE & ENGINEERING PRESCRIBED BY SHIVAJI UNIVERSITY, KOLHAPUR FOR THE ACADEMIC YEAR 2018-2019.

PROF. U. A. NULI	**PROF.(DR.) D.V.KODAVADE**
[PROJECT GUIDE]	**[HOD CSE DEPT.]**
EXAMINER	**PROF.(DR.) P.V.KADOLE**
[EXTERNAL]	**[DIRECTOR]**

DECLARATION

We hereby declare that, the project work report entitled “Restaurant recommendation system using Machine Learning” which is being submitted to D.K.T.E. Society’s Textile and Engineering Institute Ichalkaranji, affiliated to Shivaji University, Kolhapur is in partial fulfillment of degree B.E.(CSE). It is a bonafide report of the work carried out by us. The material contained in this report has not been submitted to any university or institution for the award of any degree. Further, we declare that we have not violated any of the provisions under Copyright and Piracy / Cyber / IPR Act amended from time to time.

KAMBLE HEMA KISHOREKUMAR	15CMPN17
KARVEKAR VRUSHALI MOHAN	15CMPN21
GHATAGE RUTUJA MOHAN	16MHTRCMPN67
TEZAD KOMAL DEEPAK	16DSCPMN11

ACKNOWLEDGEMENT

With great pleasure we wish to express our deep sense of gratitude to Prof. U. A. Nuli for his valuable guidance, support and encouragement in completion of this project report.

Also, we would like to take opportunity to thank our head of department Dr.D. V. Kodavade for his co-operation in preparing this project report.

We feel gratified to record our cordial thanks to other staff members of Computer Science and Engineering Department for their support, help and assistance which they extended as and when required.

Thank you,

KAMBLE HEMA KISHOREKUMAR	15CMPN17
KARVEKAR VRUSHALI MOHAN	15CMPN21
GHATAGE RUTUJA MOHAN	16MHTRCMPN67
TEZAD KOMAL DEEPAK	16DSCPMN11

ABSTRACT

On the Internet, where the number of choices is overwhelming, there is need to filter, prioritize and efficiently deliver relevant information in order to alleviate the problem of information overload, which has created a potential problem to many Internet users. Recommender systems solve this problem by searching through large volume of dynamically generated information to provide users with personalized content and services.

Recommender systems are information filtering systems that deal with the problem of information overload by filtering vital information fragment out of large amount of dynamically generated information according to user's preferences, interest, or observed behavior about item. Recommender system has the ability to predict whether a particular user would prefer a Restaurant or not based on the user's profile.

Recommender systems are beneficial to both service providers and users. They reduce transaction costs of finding and selecting items in an online environment. Recommendation systems have also proved to improve decision making process and quality. In e-commerce setting, recommender systems enhance revenues, for the fact that they are effective means of selling more products. In scientific libraries, recommender systems support users by allowing them to move beyond catalog searches. Therefore, the need to use efficient and accurate recommendation techniques within a system that will provide relevant and dependable recommendations for users cannot be over-emphasized.

INDEX

1. INTRODUCTION

1.1. Problem Definition:

The purpose of this web application is to recommend Restaurants to the users depending on analysis of his/her past history.

1.2. Aim and objectives of the project

- Aim

  This projects aims to display restaurant list as per the user choices.

- Objectives
  1. To display list of restaurant as per the users choice.
  2. To develop user friendly system that can recommend list of restaurant as per the choice and mood of the user.

1.3. Scope and limitation of the project

- Scope

The restaurant recommendation system is basically the recommendation system so that users can provide the login id as input and get the best suitable restaurant according to the ratings.

The project is specifically designed for the use of consumers who like to visit the restaurants. The product will work as a complete user interface for restaurant recommendation process and restaurant usage from ordinary users.

When the user visits any new area, it is possible that the user might be unaware of the restaurants in that area. This recommendation system will help such users to find good restaurants in that area.

The restaurant recommendation system can work as powerful recommendation system for large area

- Limitations
  1. Data of various non-local restaurants.
  2. Data on the local server.
  3. Less useful to the new user.
  4. if user has given random ratings.

Timeline of the project

We have used classic life cycle paradigm known as “Waterfall Model”. This model travels through analysis, design, coding etc. We had completed requirement analysis by the mid of September 2018. At the end of December 2018 we had completed project planning and design. On the basis of design prepared in previous stage by the mid of February 2019 we completed coding stage.

