School of Computing and Information Systems
The University of Melbourne
COMP90049, Introduction to Machine Learning,
Semester 1, 2024

Assignment 2: How good is that movie?

Release:	Monday 15 April 2024
Due:	*Stage I*: Friday, 10 May 2024 at 5 PM *Stage II*: Friday, 17 May 2024 at 5 PM
Marks:	The Project will be marked out of 30 and will contribute 30% of your total mark.
Main Contact:	Hasti Samadi (hasti.samadi@unimelb.edu.au)

1 Overview

The goal of this projec ds, to predict the rating of some movies extract

This assignment offers ithin a research context and enhance skills in da

The objective is to criti learning algorithms for predicting movie rating rt. The technical aspect involves implementing the report focuses on interpreting observatio

Your report should sh manner accessible to a reasonably informed re

2 Deliverables

Stage I: *Model develop*

1. **Report (25 marks)**: An anonymous written report, of 2200 (±10%) words including a reference list, figure captions and tables. We are using the Canvas word counter as our word count reference. Your name and student ID should not appear anywhere in the report, including the metadata (filename, etc.). *You should submit your report as a* ***single PDF file TWICE.***
   a. *Once through Canvas/Turnitin (A2: Open-ended Research Report)*
   AND
   b. *Once through Canvas/Feedback Fruits (A2: Peer Review and Self-Reflection)*
2. **Output (2 marks)**: Rating predictions for the test instance dataset. *Submitted as a single CSV file through Kaggle in-class competition.* (Described in section 7).
3. **Code**: One or more programs, written in Python, including all the code necessary to reproduce the results in your report (model implementation, label prediction, and evaluation). Your code should be executable and have enough comments to make it understandable. You should also include a README file that briefly details your implementation. Please note that if you do not submit your code or your code is not functional, we will not mark your report. *Submitted as a zip file through*

Canvas (A2: Open-ended project code and comments)

Stage II: *Peer reviews (due May 17th):*

1. **Peer review:** reviews of two reports written by other students of 210-360 words each (Described in section 5)
2. **Reflection**: a written reflection piece of 400 words. (Described in section 5)

Both should be submitted via Canvas/Feedback Fruits - A2: Peer Review and Self Reflection

NOTE 1: Do **NOT** upload your report as part of a compressed archive (zip, tar, . . .) file or in a different format.

NOTE 2: Stage I submissions will be open from May 5. Stage II submissions will be open as soon as the reports are available (24 hours following the Stage I submission deadline).

3 Data

The information on mo rm that allows users to search its database of m roject are available via Canvas and are describ

In our datasets, each m

- *Movie features* original_language` and more.
- *Text features*: verview`, `tagline` and `production_co ncode these features for you.

You are provided with:

- Labelled datase
  - TMDB with their rating labels that yo s.
  - TMDB with their rating labels that yo odels.
- Unlabelled datasets:
  - TMDB_unlabelled.csv: Consists of details of 254,701 movies that you can use to train your unsupervised or semi-supervised Machine Learning models.
  - TMDB_test.csv: Consists of details of 20,000 movies that you should use to TEST the performance of your Machine Learning models and report the result onto the Kaggle page.
- Pre-processed datasets:
  - TMDB_text_features_*.zip: The pre-processed text features for training and test sets, one zipped file for each text encoding method. Details about using these text features are provided in the README file.

3.1 Target Labels

These are the labels that your model should predict (y). We provide this label in two forms:

- the average rating (float; in the column named `average_rate` in the Train and Evaluate CSV files); and
- a categorical label indicating the rating band, where we binned the rating of the movies into 6 categories as follows (integer; in the column named `rate_category` in the Train and Evaluate CSV files).:
    - *average_rate < 4* → *0*
    - *4 <= average_rate < 5* → *1*
    - *5 <= average_rate < 6* → *2*
    - *6 <= average_rate < 7* → *3*
    - *7 <= average_rate < 8* → *4*
    - *average_rate >= 8* → *5*

You may use either of these label representations in your experiments, but different representations might call for different machine-learning approaches.

