Academic Year: 2024/25

Assessment Introduction:

Course: BSc (Hons) Computer Science, Computing, Software Engineering, Cyber Security	**Module Code:** CO3519 **Module Title:** Artificial Intelligence
Title of the Brief: Facial Emotion Recognition using Advanced Artificial Intelligence	**Type of assessment**: Report

This assessment is worth [50%] of the overall module mark.

This Assessment Pack consists of a detailed assignment brief, guidance on what you need to prepare, and information on how class sessions support your ability to complete successfully. You'll also find information on this page to guide you on how, where, and when to submit. If you need additional support, please make a note of the services detailed in this document.

How, when, and where to submit:

Submit via the Turnitin link on Blackboard.

Assessment deadline date and time: **31st March 2025, 23:59**

Feedback will be provided by: **21st April 2025**

You should aim to submit your assessment in advance of the deadline.

Note: If you have any valid mitigating circumstances that mean you cannot meet an assessment submission deadline and you wish to request an extension, you will need to apply online, via MyUCLan with your evidence **prior to the deadline**. Further information on Mitigating Circumstances via this link.

We wish you all success in completing your assessment. Read this guidance carefully, and any questions, please discuss with your Module Leader at FUMUllah@uclan.ac.uk.

Additional Support available:

All links are available through the online Student Hub

1. Our **Library resources** link can be found in the library area of the Student Hub or via your subject librarian at SubjectLibrarians@uclan.ac.uk.

2. Support with your academic skills development (academic writing, critical thinking and referencing) is available through **WISER** on the Study Skills section of the Student Hub.

3. For help with Turnitin, see Blackboard and Turnitin Support on the Student Hub

4. If you have a disability, specific learning difficulty, long-term health or mental health condition, and not yet advised us, or would like to review your support, **Inclusive Support** can assist with reasonable adjustments and support. To find out more, you can visit the Inclusive Support page of the Student Hub.

5. For mental health and wellbeing support, please complete our online referral form, or email wellbeing@uclan.ac.uk. You can also call 01772 893020, attend a drop-in, or visit our UCLan **Wellbeing Service** Student Hub pages for more information.

6. For any other support query, please contact **Student Support** via studentsupport@uclan.ac.uk.

7. For consideration of Academic Integrity, please refer to detailed guidelines in our policy document . All assessed work should be genuinely your own work, and all resources fully cited.

Preparing for your assignment

The preparation for this assignment is the weekly lab work that is set. This is provided on Blackboard, completed in class with the lecturer, and opportunities are given to discuss this work in the lecture times.

Introduction

Facial emotion recognition is an intuitive reflection of a human's mental state (Happy, Sad, Surprise, etc.), which contains rich emotional information, and is one of the most important forms of interpersonal communication. These cues can deliver a complete understanding of the desired message. Facial emotion recognition is an effort towards understanding human's personal emotions from their face. Facial emotions have high weightage over the words that are being spoken during our personal exchange of ideas.

Fear   Angry   Happy   Neutral   Sad   Surprise
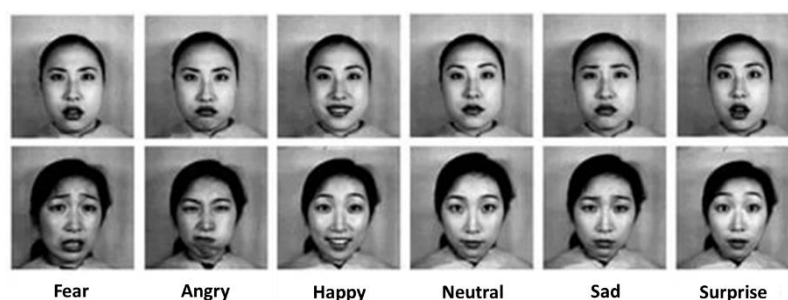
In the previous assignment, you solved this problem using traditional features engineering methods and you struggled for good performance and found some problems and challenges. Now, you need to implement a deep learning model to recognise / classify six basic facial expressions (emotions) in an image such as Neutral, Angry, Happy, Surprise, Sad and Fear. (See figure, images as samples are taken from JAFFE dataset.) If you are using the same dataset as used in previous assignment, you can compare the results.

You can use any two datasets to evaluate your model performance. The comparison should be performed for datasets results. I have included below some popular datasets below that can be used too.

1. FER-2013 **2.** MMI facial expression database **3**. JAFFE database **4**. AffectNet

Submission details

Submission of one-word processed document (.doc/.pdf) on your "Facial emotion recognition model" is required through Blackboard using Turnitin. University referencing style should be used throughout. The report should be 6-7 pages (excluding references)

Detailed assignment brief

Algorithms and Techniques

This Course Assessment gives you the opportunity to apply advanced artificial intelligence techniques. You will use a deep learning network which could be the end-to-end neural network. You can use any of the following network:

• Resnet   • VGG   • Alexnet   • EfficientNet   • Custom CNN

It is important to note that you are not limited to using only the networks mentioned above. You can implement new custom CNN network or variants of existing models for the given problem.

The Following Components Must Be Considered for Model Development and Validation

- Data Augmentation may be necessary if there are unbalance classes in datasets.
- Choosing the right parameters for model training or fine-tuning
- Metrics to consider evaluating if the model is performing well.
- Provide a Confusion matrix, training/testing accuracy and loss graphs.
- Show a figure where faces are classified with three different emotions.

Preparation of the data, training and cross-validation techniques, evaluation of the test sets and model comparisons are all crucial to the success of this type of practical development.

Deliverables

Please submit the assignment as a single Word document (.doc/.pdf) in the Blackboard Assignment Submission link for the module. Please note that all assignments will be checked for plagiarism using computer software (Turnitin) as part of the submission process.