1.4.Project Management Plan

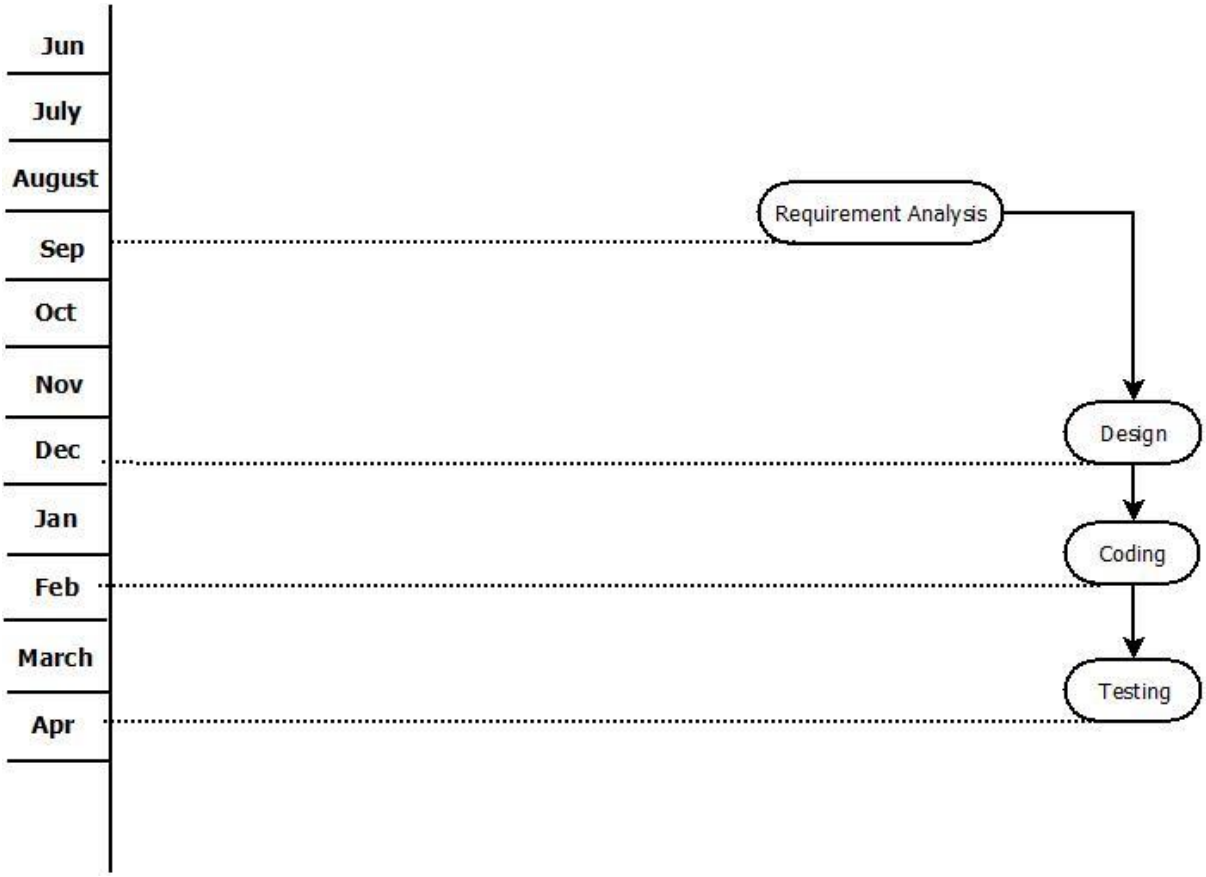


Fig 1.1 Project Management Plan

1.5. Project Cost

In this project the Cost Estimation based on COCOMO (Constructive Cost Model), the formula for this model is as follows:

Effort = Constant × (Size) scale factor × Effort multiplier

Effort in terms of person-months

Constant: 2.45 in 1998 based on Organic Mode-

Size: Estimated Size in KLOC –

Scale Factor: combined process factors

Effort multiplier (EM) : Combined effort factors

The basic COCOMO equations take the form

Effort Applied (E) = Ab(KLOC) Bb[man-months]

Development Time (D) = Cb (Effort applied) D [months]

People required (P) = Effort Applied / Development Time [count]

Where, KLOC is estimated number of delivered lines (expressed in thousands) of code for project. The coefficients ab, bb, cb and db are given in the following table.

Software project	Ab	Bb	Cc	Dd
Organic	2.4	1.05	2.50	0.38
Semidetached	3.0	1.12	2.5	0.35
Embedded	3.6	1.20	2.5	0.32

Semidetached mode:

Effort = $3.0 \times (0.254)^{1.12} = 0.6465$

Development time = $2.5 * 0.6465^{0.35} = 2.1554$

People required = $3.0*(0.254)^{1.12} = 0.3 \sim 1$ person

2. BACKGROUND STUDY AND LITERATURE OVERVIEW

2.1. Literature overview

I. **Wei-Ta Chu, Ya-Lun Tsai, 2017, proposed a hybrid recommendation system by combining content based approach and collaborative filtering approach**

In this paper, the authors have investigated the influence of visual information, i.e., photos taken by customers and put on blogs, on predicting favourite restaurants for any given user. By considering visual information as the intermediate, they have integrated two common recommendation approaches, i.e., content-based filtering and collaborative filtering, and showed the effectiveness of considering visual information. In addition to text information or metadata, restaurant attributes and user preference can both be represented by visual features. Heterogeneous items can thus be modelled in the same space, and thus two types of recommendation approaches can be linked. Through experiments with various settings, they verified that visual information effectively aids favourite restaurant prediction.

