

COMP3607 Coursework:

Designing and Developing Personalised Recommender Systems

Overview

Lecturer/Marker

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Room MCS1034

Hand-out to students: 18 October 2021

Type: summative assessment

Level: 3

Components marked: report, video, RS implementation

Total marks: 100

Weight of module mark: 100%

Expected workload: 15 days, 3-4 h/day = 60 h

Submission instructions

Submission deadline **7 February 2022; 14:00**

Format

- **Turnitin:** report/documentation, as one PDF file.
- **Learn Ultra** – compressed (.zip or .rar) files to include: video, source code, resource files (including **datasets**¹), readme .txt

Plagiarism, collusion

Students suspected of plagiarism, either of published work or work from unpublished sources, including the work of other students, or of collusion will be dealt with according to Computer Science and University guidelines -

<https://www.dur.ac.uk/learningandteaching.handbook/6/2/4/>

I. Requirements

- A. You are required to design and develop **two different recommender systems** (e.g., CARS and collaborative filtering RS; hybrid RS and knowledge-based RS; or any other combination).

¹ Provide a link to the original dataset in the report. As part of your submission, include **only** the sampled and pre-processed datasets that you have used for your recommender systems.

Please note that your mark will be affected by the complexity of the implemented recommender systems (see Section II – Marking Criteria). That is, more advanced techniques (e.g., use of model-based methods instead of memory-based; application of deep learning techniques) will be rewarded with higher marks.

- B. You can choose any **domain** and **dataset** for your RSs. You have to use the same dataset/domain for both RS implementations. A list of some publicly available datasets is provided at the end of this document (Section IV). You are free to use other datasets or synthetically generated data.

Please note that your mark will be affected by the complexity of data processing applied (e.g., dataset size, data preparation methods, feature selection techniques).

- C. Your coursework should meet the following 4 categories of requirements:

1. System design and development

▪ **Programming language and testing environment:**

- *Python 3.8.5*
 - available packages are listed in the accompanying file “ListofPackages.txt” (ask before using additional packages/modules);
 - readme.txt should provide instructions for execution.
- Your RS solution will be tested on: laptop (2.8 GHz, 8 GB RAM); Windows 10 OS; Anaconda 3 Prompt.

▪ **Dataset**

- Select any dataset suitable for the RSs you intend to develop.
 - This will not have a negative impact on your mark. However, larger, more complex datasets will yield higher marks.
- Pay particular attention to data preparation and feature selection:
 - you are free to choose the data preparation methods;
 - describe the dataset and explain the methods in sufficient detail in the report;
 - you have to **justify** why these methods were appropriate for your application domain, purpose and RS technique.

▪ **Two recommender systems**

- **Two** different systems have to be implemented, both should deliver **personalised** recommendations and be based on **different** RS techniques (e.g., you should not implement two content-based RSs).
 - You are free to choose the **two** RS techniques.
 - The selected RS techniques will not have a negative impact on your mark. However, more advanced, state-of-the-art techniques will yield higher marks.
 - You have to provide a **justification** for the suitability of the selected RS techniques for the RS purpose, domain of application and available data.

▪ **Methods/techniques:**

- You should research and select the most appropriate/suitable methods for your implementations, including those for: data pre-processing, feature selection, user profile learning, rating prediction, recommendation order/ranking, evaluation metrics, etc.
- Application of more complex, state-of-the-art methods will yield higher marks.
- In the report, **describe** and **justify** the methods.

- Justifications should address the selected methods' relevance to and alignment with the purpose, application domain and data used for the implemented recommender systems.
- If possible, illustrate the recommendation techniques/process.
- Cite supporting literature.
- **User interface:**
 - This should be a **command line** interface.
 - Note: Do not develop graphical, web-based interfaces, as these will not be marked.
 - Basic/mandatory requirements to account for:
 - *Input*: How does the system recognise the active user? Are users aware which data is collected, how and for which purposes?
 - *Output*: How are recommendations presented to the user? Consider target user needs, in terms of e.g.: number of recommendations presented; style of presentation.
- **References and code comments:**
 - Make sure to reference any external sources you have used for the code, data, algorithm logic, etc.

2. Evaluation

- Evaluate the performance of your RS by carrying out an **offline experiment**.
- Choose **one evaluation metric** from **each** of the two i-ii categories listed below.
 - i. Accuracy of **rating** predictions
 - ii. Novelty, diversity, serendipity, coverage.
- You should then **justify** the two selected metrics, i.e., why are those metrics appropriate for the purpose of the RSs and the domain of application, than other metrics from the same category.
- Finally, you should apply the two metrics you have chosen to evaluate **both** of your RSs, i.e., the two RS techniques you have implemented.
- **Compare** your two RSs, i.e., the two RS techniques you have implemented, on both evaluation metrics.
 - Consider how you will present the results – e.g., in tabular format or as visualisations.
 - Use the evaluation results to draw conclusions about which of the two RS techniques gives better performance, is more suitable for the domain of application.

