

AE2223-2 Experimental Research 2021 – Assignment 4

This is the fourth group assignment on the course AE2223-2 and the second on the AI topic. It contributes 15% towards your final grade and is a group grade.

INSTRUCTIONS

You must complete this assignment jointly with the students in your group in course AE2223-2. The assignment has been divided in 3 questions so that you can work in sub-groups of 2-3 students on the different questions.

Title page. 1 page. On the front cover of the assignment, you must include the following information:

- Course Number and Name
- Assignment Number
- Your Group Name
- Student IDs and Names of all students in your group
- Brief description of the contribution of each student the group to completing the assignment.

Answer pages.

- Start each answer on a new page
- Required length for questions 4a and 4b is between 1½ and 3 pages
- *Required length for question 4c is between 4 and 8 pages*
- You are expected to research your own material to answer some parts of the questions
- You may include pictures, graphs if it helps in answering the question

References

- You are expected to include references to your sources
- Maximum of 1 page for references

Filename

- Include your group number at the start of the PDF filename. Use 2 number digits for easier sorting of files.

ASSIGNMENT QUESTIONS

Q4a. Grouping of Royal Netherlands Air Force Aircraft (25% of assignment grade)

This question is about different ways you can group RAAF aircraft using different input data and different algorithms. Choose a wide selection of RAAF aircraft including helicopters and drones.

- First give a weblink to the dataset you use. Use the k-means method and two aircraft specifications with the same dimensions to group the aircraft into 2, 3, 4, 5 and 6 groups. Present a table of the groups and comment if the groups seem logical to you.
- Next choose two specifications which have different dimensions and give a good reasoning about how you would choose the weights for the dimensions when using the t-SNE algorithm.
- Implement the t-SNE algorithm for the two specifications with different dimensions. Present a table of the groups and comment if the groups seem logical to you.
- The final part of the question is to choose five different specification and to group the aircraft using support vector machines. Comment of the similarities and differences of the groups that you find in the different answers to the different sub-question.

Q3b. Nearest TU (25% of assignment grade)

To reduce travel, the Dutch government brings in a new rule that all technical university students must study at their nearest 4TU technical university (TU Delft, TU Eindhoven, Wageningen University or University of Twente). Assume that the total number of Dutch students and international students is unchanged.

- First define the problem. What sources of data will you use to solve this problem? – Give the weblinks. Also describe at least two other assumptions you will make in making this calculation.
- First you will only consider Dutch students. Calculate the number of Dutch students that you expect at each university. Explain how you made the calculation.
- Next make a separate calculation for the number of international students that will attend each university. Explain how you made the calculation.
- Reflect on the results you have obtained. Give at least two advantages and two disadvantages that you would expect from the government implementing this policy. How would students respond to this new policy?

Q3c Artificial Neural Network (50% of assignment grade, 8 pages maximum)

This sub-question requires a more detailed answer and is worth double points. You have heard that the Polderbaan *spotterplaats* at Schiphol airport is a very popular place to visit, but that the average member of the public has difficulty in identifying the aircraft. In this question you will investigate how to train an ANN using images of representative aircraft, so that visitors to the Polderbaan *spotterplaats* can automatically recognise aircraft.

- First build a database of 100 training images of aircraft from the internet. These should cover at least 10 different aircraft types that are seen at Schiphol airport. Briefly summarise the content of the training images in a table, including aircraft type, fleet carrier and other relevant information.
- You now need to make a pre-processing of the images to make them suitable for fleet carrier recognition. Explain which image parameters you choose and provide a python code (maximum 1 page) showing how this pre-processing is carried out.
- You now need to make a pre-processing of the images to make them suitable for aircraft type recognition. Explain which image parameters you choose and provide a python code (maximum 1 page) showing how this pre-processing is carried out.
- The final step is to train a very simple ANN. You choose a 1 hidden layer (2 function layer) ANN using quadratic and cubic functions. Program this ANN yourself in python and determine the accuracy of the ANN for TRUE POSITIVE results. Provide the python code (maximum of 2 pages). Comment on the results obtained.

DEADLINE

Sunday 4th April at 18:00

DELIVERY

Answer all questions in the assignment and complete a written report, using figures if necessary. The report must be uploaded as a PDF to BrightSpace by the deadline.