3.2 Features

To aid in your initial ex from the given datasets. You may use any subs r experiments, and you may also engineer your

The provided represent

1. **BoW (Bag of**

   We applied th of *Token_ID* and their *count*. For exa from Nigeria", will be transformed int

   [(397

   Where 39785 Token_ID for the word "Nigeri". In th opwords[1]` and (2) only retained the 10 s.

   . There are mar ent hypotheses you may have. For exar t words' can affect the behaviour of yo les.

2. **TFIDF**

   We applied term frequency-inverse document frequency pre-processing (*TfidfVectorizer*) to transform the text features as a vector of values that measure their importance using the following formula:

$$w_{d,t} = f_{d,t} \times \log \frac{N}{f_t}$$

   Where $f_{d,t}$ is the frequency of term t in document d, f_t is the number of documents containing t, and N is the total number of documents in the collection. You can learn more about TFIDF in (Qaiser, Ali 2018).
   Using TFIDF the above example title will be transformed into the following vector:

[1] Stopwords are common words like "the," "and," "is," etc., which are filtered out from text data because they carry little meaningful information for natural language processing tasks.

[(39785, 0.707), (28688, 0.707)]

Similar to the Bag of Words method, you can use and edit this basic method to experiment with your ideas. In our provided dataset, we (1) removed all `stopwords` and (2) only retained the 1000 words in the full data set with the highest TFIDF values.

There are many other text vectorization methods that you can use (e.g. word2vec, Bert, etc.). You are welcome and encouraged to use as many vectorization methods as you choose. But please keep in mind that we are more interested in the depth of analysis and quality of interpretation in your report, NOT the variety or complexity of the methods you have used.

4 Stage I

4.1 Task Basics

You'll use the TMDB_t ourself, you can use the pre-processed files (TM s. Then, you'll evaluate these models using TM

Depending on your res improve your models.

Once your models ar for all the movies in TMDB_test.csv. You'll

4.2 Research Questi

You should formulate rithms and appropriate evaluation metrics to ac questions:

- Are big-budget
- Is there any rel eir movies?
- Is the rating of
- Is the rating of
- Does the use earning models in this dataset?
- How does the earning models in this dataset?
- Does using the 'overview' assist with the identification of very high-rated movies?

There are many more possible questions. You can choose to use any as your research question.

4.3 Feature Engineering

The process of engineering or selecting features that are useful for discriminating among your target class set is inherently poorly defined. Most machine learning assumes that the attributes are simply given, with no indication from where they came. The question as to which features are the best ones to use is ultimately an empirical one: just use the set that allows you to correctly classify the data.

In practice, the researcher uses their knowledge about the problem to select and construct "good" features. What aspects of a movie's details might indicate its rating? You can find ideas in published papers, e.g., (Saraee, White et al. 2004).

It is optional for you to use the features provided (as they are), generate a new set of features or select a substitute of the features. Whatever method you choose, you have to use the features to train some models and run a few experiments on the given evaluation data.

4.4 Analysing Machine Learning Models

Various machine learning techniques have been (or will be) discussed in this subject (0R, 1R, Naive Bayes, Decision Trees, k-NN, Logistic Regression, Neural Networks, etc.); many more exist. You may use any machine learning method you consider suitable for this problem. *You are strongly encouraged to make use of machine learning software and/or existing libraries (such as sklearn) in your attempts at this project.*

In this stage, your task has two phases:

- *The training-evaluation phase:* The holdout approach should be applied to the training data provided. Check section 4.6 for the minimal expectations in this phase.
- *The test phase:* the trained classifiers will be evaluated on the provided test data. The predicted labels of test ca Kaggle. Check section 7 for details.