II. **A Jayasimhan, P Rai, Y Parekh, O Patwardhan, 2017, proposed a recommendation system for restaurants using open source dataset and applying machine learning techniques and algorithms**

In this paper, authors have analyzed different machine learning techniques and algorithms. This paper describes the various methods that can be applied for recommendation systems. Various algorithms are applied on the large dataset in order to analyze its accuracy and performance. They have depicted that, for the future, collaborative filtering can be used to further improve the predictions. It can also involve trying to identify stronger features beyond what is available in the datasets, as well as investing in an approach to gather training and evaluation data from alternate means. The recommendation system need not be limited to restaurants but can be extended for other systems and businesses as well.

III. **Badrul Sarwar, George Karypis, Joseph Konstan, and John Riedl, 2001, proposed analysis of different item-based recommendation generation algorithms.**

In this paper the authors have analyzed different item-based recommendation generation algorithms. They looked into different techniques for computing item-item similarities (e.g., item-item correlation vs. cosine similarities between item vectors) and different techniques for obtaining recommendations from them (e.g., weighted sum vs. regression model). Finally, they experimentally evaluated their results and compared them to the basic k-nearest neighbor approach. Their experiments suggest that item-based algorithms provide dramatically better performance than user-based algorithms, while at the same time providing better quality than the best available user-based algorithms.

IV. Prem Melville and Raymond J. Mooney and Ramadass Nagarajan, 2002, proposed Content-Boosted Collaborative Filtering for Improved Recommendations

In this paper, the authors have presented an elegant and effective framework for combining content and collaboration. Their approach uses a content-based predictor to enhance existing user data, and then provides personalized suggestions through collaborative filtering. They have presented experimental results that show how this approach, Content-Boosted Collaborative Filtering, performs better than a pure content-based predictor, pure collaborative filter, and a naive hybrid approach.

2.2. Investigation of Current Project and Related Work

The amount of information in the world is increasing far more quickly than our ability to process it. All of us have known the feeling of being overwhelmed by the number of new books, journal articles, and conference proceedings coming out each year. Technology has dramatically reduced the barriers to publishing and distributing information. Recommender systems help overcome information overload by providing personalized suggestions based on a history of a user's likes and dislikes. Many on-line stores provide recommending services e.g. Amazon, CDNOW, Barnes And Noble, IMDb, etc.

Recommender systems apply knowledge discovery techniques to the problem of making personalized recommendations for information, products or services during a live interaction. These systems, especially the k-nearest neighbour collaborative filtering based ones, are achieving widespread success on the Web. The tremendous growth in the amount of available information and the number of visitors to Web sites in recent years poses some key challenges for recommender systems. These are: producing high quality recommendations, performing many recommendations per second for millions of users and items and achieving high coverage in the face of data sparsity.

