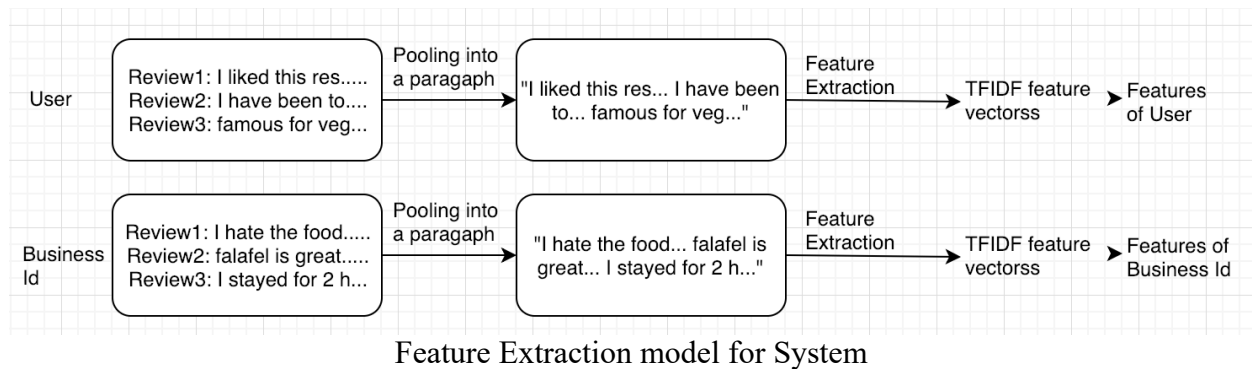# Restaurant Recommendation System
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Problem Description:

Recommendation System which returns top 3 recommendations which provide business Id based on ratings and review text.

Approach to the problem:

The architecture of the Feature Extraction model for System:

Feature Extraction model for System

Matrix Factorization:

I followed traditional approach matrix factorization or latent factor collaborative filtering. Initially constructed rating matrix $M \in \mathcal{R}^{m \times n}$ where index contains user id, columns contains business id and values filled with ratings. I factorize the matrix M into two matrices $P \in \mathcal{R}^{m \times k}$ and $Q \in \mathcal{R}^{k \times n}$ and solved the following optimization problem

$$\min_{P \in \mathcal{R}^{m \times k}, \in \mathcal{R}^{k \times n}} \sum_{(i,j) \in K} (M_{i,j} - (PQ)_{i,j})^2 + \lambda(\|P\|^2 + \|Q\|^2) \ \text{................. equation 1}$$

To extract the features from the text for a specific user, first pool all the reviews together form a single paragraph. I applied TFIDF vectorizer from sci-kit learn package to extract the features from the text. I followed the same approach for each business id (each restaurant). After all, we got the feature vectors P for user Id and Q for business Id.

Applied equation 1, to minimize the objective function (via stochastic gradient descent) I executed for 100 iterations and it took around 12 hours of time as the dimensions of the dataset is pretty huge. I stored the feature vectors and vectorizer in pickle file so that I can re-utilize the P and Q for prediction.

Prediction: Simply the inner product of the feature vector of plain text and feature vectors of business Id. Out of all, top N records to be fetched. I achieved an accuracy of 68.4% on the validation set

Deployment: I Developed basic webpage using Python, Flask, and Restful API. I deployed the web application in Amazon Web Service (AWS)
http://18.223.115.39/

Execution Instructions:

Type 1: I also deployed the application in Amazon Web Service (AWS). To access the web application, you may open below link to test the recommendation engine. This web link contains text box and submit button.

http://18.223.115.39/

Type 2: As I used REST API, you may execute below command predict the top 3 recommendation restaurants

curl http://18.223.115.39/ -d "Input Text=I am interested in non-vegetarian"

Type 3 Simple Program execution:

Step1: Unzip the quest_global zip file

Step2: Download the pickle file from below location and store in classification folder. Please let me know if you don't have access.

https://drive.google.com/file/d/1gmauZBet-Rma-PGQ_5okyvmk_601W662/view?usp=sharing

Step 3: Install requirements.txt file from recommendation folder

Pip3 install -r requirements.txt

Step 4: Run below command to execute the python file

Python3 recommendation.py