Useful Resources

Formatting Requirements

Your report should have the following structure. The percentage given in the brackets of section's title represents the weightage of the sections. For instance, Introduction (10%) means, it carries 10% weightage of grades of the overall assignment.

- **Title, Author(s)**: Title of the report. Your Name, and student ID.

- **Introduction (10%):** This section will give the overall background about what is FER, why we need to solve this problem, etc. You can make the paragraphs of this section like:
  -Definition: What is FER?
  -Background: Discuss about FER why we need it and application etc.
  -Problems: Discuss the Challenges/problems with traditional ML methods which you encountered while implementing in the previous assignment.
  -Project Aim: Final paragraph about the project saying how you solve the above problems etc.

- **Literature review (10%)**:
  -Discuss advanced AI-based (Deep Learning) published work that relates to FER project.
  -What are the problems in these methods?
  -How is your approach similar or different from others?

- **Datasets (10%)**:
  -Describe the data you are working with for your project.
  -Where did it come from?
  -How much data are you working with (No. of images, classes, etc.)?
  -Did you have to do any preprocessing, filtering, or other special treatment to use this data in your project?

- **Model Development (30%)**: This section should include:
  -What technique you used for face detection?
  -What deep learning-based model are you proposing/using?
  -Discuss your approach for solving the given problem.
  -If you are using any existing implementations, how will you use them and justify the reason for using it to solve the given problem? How have you planned to improve or modify it?
  -How have you planned to improve or modify such implementations?

-Explain the inner workings of your developed/used model and justify why and how the model works to solve the given problem.

-It may be helpful to include *figures*, *diagrams*, or *tables* to describe your method.

- **Model Evaluation (30%)**: This section should include:

  -Discuss the results obtained from your model.

  -Qualitatively, what kind of results do you expect (e.g., plots or figures)?

  -Quantitatively, what kind of analysis will you use to evaluate and/or compare your results (e.g., what performance metrics or statistical tests: Accuracy, Precision, Recall, F1-score, etc.)?

  -Discuss the experiments that you performed to demonstrate that your approach solves the problem. You can perform an ablation study to determine the impact of various components of your system, experiment with different hyperparameters or architectural choices, use visualization techniques to gain insight into how your model works, discuss common failure modes of your model, etc.

  -You should include graphs, tables, or other figures to illustrate your experimental results.

- **Conclusion (10%)**:

  -Summarize your method and key results.

  -Provide any future directions that could bring further improvement in the project.

  -In few lines, add what you learned.

- **Supplementary Material**: Not counted toward your 6–7-page limit. Include link to the source code of your project (google colab link is recommended). You are allowed to get help from the lab sheets for the code.

The practical development must be <u>individual work</u>. This cannot be completed as a group. <u>Students must write and submit their own individual final report.</u> You can discuss solutions with other students and ask for help from your lecturer if needed.

Sample of successful assignment

Sample assignments will be discussed in lectures and practical sessions but will not be available on Blackboard.

Learning outcomes

- Apply the theoretical underpinnings of algorithms and techniques specific to advanced artificial intelligence.
- Critically evaluate the principles and algorithms of advanced artificial intelligence.
- Evaluate the theoretical foundations of artificial intelligence.
- Understand some of theoretical underpinnings of computing and apply them to given scenarios.

NOTES: CHATGPT IS NOT ALLOWED.

Marking grid/marking rubric

Grade band	Marks available	A description of work example
3rd class	42	The report lists all tasks undertaken. There may be a few inaccuracies but most will be correct. Writing may be brief, or poorly presented. Some items might be in bullet points rather than full sentences.
	45	As above, but nearly all descriptions will be correct, though perhaps only explained briefly.
	48	As above, but all descriptions will be correct.
2:2	52	The report lists all tasks undertaken, using the correct technical terms to explain the techniques used and why. At least most of the tasks will be correctly explained, although some parts may be incomplete.
	55	As above, but nearly all descriptions will be explained using technical details.
	58	As above, but all descriptions will be explained using correct technical details
2:1	62	The report lists all tasks undertaken, explaining in detail the technique used and why. At least most of the tasks will have a detailed and clear explanation, demonstrating understanding of the topics. The work will be presented in a professional, structured manner and may include simple references
	65	As above, but nearly all of the tasks will have a detailed and clear explanation.
	68	As above, but all of the tasks will have a detailed and clear explanation
1st class	74	All tasks will have a detailed and clear explanation which demonstrates full understanding of the topic. There may be a few slight errors or minor missing details
	80	As above, but of good quality throughout, without obvious errors or missing details
	87	As above, but showing evidence of background reading through appropriate citing of sources. Discussed the result obtained from the model. Explained why it worked and what alternatives can be taken in the future to solve the given problem.
	94	As above, but ensuring that sources are of a good quality and used throughout the work.
	100	provides evidence of thorough independent research and development. Algorithms and techniques are tailored to the use case, and explanation of how and why this was done is provided. The submitted material makes it easy for a developer or user with a disciplinary background in computing to validate, test, employ, and further develop the code

Feedback Guidance:

Reflecting on Feedback: how to improve.

From the feedback you receive, you should understand:

- The grade you achieved.

- The best features of your work.

- Areas you may not have fully understood.

- Areas you are doing well but could develop your understanding.

- What you can do to improve in the future - feedforward.

Use the WISER: Academic Skills Development service. WISER can review feedback and help you understand your feedback. You can also use the WISER Feedback Glossary

Next Steps:

- List the steps have you taken to respond to previous feedback.

- Summarise your achievements.

- Evaluate where you need to improve here (keep handy for future work):