Based on your researc a few experiments, you are expected to develop lo and some hypotheses of how you can change

Example 1

Hypothesis: *removi noise and increase the performance of x an*

Test: *compare the pe ' removal and comment on the observation. t?*

Example 2

Hypothesis: The *ma omething to do with the structure of the inst*

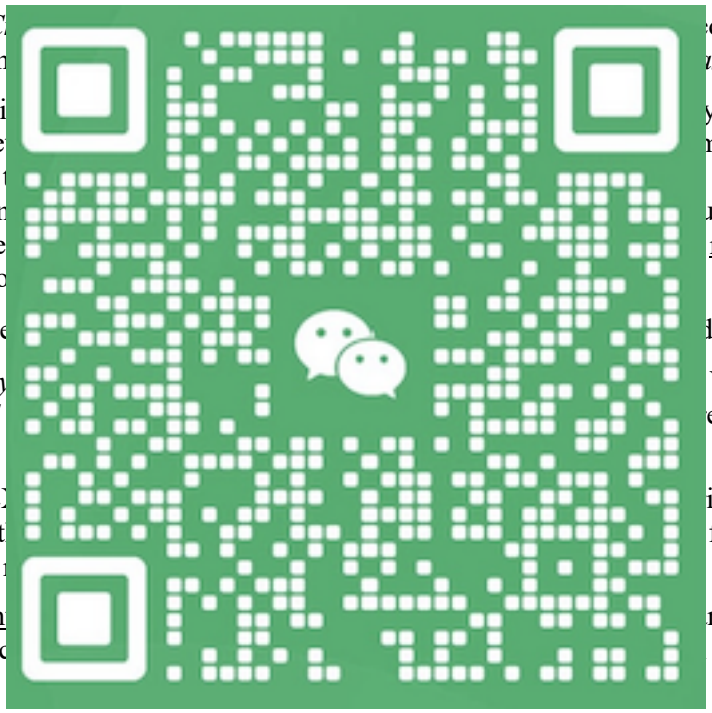
Test: *Change the str ering or any other way) and test the perform he observation support the hypothesis? Why*

You should then test these hypotheses with more experiments. When explaining your results, you are expected to use examples from the dataset as well as theories and findings from the lectures and published literature. You are also expected to use appropriate visualization tools (e.g., tables or diagrams) to communicate your findings professionally and academically.

4.5 Report

Your main submission for this assignment is your report. The report should follow the structure of a short research paper, as will be discussed in the guest lecture on Academic Writing. It should describe your approach and observations, both in engineering features, and the machine learning algorithms you tried. Its main aim is to provide the reader with knowledge about the problem, in particular critical analysis of your results and discoveries. The internal structure of well-known classifiers (discussed in the subject) should only be mentioned if it is important for connecting the theory to your practical observations.

The following is the expected structure of the report for this assignment.

- *Introduction*: a short description of the problem, data set and research question. Your report should clearly state your research question. Remember addressing more than one research question does not necessarily lead to higher marks. We value the depth and quality of your critical analysis of methods and results over simply covering more content or materials.
- *Literature review:* a short summary of some related literature, including the data set reference and at least two additional relevant research papers of your choice.
- *Method:* Introduce the used feature(s), and the rationale behind including them. Explain and justify the Machine Learning models you have used and their hyperparameters. You also need to explain your evaluation method(s) and metric(s) you have used (and why you have used them). *This should be at a conceptual level; a detailed description of the code is not appropriate for this report. The description should be similar to what you would see in a machine learning conference paper.*
- *Results*: Present the results, in terms of evaluation metric(s) and, ideally, illustrative examples and diagrams.
- *Discussion / C*  d on the understanding of the subject m *ssignment*).

  Contextualise i you have thought about the task and de methods, rather than the raw scores of t you should ignore the relative perform uld think beyond simple numbers to the research question. You can also add co
- *Conclusion*: De l suggest the next steps.
- A *bibliography* You are encouraged to use the APA 7 e consistent throughout your report.

We will provide LATE iting the report. Reports are to be submitted in t format other than PDF, we reserve the right to

Your name and studen ny metadata (filename, etc.). If we find any suc a mark of 0.

