University of Aberdeen

School of Natural and Computing Sciences

Department of Computing Science

MSc in Artificial Intelligence

2020 – 2021

Assessment Item 2 of 3 Briefing Document – Individual Work

Title: CS5079 – Applied AI	Note: This assessment accounts for 33% of your total mark of the course.

Learning Outcomes

On successful completion of this component, a student will have demonstrated competence in Explainable AI techniques, understanding of ethical and social challenges of AI and ability to investigate and identify solutions to commercial challenges.

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

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 the necessary code (in Python notebooks – if applicable), along with a written report containing:

- An introduction to the problem (environment) written using your own words
- The motivation for each approach considered to solve the problem.
- An evaluation of the approach(es) with a critical and reflective account of the processes undertaken. *You should highlight any further measures taken as a result of the evaluation.*

The report should 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. If any open-source code is used, 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 Scheme

The following marking criteria will be taken into account:

- Quality of the report, including structure, clarity, good English and brevity.
- Reproducibility. How easy is it for another MSc AI student to repeat your work based on your report and code?
- Understanding. Can you show a deep understanding of the approaches used?
- 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 and conclusions.
- Quality of the source code (including the documentation of the code and comments).

This examination will be marked on 100 marks by your instructor. This assignment is an individual assignment – where each student has to solve the questions individually. Note: This is not a group assessment.

Submission Instructions

You should submit a PDF version of your report along with your code via MyAberdeen by 23:59 on 14th of December 2020. The name of the PDF file should have the form "CS5079_Assessment2_<Student_Name>".

You should submit your code and any associated files along with your report. If you have additional files that you wish to include then these should also be included in your submission. If you have more than two files to submit, please compress all your files into one "zip" file (other formats of compression files will not be accepted). Please try to make your submission files less than 10MB as you may have issues when uploading large files to MyAberdeen.

Any questions pertaining to any aspects of this assessment, please address them to the course coordinator Raja Naeem Akram, raja.akram@abdn.ac.uk.

Assessment Description

This assessment focuses on two important problems that ML experts might face in real-life situations. The first one refers to the Explainable AI; the second one refers to bias and fairness requirements many industries have to satisfy for their AI application.

You will have to complete each of the **two tasks** described below. Please use Python for all programming tasks. You may use python-based frameworks, such as **Tensorflow and Keras**.

Task 1: Using SHAP (Shapley Additive exPlanations) for Healthcare applications (50 Marks) [max. 3 pages]

You have to train a gradient boosted decision tree (GBDT) algorithm for the cervical cancer dataset provided below:

The cervical cancer dataset used in this question contains indicators and risk factors for predicting whether a woman will get cervical cancer. The features include demographic data (such as age), lifestyle, and medical history. The data can be downloaded from the UCI Machine Learning repository (https://archive.ics.uci.edu/ml/datasets/Cervical+cancer+%28Risk+Factors%29) and is described by Fernandes, Cardoso, and Fernandes (2017) (https://doi.org/10.1007/978-3-319-58838-4_27).

For this GBDT algorithm, you have to provide SHAP Feature Importance.

Subtasks:

1.1) Please describe the problem, along with how you imported the environment, providing snippets of code and/or detailed description. (**5 marks**):

1.2) *Using your own words*, first explain the advantages of using SHAP for an explanation. Second, explain how gradient boosted tree algorithm work and how they can be applied in this case for training the agent (**5 marks**).

1.3) Working directly with provided data can be computationally demanding. Explain the appropriate pre-processing techniques that you used and provide snippets of code **(5 marks)**.

1.4) Describe in detail how you deployed your agent and adjusted its parameters. You may use open source code and libraries as long as you acknowledge them (**5 marks**).

1.5) Describe in detail how you deployed your SHAP explanation features with the deployed agent. You may use open source code and libraries as long as you acknowledge them (**15 marks**).

1.6) Explain what features have a higher probability of influencing a decision and discuss why this is the case from the context of the provided datasets (**10 marks**)

Task 2: Ethical considerations and challenges related to the cervical cancer dataset used in Task 1 (50 Marks) [max. 3 pages]

In this task, you need to provide a 1000 words report that discusses.

Subtasks:

2.1) Ethical considerations that data scientist have to take into account when dealing with medical data sets (**10 marks**).

2.2) What steps are necessary to make sure that the trained model is unbiased and uphold fairness requirements (**20 marks**).

2.3) Discuss whether for machine learning models deployed in the medical domain have to be unbiased and fair or in certain situation it is acceptable for them to have a bias. Please provide your rationale for supporting either or both points with examples. (**20 marks**).