

CW1: Image Classification with Keras - 40%

Start Assignment

- Due 18 Mar by 12:00
- Points 40
- Submitting a website url or a file upload
- Available 15 Feb at 0:00 - 22 Apr at 23:59



Weighting %:	40	Submission deadline (for students):	18 March 2024, 12:00
Authorship:	Group	The target date for returning marked coursework:	22 Apr 2024
Tutor setting the work:	Rafael S. de Souza	Number of hours you are expected to work on this assignment:	25-30

This Assignment assesses the following module Learning Outcomes (from the Definitive Module Document):

1. Demonstrate knowledge and understanding of advanced machine learning methods and their effectiveness for the analysis of numerical data
2. Be able to critically evaluate research papers and methodologies
3. Demonstrate knowledge and understanding of a range of neural networks as models of neural computation
4. Be able to work as part of a team to achieve computer data analysis tasks at a professional or equivalent level.

Assignment Tasks:

In this assignment, you will explore the potential of transfer learning in image classification using Keras. Transfer learning is a method where a model developed for one task is reused as the starting point for a model on a second task. You are required to:

1. **Understanding Transfer Learning:** Delve into the principles of transfer learning and its significance in image classification.
2. **Keras and Transfer Learning:** Discuss how Keras can be utilized to implement transfer learning, emphasizing model selection, freezing layers, and fine-tuning.
3. **Use the following dataset:** It is composed of Natural Scenes around the world. Source: [Intel Image Classification](https://www.kaggle.com/datasets/puneet6060/intel-image-classification?resource=download)  (<https://www.kaggle.com/datasets/puneet6060/intel-image-classification?resource=download>). Full data: [Archive.zip](https://herts.instructure.com/courses/110284/files/8272645?wrap=1) (<https://herts.instructure.com/courses/110284/files/8272645?wrap=1>)  (https://herts.instructure.com/courses/110284/files/8272645/download?download_frd=1)

Your emphasis should be on the critical evaluation of the role that Keras and transfer learning play in image classification, backed by a review of relevant scientific literature.

Your Submission Should:

- **Describe a specific pre-trained model:** Select from popular architectures like VGG16, ResNet, Inception, etc., and explain its initial use.
- **Highlight the fine-tuning process:** Discuss which layers you decided to freeze/unfreeze and why.
- **Discuss the results:** Compare the results of using transfer learning vs. training a model from scratch for the same task.
- **Consider potential implications:** Delve into the benefits, potential pitfalls, and ethical implications of using transfer learning in image classification.

For Your Submission, You Should Create:

1. Slide Presentation:

- Construct a 10-page slide presentation detailing your findings.
- The slides should cover:
 - Introduction to the chosen dataset.
 - A brief overview of transfer learning and its importance.
 - Selection of the pre-trained model and its original purpose.
 - Fine-tuning steps employed.
 - Comparison of results: Transfer learning vs. from scratch.
 - Limitations and potential areas of improvement.

2. Colab Notebook:

- Create a [Google Colab](https://colab.research.google.com/) (<https://colab.research.google.com/>) notebook that contains all the code used for your analysis.

- The notebook should be well-commented, ensuring that steps are clear and replicable.
- Include sections for data loading, preprocessing, model definition, training, prediction, and evaluation.
- Ensure the notebook can be executed seamlessly from start to finish.

Upon completion, **submit both the slide presentation (in PDF format) and the shareable link to your Colab notebook.**

Marks awarded for:

- You will be marked on the breadth and depth of your analysis, your understanding of the methodology, how well you present the context and conclusions, the quality of references, and the overall quality of your presentation.
- You will receive zero marks if you do not submit a shareable link to your Colab notebook or if the link does not work.
- You will receive a maximum of 50% marks if no slide presentation is submitted.

Additional information:

- Regulations governing assessment offences including Plagiarism and Collusion are available from https://www.herts.ac.uk/_data/assets/pdf_file/0007/237625/AS14-Apx3-Academic-Misconduct.pdf (https://www.herts.ac.uk/_data/assets/pdf_file/0007/237625/AS14-Apx3-Academic-Misconduct.pdf) (UPR AS14).
- Guidance on avoiding plagiarism can be found here: <https://herts.instructure.com/courses/61421> (<https://herts.instructure.com/courses/61421>) (see the **Referencing** section)
- For **postgraduate modules**:
 - a score of 50% or above represents a pass mark.
 - late submission of any item of coursework for each day or part thereof (or for hard copy submission only, working day or part thereof) for up to five days after the published deadline, coursework relating to modules at Level 7 submitted late (including deferred coursework, but except referred coursework), will have the numeric grade reduced by 10-grade points until or unless the numeric grade reaches or is 50. Where the numeric grade awarded for the assessment is less than 50, no lateness penalty will be applied.

Coursework - Image Classification					
Criteria	Ratings				Pts
Problem statement	10 Pts Full marks You provided a comprehensive overview of the subject. Both your slides and Colab have a professional look.	5 Pts Good Generic text. Either slides or Colab lack high quality.	2.5 Pts Poor Poorly written text	0 Pts No marks	10 pts
Exploratory Data Analysis	10 Pts Full marks Publication quality plots.	5 Pts Good Basic visualization	2.5 Pts Poor Poor visualization	0 Pts No marks	10 pts
Model implementation	10 Pts Full marks The model is efficient and clearly tailored toward the task. You explored few	5 Pts Good The model performs well on the data, but you did not provide any further insight in terms of model choice and	2.5 Pts Poor Off-the-shelf approach.	0 Pts No marks	10 pts
Performance Evaluation	10 Pts Full marks You have provided a critical and logically sound evaluation of your results.	5 Pts Good You have provided an average discussion.	2.5 Pts Poor Generic discussion or lack thereof.	0 Pts No marks	10 pts
Total points: 40					