Assessment 3: Project Plan

Due: ***11:59 PM EST Wednesday week 7***

Weight: ***4 5%***

Overview

During this assessment, you will produce a written report on

- reviewing a structure of convolution neural networks
- planning of a computer vision data science project utilising AWS as the primary data repository and computational resource.

Learning outcomes

1. Analyse real world computer vision tasks using machine learning techniques learnt in this subject
2. Engage AWS cloud computing services
3. Develop and deploy machine learning models on AWS
4. Tune hyperparameters for machine learning models using AWS
5. Construct a written communication and interpretation of machine learning methodologies
6. Demonstrate and apply advanced theoretical and technical knowledge of data science to an industry or research problem.

Format

You will need to submit the following:

- A PDF file clearly shows the assignment question, the associated answers, relevant Python outputs, analyses and discussions. The assignment must be presented in 12 font on A4 pages using single line spacing, double column format.
- Appendices include Jupyter Notebook or Python code or screen images of AWS console detailing the development, training and deploying the CNN model
- The task cover sheet
- The assignment **should not exceed 18-A4 pages**. Appendices do not form part of the page limit.

You have up to three attempts to submit your assessment, and only the last submission will be graded.

A word on plagiarism

Plagiarism is the act of using another's words, works or ideas from any source as one's own. Plagiarism has no place in a University. Student work containing plagiarised material will be subject to formal university processes.

Part 1: Paper review

Select one of the following papers:

1. Krizhevsky, A., Sutskever, I., & Hinton, G. (2017). ImageNet classification with deep convolutional neural networks. *Communications of the ACM*, *60*(6), 84–90. https://doi.org/10.1145/3065386
2. K. He, X. Zhang, S. Ren and J. Sun, "Deep Residual Learning for Image Recognition," *2016 IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2016, pp. 770-778, doi: 10.1109/CVPR.2016.90.Deep Residual Learning for Image Recognition
3. C. Szegedy *et al*., "Going deeper with convolutions," *2015 IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2015, pp. 1-9, doi: 10.1109/CVPR.2015.7298594.

Your task is to write maximum of **2- A4 pages** to review CNN architecture proposed in the selected paper. At least discuss the following aspects

a) Describe a CNN structure proposed in the selected paper.
b) Discuss key innovations of the CNN structure proposed in the paper.
c) Discuss limitations of the CNN structure of the paper.
d) Summarise key results found in the paper.

Part 2: Computer vision

Computer vision is an expanding field in data science, being led by business applications. Computer vision applications range from analysing static photographs (drone images, satellite imagery, static albums), interactive image albums and content (such as Facebook, Instagram and Twitter), to live steaming of video (cctv, drone/satellite video).

Assessment Tasks

Develop a research/project proposal for an image classification using your own dataset. The project proposal should cover the following aspects.

Note: Please note that the selected dataset **must NOT** be the one covered in collaborate sessions and AWS JupyterLab (e.g. MNIST or CIFAR-10/100, dogsvscats).

1. **Research proposal/Business Understanding**
    a) Describe the primary objectives/questions from a research/business perspective.
2. **Data**

a) Discuss the quality of the data with respect to *completeness*, *errors and outliers*, *missing values*.

b) List and Justify the data cleaning tasks required for the image classification task.

3. **Modelling**

a) Build your own CNN model and describe the structure of the model.

b) Train the model using the training dataset. Justify the choice of parameters and hyperparameters in the model

4. **Model Evaluation and Deployment**

a) Evaluate and Discuss the performance of the model for the training and test data. Provide the evidence of Endpoint and deployment of the CNN model.

b) Evaluate and Discuss the degree to which the model meets your research/ business objectives and seek to determine if there is some business reason why this model is deficient.

NB: Model Deployment in this report must be conducted using AWS SageMaker.

5. **Model comparison**

a) Implement the CNN structure reviewed in Part 1 using the data in Part 2. Compare the performance of the model with that of your proposed model.

Marking Criteria and Rubric: MA5852 Assessment 3

Criteria	High Distinction	Pass	Fail
Review the article **20% of the total grade**	Demonstrate excellent understanding on the selected article. Provides detailed, accurate descriptions of the CNN structure presented in a paper. Demonstrate excellent understanding on contributions and limitations of a paper.	Demonstrate good understanding on the selected article. Provides adequate descriptions of the CNN structure presented in a paper. Demonstrate general understanding on contributions and limitations of a paper.	Does not meet pass criteria – See commentary for specific details.
Project proposal design. Logically arrange, present and communicate the information of analysis and comparison **10% of the total grade**	Project plan is coherently and logically structured. Its impact is clear and well-defined. Communication is clear, concise, accurate and uses appropriate terminology and references to relevant theoretical frameworks.	Project plan is structured so that with some inferences, a logically structure incorporating adequate detail that can be deduced. Some inaccurate statements and limited justifications. Communication is adequate with some ambiguous and inferred elements. Some replications and not all internal and external sources are appropriately referenced.	Does not meet pass criteria – See commentary for specific details.
Data considerations for machine learning analysis	Provides a detailed, accurate description of the data used in the project.	Provides adequate description of the data used in the project. Some elements of the method are inferred or partially detailed.	Does not meet pass criteria – See commentary for specific

10% of total grade			details
Model and Model Evaluation **35% of total grade**	Provides a detailed, accurate and description of the proposed model. The model is clearly visualised, and the visualisation is clearly and concisely described. Hyperparameter tuning is clearly and concisely described with overt justifications link to model theory and supporting literature. Model development draws upon unit knowledge and demonstrated wider readings with clear overt links to external sources. Model overfitting and regularisation elements are clearly and concisely justified with links to model theory. Provide detailed explanation on performance of	Provides an adequate description of the proposed model where some elements are inferred or ambiguous. The model is visualised, but the visualisation is not completely described, or elements are inferred or ambiguous. Hyperparameter tuning described with some inferred or ambiguous links to model theory or supporting literature. Model development draws upon unit knowledge and limited wider readings with some links to external sources. Model overfitting and regularisation elements are described with limited links to model theory. Some elements are inferred or ambiguous. Provide some explanation on performance of the	Does not meet pass criteria – See commentary for specific details

	the model	model	
Model comparison **15% of total grade**	Provides a detailed comparison and discussion regarding performance of the proposed model and the model proposed in the reviewed in Part 1.	Provide limited comparison and discussion regarding performance of the proposed model and the model proposed in the reviewed in Part 1.	
Application on AWS **10% of total grade**	Provide evidence suggesting all models considered in the analysis are successfully trained and deployed. Model deployment, monitoring and maintenance is clearly and concisely described using AWS Sage Maker services.	Provide some evidence suggesting all models considered in the analysis are successfully trained and deployed. Model deployment, monitoring and maintenance is clearly and concisely described using AWS Sage Maker services.	Does not meet pass criteria – See commentary for specific details