3. REQUIREMENT ANALYSIS

3.1. Functional Requirements

The project contains following functional requirements

1. User registration
2. Login
3. Restaurant Display as per user's choices.

3.2. Performance Requirements

a. Windows version 7 or above

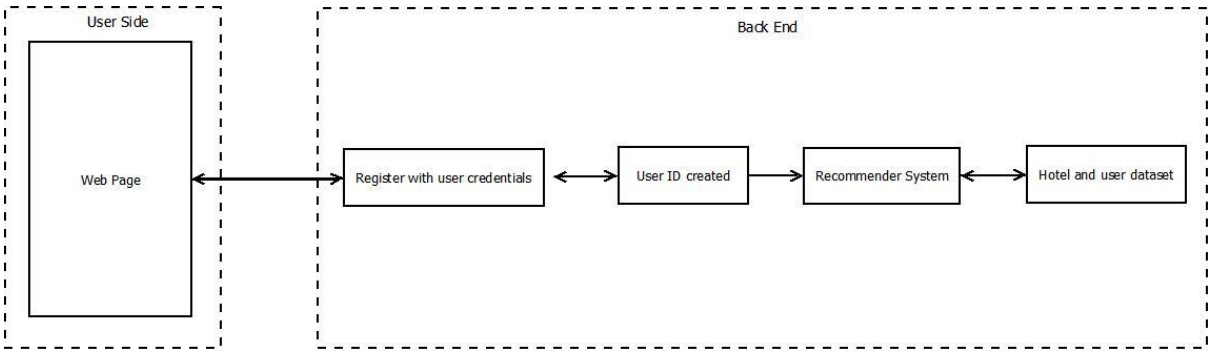
3.3. Design Constraint

1. Windows version; The application cannot run below 7
2. RAM - more than 4 GB.
3. Space on disk is 3-4 MB.

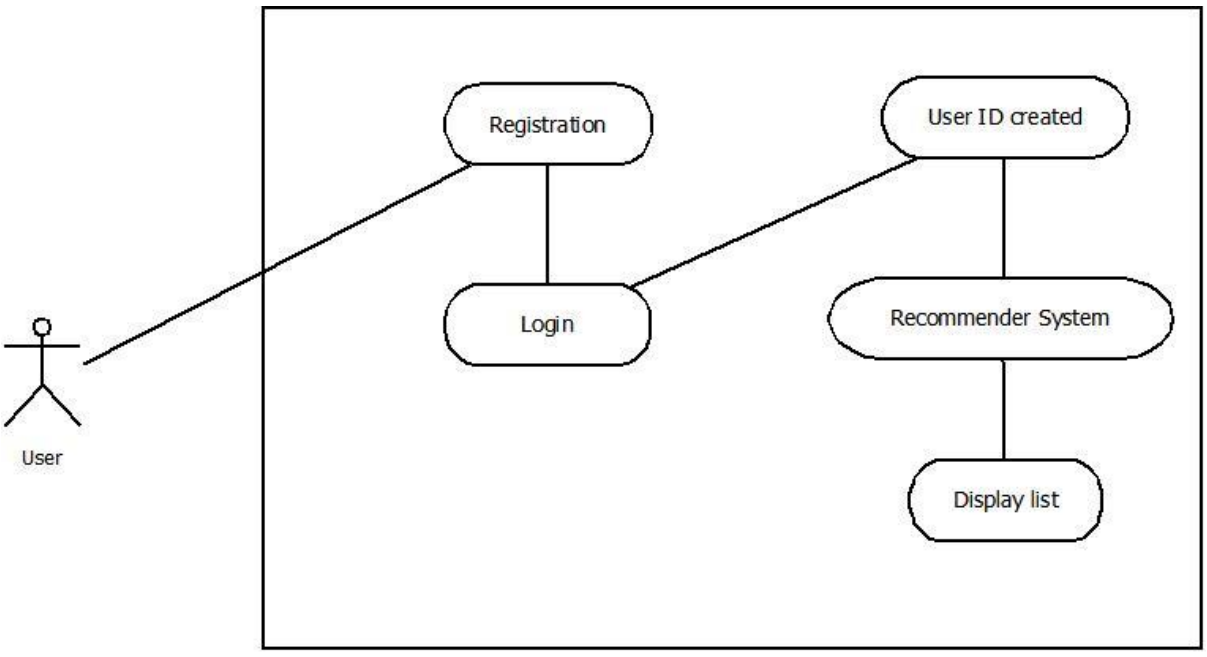
.

