

TU Dublin, Tallaght Campus

Enterprise Computing and Digital Transformation

HCAIM – Human Centric Deep Learning 2022/23

CA2 (25% Weighting)

CA Overview:

Students will have access to the UTK face dataset, you will be required to develop a subset of 1000 images per class that you choose. You must select a target group unique to you, age, gender and race. These must be unique to you. The dataset details can be found in [Appendix 1](#).

The students will be expected to design develop a convolutional neural network for a specific context, that will result in a production model, with an emphasis on transparency and trustworthiness.

This CA requires you to develop the most suitable AI model, where every suitable method for model development be employed to ensure the best generalization.

CA Points:

All steps should be separated in a Jupyter notebook (sections), and two versions of the notebook are required on final upload of the elapsed CA: HTML(or PDF) and the .ipynb Jupyter notebook.

Note: The HTML(or PDF) will be run through URKUND, for plagiarism evaluation, where the institution's plagiarism policy will be applied¹.

Students are expected to discuss each piece of work, expanding on the rationale for selection of techniques and the processes applied to get to the final model, including the use of any visual aids such as tables, plots etc. The word count is a minimum of 3000 words. Code on its own, will not be considered as a passing grade. A random selection of students may be invited to a voice viva for academic integrity.

Please add your name and student number as the first block in markdown on the notebook.

¹ <https://www.tudublin.ie/for-students/student-services-and-support/student-wellbeing/disability-support-services/tallaght/open-book-exam-study-tips/policy-on-plagiarism/#:~:text=Plagiarism%20Policy%20Statement%20%2D%20TU%20Dublin%20%2D%20Tallaght&text=Globally%2C%20plagiarism%20is%20recognised%20as,recognition%20to%20the%20original%20source.>

CA Headings:

The CA will be graded under the following headings. Where each heading should have (where appropriate) a rationale and description expanding the approach and its findings, code that executes the work, and in some cases a visual aid to further compound your findings. Use standard Jupyter notebook markdown, to create headings and sections. A grading Rubric is also provided in [Appendix 2](#). The following headings should guide your project:

- Introduction
- Opening the dataset, Brief data exploration and data pre-processing
- Model exploration to determine network topology (convolutional layers and dense layers)
- Hyperparameter investigation (kernel size only)
- Most appropriate model selection and performance evaluation
- Analysis of performance per class and unseen data (10 per class including saliency maps for unseen data)
- Analysis of performance for the target group
- Development of a cloud hosted production model and testing on unseen data (10 per class) (You can kill azure service – keeping the output in the JN) and please provide your Docker Hub URL for your image.
- Summary and Conclusion

Quality of report and model development process will also be graded.

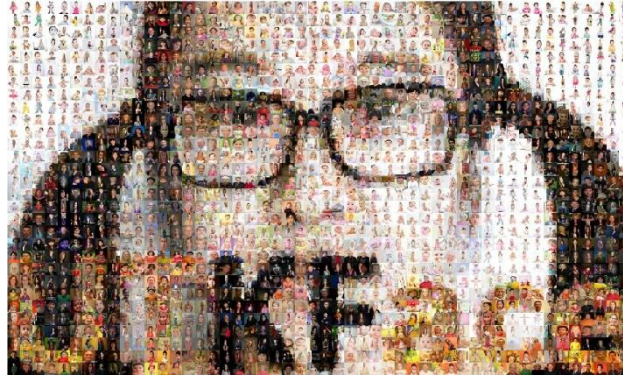
CA Notes:

At all stages, precautions must be taken to ensure work is completed by the CA deadline.

It is up to the student to select the notebook platform (such as locally, Google CoLab or on Azure Data Science Virtual machines) and it is the student's responsibility to ensure that the platform has the required version of Python, Anaconda and required libraries.

Dataset

UTKFace dataset:



Note: we used the Aligned&Cropped Faces version,

The full details on this dataset, its file naming scheme and the download zip file can be found at: <https://github.com/aicp/UTKFace>

It can also be downloaded via: https://1drv.ms/f/s!An-taX4pRW2np7QrH7VInvqvTd_luw?e=Qxnc6M

The labels of each face image are embedded in the file name, formatted like [age]_[gender]_[race]_[date&time].jpg

- [age] is an integer from 0 to 116, indicating the age
- [gender] is either 0 (male) or 1 (female)
- [race] is an integer from 0 to 4, denoting White, Black, Asian, Indian, and Others (like Hispanic, Latino, Middle Eastern).
- [date&time] is in the format of yyymmddHHMMSSFFF, showing the date and time an image was collected to UTKFace

This dataset/hosting of the dataset is credited to: [Yang Song](#) and [Zhifei Zhang](#)

Appendix 2 – Grading Rubric

1. Introduction
2. Opening the dataset, Brief data exploration and data pre-processing
3. Model exploration to determine network topology (convolutional layers and dense layers)
4. Hyperparameter investigation (kernel size only)
5. Most appropriate model selection
6. Analysis of performance per class and unseen data (10 per class including saliency maps for unseen data)
7. Analysis of performance for the target group
8. Development of a cloud-hosted production model and testing on unseen data (10 per class)
9. Summary and Conclusion

| ID | Marks | Poor example | Average Example | Strong example |
|--------------|------------|---|---|--|
| 1 | 3 | Little to no discussion on the dataset and its overall structure. | Some discussion on the dataset and/or structure. | Strong understanding of the dataset and its structure presented. |
| 2 | 20 | Dataset opened, but issues may exist, little to no data exploration and no pre-processing. | Dataset opened, and some pre-processing completed, little or no discussion on the process. | Dataset opened, data was explored, correct preprocessing (batch processing with image gen regularization) was applied and a strong discussion on the process. |
| 3 | 10 | One or more networks developed, no rationale for the selection of models or the order of development | 1-3 networks developed, some rationale for the selection of models or the order of development | 4 networks were developed, strong rationale for the selection of models and the order of development. Transfer learning is optional but can be used in some of the networks. |
| 4 | 5 | Little or no kernel configurations trailed, no concise discussion on the order of trials and why one was selected over another | Some kernel configurations, some concise discussion on the order of trials and why one was selected over another | Three kernel configurations were trailed, strong concise discussion on the order of trials and why one was selected over another |
| 5 | 5 | Little to no (or incorrect) rationale for the selection of the best model, or incorrect model selected | Some to no (or partially incorrect) rationale for the selection of the best model, or incorrect (but close) model selected | Strong rationale for the selection of the best model, and best model selected |
| 6 | 22 | Little to no analysis per class value, some unseen data used and/or no saliency maps generated and/or discussed for the incorrect predictions | Some analysis per class value, some unseen data used and/or saliency maps generated however not discussed in any great detail for the incorrect predictions | Detailed analysis per class value, appropriate unseen data used and saliency maps generated and discussed in detail for the incorrect predictions |
| 7 | 12 | Little to no generation of metrics per target group and/or little to no discussion on the findings/meaning | Generation of metrics per target group and little to no discussion on the findings/meaning | Generation of metrics per target group and strong discussion on the findings/meaning |
| 8 | 23 | Docker image was created, but container not working in cloud and was unable to run query code | Docker image was created and the container is working in cloud but was unable to run query code | Docker image was created and the container is working in the cloud and was unable to run query code |
| Total | 100 | | | |