Isfahan University of Technology
Information Technology Fundamentals
Dr. Manshaei
Homework 2: Module 5 Web System - Recommender Systems
Deadline: Friday 4th **Khordad, at** $23 : 59$

We only accept the homework **delivered via Yekta (yekta.iut.ac.ir), before the deadline**.

Overview

This exercise aims to improve your understanding of recommendation systems. Following are almost all the methods used to implement these systems:

- Content-based recommendation

- Collaborative filtering

- Nearest neighbors

- Latent factor methods

- Matrix factorization

- Deep learning embedding

- Hybrid approaches

You can use python files or a Jupyter Notebook file for this homework. (For example, you can use Jupyter Notebook in PyCharm)

Goals and Instructions

1. (10 points) The goal of this exercise is to design a movie recommendation system using Collaborative Filtering and Content-based recommendation. First, study Collaborative Filtering and Content-based recommendation and briefly explain their algorithms.

2. (25 points) Recommendation systems also have problems of their own. The most important of these problems include:

    - Cold start

    - Exploitation (Diversity)

    - Sparsity

    - Scalability

    Each of the following examples addresses a problem in recommendation systems. After stating the problem, provide your proposed solution:

    - In a movie recommendation system, some users have only rated a few movies, making it difficult to find similar users for collaborative filtering.

    - In an e-commerce recommendation system, some products are very popular and are frequently recommended, while others are rarely recommended.

    - In a music recommendation system, new users have no listening history available, making it challenging to provide personalized recommendations.

    - In a news recommendation system, users may want to see diverse articles from different categories, but the system may repeatedly recommend similar articles to improve recommendation accuracy.

    - In a restaurant recommendation system, some restaurants have a high number of reviews and ratings, while others have only a few.

3. (45 points) The MovieLens dataset contains information about 100,000 movie ratings provided by 943 users for 1682 movies. This dataset also includes demographic information about users, such as age, gender, and occupation.

   Suppose you are working for a movie streaming service and your task is to design a recommendation system to suggest movies to users based on their past ratings and demographic information. Your goal is to provide movie recommendations that users will enjoy and keep them engaged with the platform.

   Design a collaborative filtering (item-based with cosine similarity) recommender system that recommends movies based on users' rating history. Measure the accuracy of your predictions using metrics such as the mean absolute error and the root mean squared error (Using libraries is not allowed in this section).

4. (45 points) Utilize film metadata (such as genre, year, director) in your recommendation system and create a content-based filtering model that suggests movies to users based on their preference history for specific genres or directors (In this section, you are allowed to use pre-built libraries, but you will receive fewer points (20 points)).

What should you upload as your homework?

- Your codes.

- A report of what you did.

- A video for explaining whatever you did. You should analyze and explain your solutions. (This video must be at most 15 minutes).

What should you do if you need help?

- Available links in this file

- ChatGPT

- GitHub

- Contact the TA (Reach out to `@Amir_Ahangarzadeh` via Telegram)