



UNIVERSITY OF
ABERDEEN

University of Aberdeen
School of Natural and Computing Sciences
Department of Computing Science
MSc in Artificial Intelligence
2020 – 2021

Assessment Item 3 of 3 Briefing Document – Individually Assessed (no teamwork)

Title: CS5079 – Applied AI

Note: This assessment accounts for 34% of your total mark for the course.

Learning Outcomes

On successful completion of this component, a student will have demonstrated competence in the following areas:

- Using a non-trivial dataset, plan, execute, and evaluate significant experimental investigations using multiple machine learning algorithms for sentiment prediction.
- Ability to deploy a model into an online platform.

Information for Plagiarism: The source code and your report may be submitted for plagiarism check (e.g., Turnitin). Please refer to the slides available at MyAberdeen for more information about avoiding plagiarism before you start working on the assessment. Please also read the following information provided by the university: <https://www.abdn.ac.uk/sls/online-resources/avoiding-plagiarism/>

Report Guidance & Requirements

Your report must conform to the below structure and include the required content as outlined in each section. Each subtask has its marks allocated. You must supply a written report, along with the corresponding code, containing all distinct sections/subtasks that provide a full critical and reflective account of the processes undertaken.

A detailed description of each of the **two tasks** can be found below. Please use **Python** for all programming tasks. You may use python-based frameworks, such as **Tensorflow and Keras**.

Both datasets needed to fulfill the requirements of this assessment can be found in MyAberdeen.

Useful Information

- Describe and justify each step that is needed to reproduce your results by using code-snippets, screenshots, and plots. When using screenshots or plots generated in Python, make sure they are readable.
- As the datasets provided correspond to real-life problems, the performance expected might not be as high as you might think.

- If you use open source code, you must point out where it was obtained from (even if the sources are online tutorials or blogs) and detail any modifications you have made to it in your tasks. You should mention this in both your code and report. *Failure to do so will result in zero marks being awarded on related (sub)tasks.*

Marking Criteria

- Quality of the report, including structure, clarity, and brevity.
- Reproducibility. How easy is it for another MSc AI student to repeat your work based on your report and code?
- Quality of your experiments, including design and result presentation (use of figures and tables for better reporting).
- Configured to complete the task and the parameter tuning process (if needed).
- In-depth analysis of the results generated, including critical evaluation, insights into data, and significant conclusions.
- Quality of the source code, including the documentation of the code.

Submission Instructions

You should submit a “ZIP” file via MyAberdeen by 23:59 on 20th of December 2020. The name of the ZIP file should have the form “CS5079_Assessment3_< your Surname>_<your first name>_<Your Student ID>”. For instance, “CS5079_Assessment3_Smith_John_4568985.pdf”, where 4568985 is your student ID.

The ZIP file should contain two folders: “task_1” and “task_2”. Each folder should contain your code and any associated files along with the report for the corresponding task. Please try to make your ZIP file less than 10MB as you may have issues when uploading large files to MyAberdeen.

Any questions about any aspects of this assessment, please address them to the course coordinator Bruno Yun, bruno.yun@abdn.ac.uk.

Task 1: Creating a Sentiment Prediction Platform (50/100) [max. 3 pages]

We consider a real-life dataset consisting of 50,000 labeled gourmet food reviews from Amazon extracted from the work of McAuley and Leskovec¹. A food review is labeled as 1 (positive) if it received four or more stars and 0 (negative) otherwise. The dataset is balanced and we provide two files (*positive_reviews.csv* and *negative_reviews.csv*) containing 25,000 positive and negative reviews respectively (see Figure 1).

Review	Label
Over 6.00 a box and people call this a good deal?? Waste of money. You can get better deals at Sam's Club or Costco...	0
This was a very good buy and arrived in perfect condition in a very timely manner. Yes, I would order again.	1

Figure 1: Example of food reviews from the data

The goal is to train machine learning (ML) models for sentiment prediction, evaluate them, and deploy the best model on a platform. The result should be similar to the service proposed on the following website: <https://monkeylearn.com/sentiment-analysis-online/>

Subtasks:

- 1.1) *Using your own words*, please explain the several steps that you will need to go through to create your sentiment prediction platform. Your description should include (but not only) the following points (**2 marks**):
 - Data retrieval
 - Feature Extraction
 - Feature Engineering
 - Model Evaluation
 - Deployment
- 1.2) Please provide a short description of the dataset provided, along with how you imported the data, providing snippets of code along with a detailed description (**2 marks**).
- 1.3) Employ exploratory data analysis (EDA) techniques to gain an initial understanding of the data. Please provide appropriate visualization results and initial insights gained from EDA (**4 marks**).
- 1.4) Motivate, explain, and apply any necessary pre-processing techniques on your food reviews. Using an example, show how a string is transformed after each processing step. (**6 marks**)
- 1.5) Implement the following techniques for sentiment prediction:
 - Logistic regression with BOW and TF-IDF word features
 - Support vector machine with BOW and TF-IDF word features
 - Long-short term memory network with an embedding layerFor each of them, describe in detail how you deployed them and adjusted their parameters, going into detail on what each parameter does as well. You may use open source code and libraries as long as you acknowledge them (**14 marks**).
- 1.6) Split your dataset into a training and test set of size 35,000 and 15,000 respectively. Train and evaluate the performance of the techniques developed in task 1.5. Please present and discuss your results using metrics and/or tables. (**8 marks**)

- 1.7) Select and save the “best” model, then deploy it on an online platform of your choice. The end-user should be able to input a string of text and receive its polarity (along with a confidence score). The report should contain the URL of the online platform along with detailed explanations and screenshots. You may use Flask or Django and services like Heroku. (14 marks)

Bonus – Optional: Should you decide to implement any further explanation features on your online platform along with the predicted sentiment, there will be a bonus of up to **5 marks**. To explain the intuition of your explanation method and the code, you will be allowed *at most one additional page*. The maximum overall mark for this assessment remains at 100/100; however, attempting the bonus exercise will make you practice more on developing algorithms on your own and enhance your chances of getting a higher mark overall.

Task 2: Regulatory challenges faced by machine learning deployments in the Healthcare sector (50/100) [~ 1000 words]

You are working for a healthcare company in the UK. The company is developing patient prioritisation systems. The system looks at the patient, their medical records and severity of their illness to prioritise them for care at NHS hospitals. Although the short term focus on the company is to roll out their services in the UK, they want to expand their product offerings to the USA in the next two to three years period. You are being tasked with looking into all upcoming regulations and requirements for AI adoption in the healthcare sector from UK, EU and USA perspectives. Also, your boss has asked to provide potential solutions that meet these requirements.

For this task, you have to write ~ 1000 words report that discusses:

- 2.1) Provide a brief explanation of upcoming regulations that AI in healthcare has to satisfy? For example EC's AI Framework, FDA's AI Healthcare and ICO UK AI whitepapers. (10 marks)
- 2.2) Use a tabular format to identify relevant requirements imposed by the listed frameworks/whitepaper in 2.1
 - a) Combine the requirements from the listed frameworks/whitepapers along with providing references. (10 marks)
 - b) Provide an explanation of what the individual requirements require an AI application to support. (10 marks)
 - c) What technical solutions you recommend that your company can deploy to make sure they comply with the listed frameworks/whitepaper in 2.1. (20 marks)