UNIVERSITY of ABERTAY DUNDEE

School of Design & Informatics

Session 2021/22

CMP304: Artificial Intelligence

Module Deliverer: Christopher Acornley

<u>Part 2</u> of the module assessment – 50%

Learning outcomes assessed by this assignment:

LO1. Critically examine various artificial intelligence techniques.
LO2. Develop a critical understanding of AI techniques and technologies.
LO3. Evaluate the use of AI technologies and techniques for specific purposes.

Date of Issue: 31st January 2022

Submission date: Tuesday 17th May 2022 (last submission 11.59pm)

Grade Release and Feedback date: 7th June 2022

Assessment Overview

Computer vision is one of the main tracks of research working towards creating artificially intelligent machines. It aims to develop systems or agents able to solve problems the way humans usually do, by "observing the scene". In short, it is machine learning with visual data in the form of images, videos, depth images, satellite imagery, medial images etc. For this assessment, you are going to design and develop a computer vision application to demonstrate your understanding of machine learning concepts and the relevant techniques.

The Coursework

You should develop and application and use it to solve a computer vision problem of your choice. You should consider which domain would be most appropriate for a solution. For example, you may want to develop a supervised model able to distinguish between two or more visual entities (like binary or multi-class classifiers) or predict certain visual content (like regression systems). Or you may choose an unsupervised approach where no training is required (like clustering and data mining). Based on your selected application and technique, you may need to find relevant datasets suitable for training/testing your system. You have to have enough data to enable you to create a reasonably sophisticated AI system.

Some Ideas

You have a completely free choice as to what your ML system will do, but here are some possible ideas relevant to computer vision to get you started. Keep in mind that data is a significant component in ML. Before starting on the application, make sure you are able to find appropriate datasets for the specific problem.

- Determine if a medical image of certain body part contains any abnormality and locate it on the image.
- Identify which body part a medical image belongs to.
- Assist a virtual agent gain awareness of its surroundings by identifying what object it "sees".
- Analyse visual data for a specific context (e.g. satellite imagery, strategy game maps) to infer meaningful information like patterns and groupings.
- Identify user's emotions from their facial expressions.
- Estimate user's age from their facial features.
- Process scanned documents to annotate its different components e.g. text, image, graph.
- Authenticate images to determine if content has been altered.
- Predict the next frame or location of an object in a video.
- Reduce the dimensionality of visual data by selecting the best representative patterns or features.
- Estimate the difficulty of generated game dungeon maps or puzzles.

There will be a class dedicated to discussing the above ideas in more detail with examples. I am sure you can think of many more. If you do come up with your own idea, you should discuss it with staff before going ahead with the implementation to ensure that you are doing something appropriate.

Suggested Approach

1. Find a suitable dataset for the problem you are trying to solve – you can use dataset search tools or generate your own data based on certain rules. You need to be systematic and deliberate about your choices and justify your data sources in the report.
2. Design any pre-processing steps that may be needed to prepare the data.
3. Investigate ML models that can be used in the task. Select one and give rationale for your choice.
4. Define features to describe the inputs. Not all ML problems/models require a separate feature extraction step. You will have to decide and justify your decision.
5. Write an application that will implement the ML pipeline you decided.
6. Conduct a performance analysis of the system with appropriate measures.
7. Write a report detailing how you developed the application and how it was tested and assessed. Discuss how successfully the application works overall.

Grading the Assessment

The Application (40%)

The application should be coded efficiently and properly documented. Remember to follow good programming practices. You will need to create a video, no more than 10 minutes long, demonstrating the application with an appropriate commentary detailing how you created and trained the model and demonstrating test cases with different inputs and corresponding outputs.

The Report (60%)

The report should fully describe the design process for the application, giving specific details of the steps you followed. You should give full rationale for the choice of features (if any) and techniques. i.e. why you chose them and why they are particularly suited for your application. Your report should include details of testing, an explanation of the performance, and a quantitative performance measure (e.g. system accuracy).

The report should be well written and structured in a style suitable for a technical report (introduction, method, test data, results and conclusions with appropriate headings etc.). It should be written in the passive voice avoiding the use of pronouns such as "I" and "we". There should be a full set of test data and results as well as suitable conclusions drawn and discussion on the advantages and disadvantages of the adopted approach. **Any references or images used MUST be properly cited.** Refer to Abertay's referencing guide on how to cite different material.

Submission

You must submit your written report and program **separately**. Please submit your solution via MyLearningSpace as follows (separate files):

- Report as .pdf
- Source file or .zip of source files.
- Link to video demo

Please **DO NOT UPLOAD ANY IMAGE DATASETS** with your submission.

All submissions must be uploaded via appropriate location within MyLearningSpace system. No email submissions will be accepted. The deadline for submissions is 11:59pm and the system is likely to be busy at that time. **For this reason, you are advised to leave plenty of time (at least an hour) to successfully complete the upload process. If the MyLearning Space system records a submission time after 11:59pm then the work will be treated as a late submission.**

Guidance on submitting via MyLearningSpace is available at digital skills guide for students. Please contact the Support Enquiry Zone sez@abertay.ac.uk if you have any problems with the submission process.

Late Submission

Work submitted up to 2 weekdays following the submission deadline will not be accepted in the absence of valid cause but will be subject to a penalty of 1 letter grade for each weekday it is late. Work submitted after 2 weekdays without valid cause will be treated as a non-submission and will be awarded a NS grade.

Assessment Criteria

You will be marked using the criteria in the coursework grading scheme below.