4.6 Number of the models

You should minimally implement and analyse in your report one baseline, and at least two different machine learning models.

Reminder: We are more interested in your critical analysis of methods and results than the raw performance of your models.

You may not be able to arrive at a definitive answer to your research question, which is perfectly fine. However, you should analyse and discuss your (possibly negative) results in depth.

5 Stage II

Task Basics

Once you've submitted your anonymized report through Feedback Fruit AND the main assignment page, you'll receive two reports from your classmates to review. You'll need to read them carefully and provide a peer review for each. Additionally, you'll write a self-reflection report about your own submission.

Peer Review

During the reviewing process, you will read two anonymous submissions by your classmates via Feedback Fruits. This is to help you contemplate some other ways of approaching the project and to ensure that every student receives some extra feedback. You should aim to write 210-360 words per review, responding to three 'questions':

- Briefly summa ds)
- Indicate what y graph (70-120 words)
- Indicate what y aph (70-120 words).

Please be courteous and reviewers can be found here.

Self-Reflection

A comprehensive writt the following topics in 400($\pm$10%) words.

- the process of
- things that you tage I deliverables, e.g. modelling, eva

The reflection report i heir own reflection on Feedback Fruits.

6 Assessment Cri

The Project will be marked out of 30 and is worth 30% of your overall mark for the subject. The mark breakdown will be:

Report Quality: (25/30 marks)

You can consult the marking rubric on the Canvas/A2: Open-ended Research Report page which indicates detailed categories that we will be looking for in the report.

Kaggle: (2/30 marks)

The performance of the classifier *(1 mark)* is for submitting (at least) one set of model predictions to the Kaggle competition; and *(1 mark)* to get a reasonable accuracy, e.i., better than our threshold.

Reviews: (2/30 marks)

You will write a review for each of the two reports written by other students; you will follow the guidelines stated above.

Reflection: **(1/30 mark)**

You will write a self-reflection review for your report following the guidelines stated above.

You must submit your code that supports the results presented in your report. If you do not submit an executable code that supports your findings, you will receive **zero** marks for the report section.

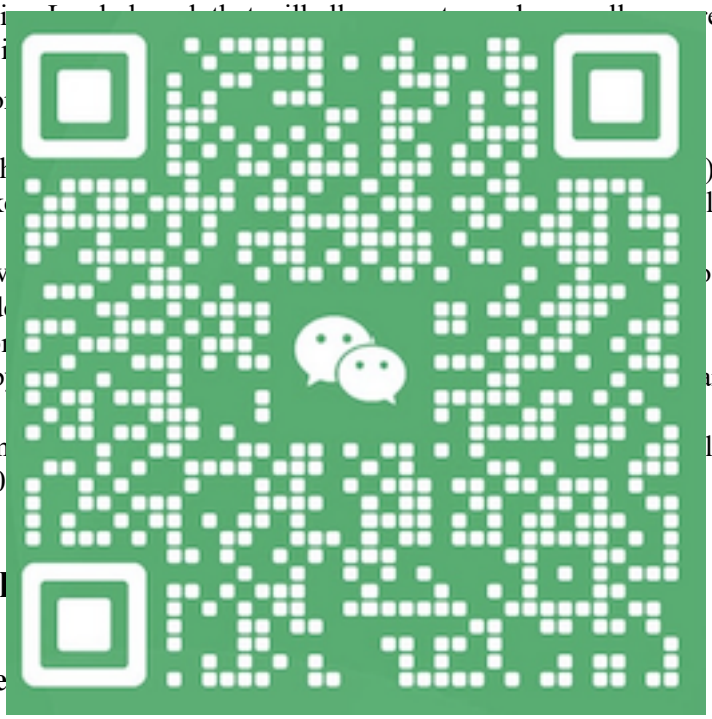
Since all the documents exist on the World Wide Web, it is inconvenient but possible to "cheat" and identify some of the class labels from the test data using non-machine learning methods. If there is any evidence of this, the performance of the classifier will be ignored, and you will instead receive a mark of **zero** for this component.