4. SYSTEM DESIGN

4.1. Architectural design



4.2. User Interface Diagram



4.3. Algorithmic description of each modules

1. Go to web page
2. Log in with user credentials

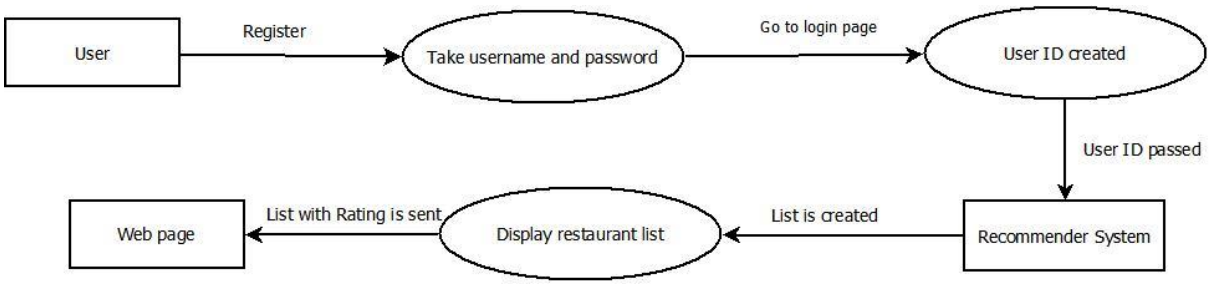
A. if not register, signup

B. Login with user credentials

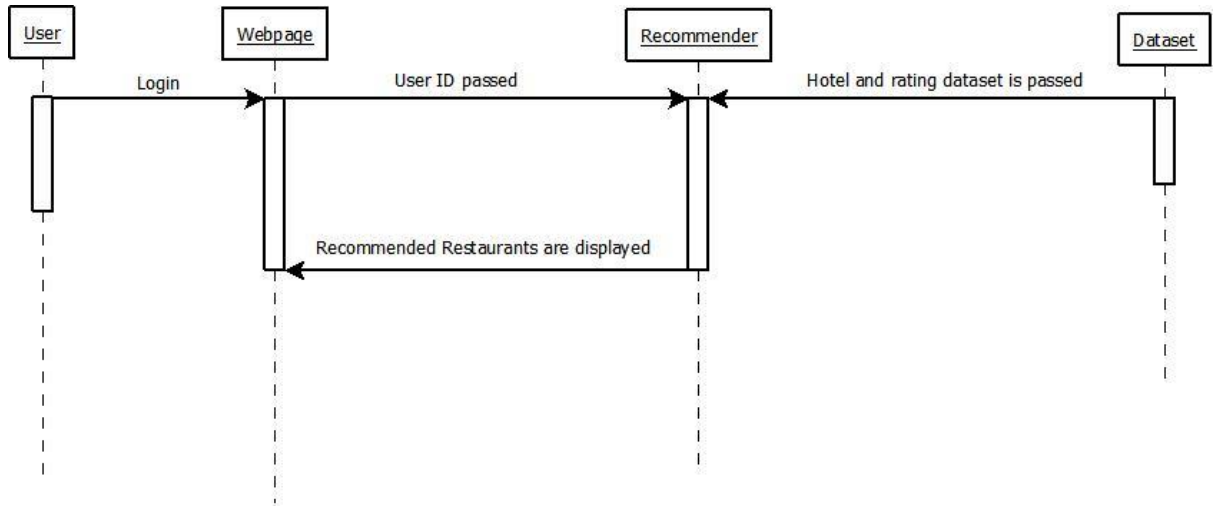
3. Implement collaborative algorithm
4. Display Restaurant List as per the recommendation system

4.4.System modeling

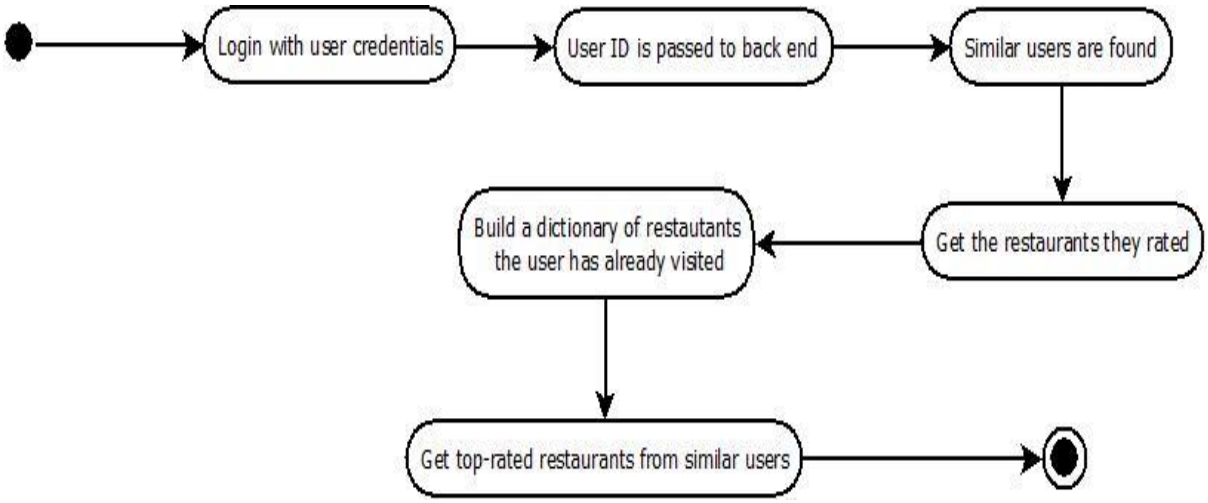
4.4.1. Dataflow Diagram



4.4.2. Sequence Diagram



4.4.3. Activity Diagram



5. IMPLEMENTATIONS

5.1. Detailed description of Methods:

- **PHP Code**

1. Register user
    - Registers the user

2. Login
    - Creates a user ID
    - Passes the user ID to next process

3. Display method
    - Displays list of the restaurants with ratings.

- **Python Code**

1. Load method
    - Loads the dataset as training set using function data.build_full_trainset().

2. Collaborative Method
    - Store user id from web page in 'pythonID.txt'
    - Let r_x be vector of user x's rating
    - Use KNN basic algorithm to find neighbors of user for which we are recommending restaurant
    - Use the cosine similarity method
    - Fit the train set to compute similarity
    - Arrange neighbors in descending order of their similarity
    - Choose 10 most similar users to user x.
    - Cancel x-to-x similarity score.