CMP304 – Coursework Grading Criteria

	Introduction (5%)	Data Specs (10%)	Methodology (15%)	Results (10%)	Conclusions (10%)	References (5%)	Structure and Style (5%)	Application (40%)
A	Excellent introduction which gives an appropriate overview of the project.	Excellent description of data specs and rationale for datasets choice, including proper citation and sample pictures.	Excellent description of the methods used including a complete explanation and rationale for the chosen techniques.	Excellent results, clearly tabulated and relevant.	Excellent conclusions with a full analysis and summary of the project.	A good number of excellent references properly cited in Cite Them Right Harvard style.	Excellent structure in a good, readable style with excellent spelling and grammar.	Excellent application which clearly shows how the programme is operating, efficiently coded with excellent documentation.
B	Very good introduction which gives an almost perfect overview of the project.	Very good description of data specs with a mostly complete rationale for datasets choice, including proper citation and sample pictures.	Very good description of the methods used including a mostly complete explanation and rationale for the chosen techniques.	Very good results, very well tabulated and mostly relevant.	Very good conclusions with a very good analysis and summary of the project.	A number of very good references mostly properly cited in Cite Them Right Harvard style.	Very good structure in a readable style with very good spelling and grammar.	Very good application which clearly shows how the programme is operating, mostly efficiently coded with very good documentation.
C	A good introduction which gives a more than adequate overview of the project.	Good description of data specs including some rationale for datasets choice, citation, and sample pictures.	A good description of the methods used including an explanation and rationale for the chosen techniques.	Good results, reasonably well tabulated and relevant.	Good conclusions with a good analysis and summary of the project.	A reasonable number of good references mostly cited in Cite Them Right Harvard style.	Good structure in a fairly readable style with good spelling and grammar.	Good application which mostly shows how the programme is operating, well coded with good documentation.

D	A brief introduction which gives an adequate overview of the project.	An adequate description of data specs with an incomplete rationale for datasets choice, citation, and sample pictures.	An adequate description of some of the methods used including an incomplete explanation and rationale for the techniques and features chosen.	Adequate results, with some tabulation and relevance.	Adequate conclusions with an adequate analysis and summary of the project.	A few adequate references properly cited in Cite Them Right Harvard style.	Adequate structure in a just readable style with passable spelling and grammar.	Adequate application which just shows how the programme is operating, adequately coded with some documentation.
MF	A very brief introduction which just fails to give an adequate overview of the project.	A not quite adequate description of data specs with incomplete rationale for datasets choice, no citation or samples pictures.	A not quite adequate description of the methods used with an incomplete explanation and rationale for the chosen techniques.	A few results, with little tabulation and relevance.	Inadequate conclusions with inadequate analysis and summary of the project.	Some references inadequately cited.	Some structure, readable in places with inadequate standards of spelling and grammar.	Inadequate application which does not show how the programme is operating clearly enough, inadequately coded with insufficient documentation.
F	Too brief and completely fails to give a sufficient overview of the project.	Totally inadequate description of data specs with very little explanation and no rationale for datasets choice, no citation or samples pictures.	Totally inadequate description of the methods used with very little explanation and rationale for the chosen techniques.	Inadequate results, not properly tabulated and barely relevant.	Scant conclusions with barely any analysis or summary of the project.	Barely any references cited, or poorly cited.	Poorly structured, not easy read with poor spelling and grammar.	Very poor application which barely shows how the programme is operating, poorly coded with little documentation.

Please note that the percentage weightings for each criterion are approximate.

Marking Scheme

Literal Grade	Grade Point	Evaluative Descriptor
A+	4.5	Excellent overall. Demonstrates an excellent grasp of the subject matter. Excellent capacity for original and creative enquiry. Excellent ability to critically evaluate, analyse, synthesise and integrate complex information. Excellent communication skills. In addition, exceptional in at least one of the above.
A	4	Excellent overall. Demonstrates an excellent grasp of the subject matter. Excellent capacity for original and creative enquiry. Excellent ability to critically evaluate, analyse, synthesise and integrate complex information. Excellent communication skills.
B+	3.5	Very good overall. Demonstrates a very good grasp of the subject matter. Very good capacity for original and creative enquiry. Very good ability to critically evaluate, analyse, synthesise and integrate complex information. Very good communication skills. In addition, excellent in at least one of the above but overall performance deemed to be very good.
B	3	Very good overall. Demonstrates a very good grasp of the subject matter. Very good capacity for original and creative enquiry. Very good ability to critically evaluate, analyse, synthesise and integrate complex information. Very good communication skills.
C+	2.5	Good overall. Demonstrates a good grasp of the subject matter. Good capacity for original and creative enquiry. Good ability to critically evaluate, analyse, synthesise and integrate complex information. Good communication skills In addition, very good in at least one of the above but overall performance deemed to be good.
C	2	Good overall. Demonstrates a good grasp of the subject matter. Good capacity for original and creative enquiry. Good ability to critically evaluate, analyse, synthesise and integrate complex information. Good communication skills
D+	1.5	Satisfactory overall. Demonstrates a satisfactory grasp of the subject matter but limited grasp in some areas Satisfactory capacity for original and creative enquiry. Satisfactory ability to critically evaluate, analyse, synthesise and integrate information. Satisfactory communication skills.
D	1	Adequate. Achievement of all threshold standards but grasp of some subject areas and graduate attribute development may be more limited.
MF	0.5	Marginal fail. Performance just below the threshold standard. A reasonable expectation that a pass is achievable by reassessment without the need to repeat the module.
F	0.0	Fail. Performance well below the threshold level. Some limited evidence of achievement of the outcomes.
NS		No assessments submitted.