7 Using Kaggle

To give you the possibility of evaluating your models, even more, we will be setting up a Kaggle In-Class competition. You can submit results on the test set there and get immediate feedback on the performance of your system. There i e doing as compared to other classmates partici

The Kaggle in-class co competition:

- Each student sh) using your Student-ID
- You may mak le can be found on the Kaggle site.
- Submissions w f the test data, forming the public lead
- Before the co of the ones submitted previously – b rd score is selected by Kaggle.
- After the com laced with the private leaderboard 10



8 Assignment Pol

8.1 Changes/Update

We will use Canvas to advertise any (hopefully small-scale) changes or clarifications in the assignment specifications. Any addendums made to the assignment specifications via Canvas will supersede the information contained in this version of the specifications.

8.2 Late Submissions

Late submissions in stage I will bring disruption to the reviewing process. **There will be no extensions granted, and no late submissions allowed to ensure a smooth run of the Stage II process.** Submission will close at 5 pm on May 10th.

You are strongly encouraged to submit by the date and time specified above. For students who are demonstrably unable to submit a full solution in time, we may offer a solution but note that you may be unable to benefit from the peer review process in that case. A solution will be sought on a case-by-case basis. Please email Hasti (hasti.samadi@unimelb.edu.au) with documentation of the reasons for the delay.

8.3 Academic Honesty

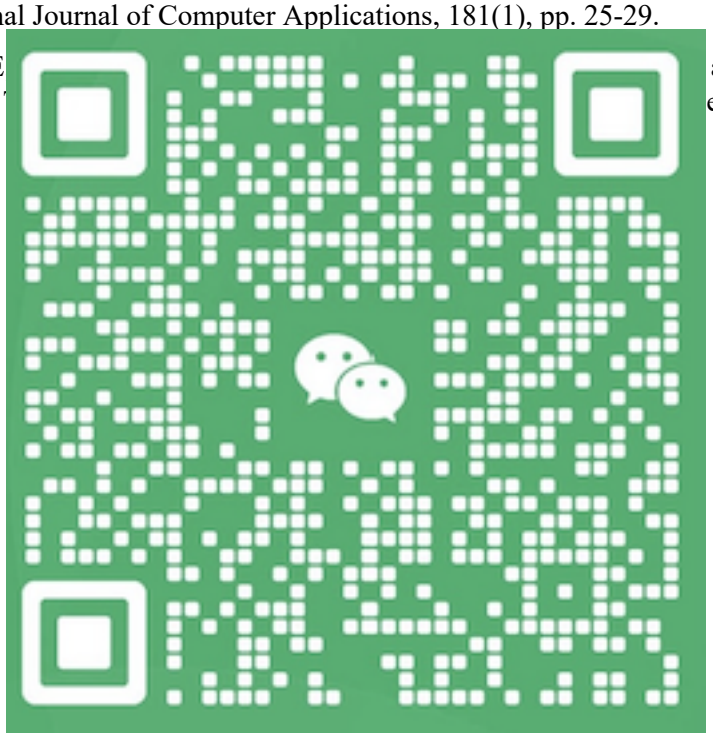
While it is acceptable to discuss the assignment with others in general terms, excessive collaboration with students outside of your group is considered cheating. Your submissions will be examined for originality and will invoke the University's Academic Misconduct Policy[2] where either inappropriate levels of collaboration or plagiarism are deemed to have taken place.

We highly recommend (re)taking the academic honesty training module in this subject's Canvas. We will be checking submissions for originality and will invoke the University's Academic Misconduct policy where inappropriate levels of collusion or plagiarism are deemed to have taken place.

Reference:

QAISER, S. and ALI, R., 2018. Text mining: use of TF-IDF to examine the relevance of words to documents. International Journal of Computer Applications, 181(1), pp. 25-29.

SARAEE, M., WHITE analysis and prediction of movie ratings. WIT es, 33.



[2] https://academicintegrity.unimelb.edu.au/home