3. Recommendation Method
    - The prediction calculates similarity between each user and then based on each similarity calculates prediction
    - Using the formula, the prediction $P_{u,i}$ is given by

$$P_{u,I} = \Sigma_v (r_{v,i} * s_{u,v}) / \Sigma_v s_{u,v}$$

    - Recommend top 10 restaurants by deleting the visited restaurants.
    - Write result in 'output.txt' and send it to web page.

6. INTEGRATION AND TESTING

6.1. Description of the Integration Modules:

Integration testing is the phase in software testing in which individual software modules are combined and tested as a group. In this project we combine our 3 modules one by one after testing individual module and conduct testing for whole system.

6.2. Testing:

	Requirements	**Essential or Desirable**	**Description of Requirements**	**Expected Output**
RS1	The user should register	Essential	The user should register to go to login page	Jump to Login page
RS2	The user should login	Essential	The user should login to get restaurants' list.	Enter in the algorithm
RS3	The user id is taken as the input to the algorithm	Essential	The user id should be used as input to collaborative algorithm	User id is given to the similarity matrix
RS4	The similarity matrix is calculated	Essential	The similarity matrix should be calculated to find the similarity with other users	List of top similar users
RS5	The restaurants rated by the top similar users is taken	Essential	The restaurants rated by the top similar users is taken to find their visited restaurants	List of visited restaurants
RS6	The visited restaurants are found	Essential	The visited restaurants are found to check the restaurants which are not visited	The restaurants which are not visited are found

RS7	Find top rated restaurants	Essential	Finding top rated restaurants by similar users	List of recommended restaurants

7. PERFORMANCE ANALYSIS

- The performance analysis of this project is based on :

1. The accurate rating given by the user
2. The frequency in which the user gives the rating

8. APPLICATIONS

- **Real time implementation with the help of map**

The proposed system will guide the user, by plotting the paths on the map to the recommended location.

It will also point to the favorite restaurant in a nearby area.

The map can be used for the same. The web provides wide varieties of services for user to embed into website.

- **Tourism or hotel booking system or shopping**

This system can also be useful for tourism as well as for hotel booking

This system can be proposed for the user based on preference transaction network when a user selects hotels.

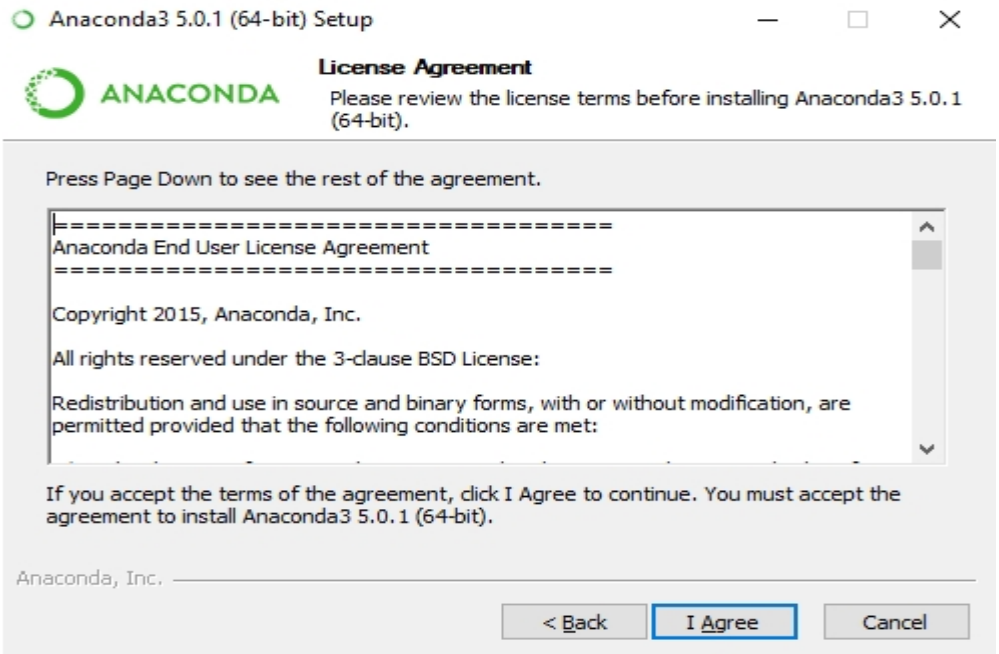
The proposed system is available for repeatable purchases without explicit product evaluation.