3. Report

The report should be up to (**max.**) 3 pages, including references; use IEEE conference paper formatting²; apply research paper/academic writing style (e.g., use formal language, avoid singular first-person pronouns).

It should include **all** of the following sections:

- Introduction
 - Domain of application

² <https://www.ieee.org/conferences/publishing/templates.html>

- Purpose/Aim
- Methods
 - Data description
 - Data preparation and feature selection
 - Recommendation techniques/algorithms
 - Evaluation methods
- Implementation
 - Input interface
 - Output interface³
- Evaluation
 - Evaluation metrics' results
 - RS techniques' comparison
- Conclusion
- References

4. Video

The video should showcase and **compare** your two recommender systems. In up to 2 minutes, you are to demonstrate:

- Input interface: how the user inputs data to the system.
- Output interface: how recommendations are presented to the user and any other interaction (e.g. feedback) a user is allowed at this stage.
- Back-end: explain how recommendations are generated; the techniques/algorithms used.

Note – marks will be **reduced** for videos longer than 2 minutes. For every 5 seconds longer, 10% of the marks for the video will be reduced.

II. Marking Criteria

The marking criteria is outlined below:

1. **Fail mark** – most of the basic requirements have not been met; there are major errors in the two RS implementations' functionality.
2. **Pass mark** - basic requirements were met, with some errors in the methods' selection and justification, and some errors present in the two systems' functionality.
3. **Average mark** – all basic/mandatory requirements were met; simpler, conventional methods were adopted; both RSs are fully functional.
4. **Exceeded requirements** (>70) – beyond the basic requirements, more complex, state-of-the-art solutions were implemented, including, e.g.: processing larger dataset; advanced feature extraction/selection methods; user profiling based on a variety of features (e.g., where data permits, demographic, ratings, reviews, contextual data, etc.); more advanced, state-of-the-art prediction and recommendation methods (e.g., model-based, deep learning); UI with explainable recommendations and user profile

³ Note: Present the recommendations

updating; strong, clear, supported justification of the used methods; fully functional implementation of both RSs.

Continuous participation - 10% of your coursework mark will be derived from your on-going participation and engagement in the module's activities and tasks, including: formative assignment, peer review, in-class tasks, group discussions. Participation mark components and their weight are:

Marking	Submitted (1); not submitted (0)
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Components	Weight
Formative assignment	35%
Peer review	25%
Pre-/post-lecture tasks	40%
During-lecture interaction	<i>bonus</i>

The distribution of coursework marks is presented in the table below.

Methods and techniques	30
Description and justification (supported by literature) of all methods applied, including: data preparation, feature selection/extraction, user profile learning, rating prediction, recommendation presentation, user interface (input, output), etc.	
Implementation	20
Both recommender systems work as per reported methods; functionality is streamlined, robust, without errors; input interface – active user is recognised; output interface – personalised recommendations are presented to the active user; selected dataset is used to generate recommendations; evidence of applied evaluation metrics is provided	
Evaluation	25
Two evaluation metrics selected and applied to both RSs; justification of each of the selected metrics; comparison of two RS techniques	
Presentation	15
Report, video	
Participation	10
Participation and engagement in formative assignment and weekly tasks.	
TOTAL	/100

III. Learning Outcomes

Subject-specific knowledge demonstrated via:

- an understanding of the different types of recommender systems, their purpose and domains of application
- an understanding of recommender system users: usage behaviour, demographics, preferences, contextual information
- an in-depth knowledge of recommender system algorithms.
- an understanding of recommender system evaluation methods.

Subject-specific and key skills demonstrated via:

- an ability to undertake self-study and independent research

- an ability to critically analyse and evaluate state of the art practices
- an ability to apply RS methods and techniques
- an ability to implement a recommender system for a specific domain
- an ability to evaluate RS performance.

IV. Datasets

Some publicly available datasets for recommender systems are listed here:

- Yelp - <https://www.yelp.com/dataset> - user reviews of different businesses and services in a specific location
- LDOS-CoMoDa - <https://www.lucami.org/en/research/ldos-comoda-dataset/> - context-aware movie data
- Million Song Dataset - <http://millionsongdataset.com/> - music and context data
- GroupLens datasets - <https://grouplens.org/datasets/> - including: movies, books, personality-aware data
- UC San Diego repository of RS datasets - <https://cseweb.ucsd.edu/~jmcauley/datasets.html> - including: Amazon reviews, Goodreads, clothing data, etc.
- Synthetic data - DataGenCARS - http://webdiis.unizar.es/~maria/?page_id=70