9. INSTALLATION GUIDE AND USER MANUAL

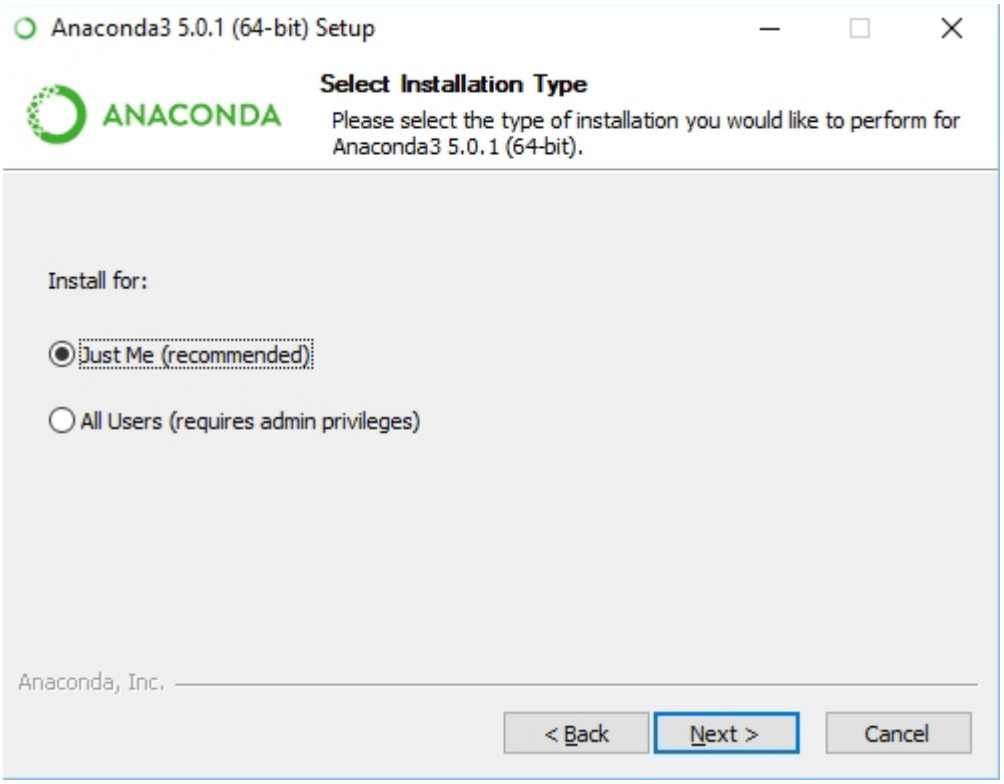
9.1. Installation of Anaconda

1. Download the Anaconda Installer
2. Double click the installer to launch setup file and Click “Next”

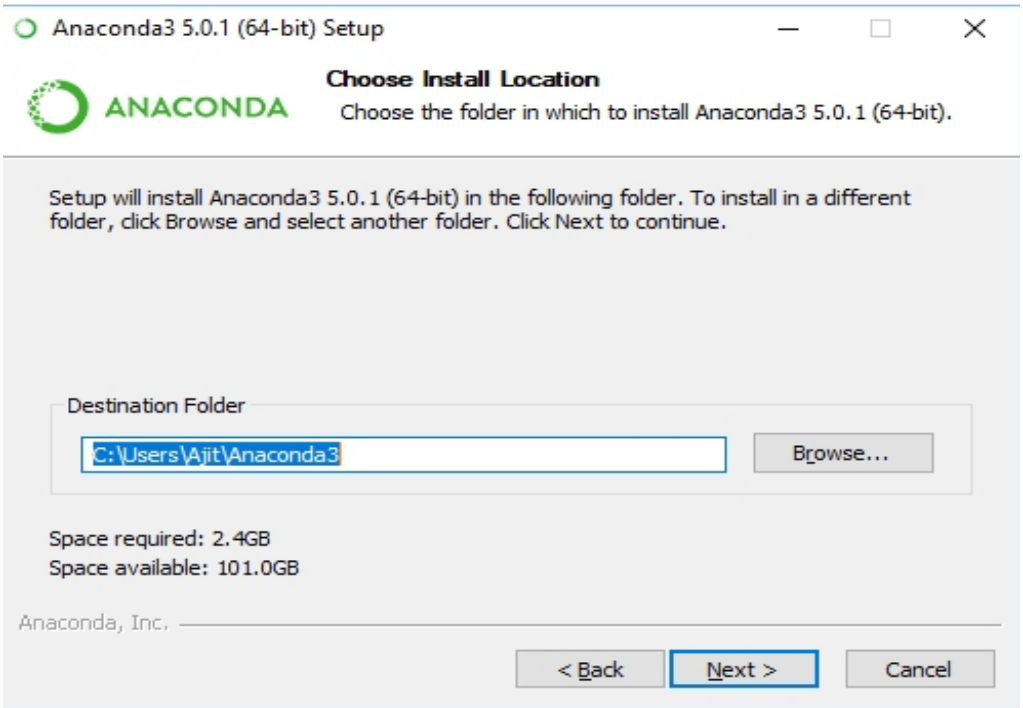
3. Read the license agreement and click on “I Agree”



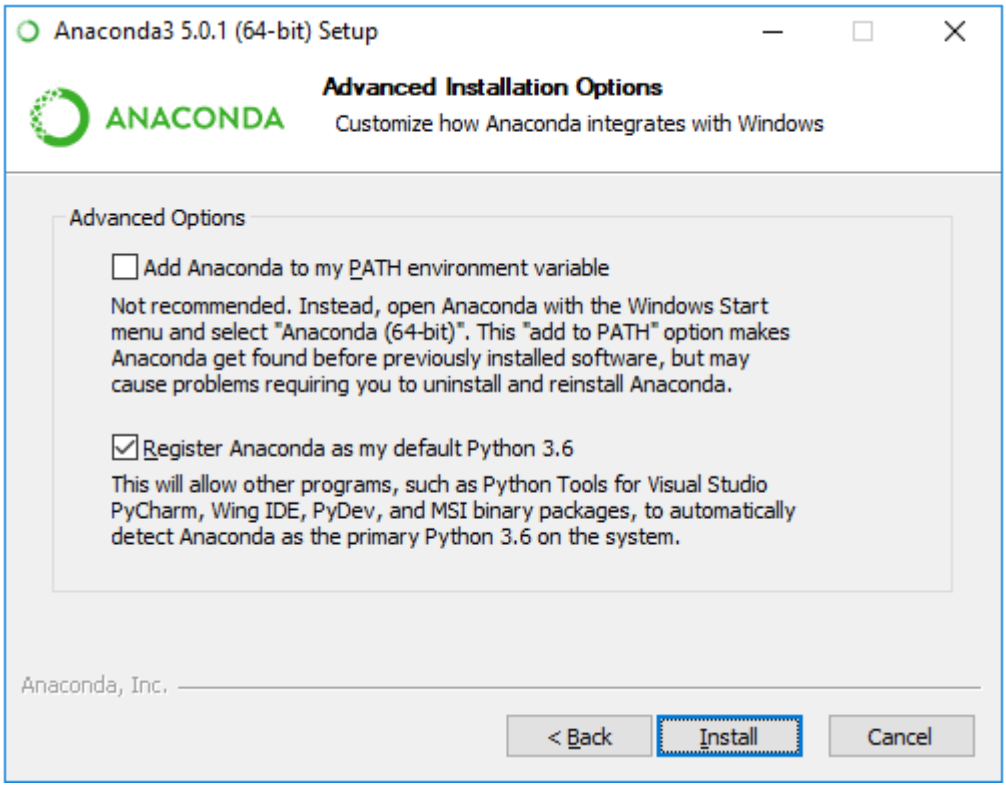
4. Click on “Just Me (recommended)” and click on Next



5. Note you installation location & click “Next”



6. Click on “Add Anaconda to my PATH environment variable”



7. You can install Microsoft VSCode if you wish, but it is optional
8. Click on “Finish”

10. ETHICS

As a Computer Science & Engineering student, I believe it is unethical to

1. Surf the internet for personal interest and non-class related purposes during classes
2. Make a copy of software for personal or commercial use
3. Make a copy of software for friends.
4. Loan CDs of software to friends.
5. Download pirated software from the internet.
6. Distribute pirated software from the internet.
7. Buy software with a single user license and the install it on multiple computers.
8. Share a pirated copy of software.
9. Install a pirated copy of software.

11. REFERENCES

[1] Wei-Ta Chu, Ya-Lun Tsai, “A hybrid recommendation system considering visual information for predicting favourite restaurants”, World Wide Web DOI 10.1007/s11280-017-0437-1, January 2017

[2] A Jayasimhan, P Rai, Y Parekh, O Patwardhan, “Recommendation System for Restaurants”, International Journal of Computer Applications (0975-8887), Volume 167-No.6, June 2017.

[3] Badrul Sarwar, George Karypis, Joseph Konstan, and John Riedl, “Item-based Collaborative Filtering Recommendation Algorithms” , WWW10, May 1-5, 2001, Hong Kong.

[4] Prem Melville and Raymond J. Mooney and Ramadass Nagarajan. “Content-Boosted Collaborative Filtering for Improved Recommendations”, Proceedings of the Eighteenth National Conference on Artificial Intelligence(AAAI-2002), pp. 187-192, Edmonton, Canada, July 2002