Machine Learning 1, Course Project 2021

Very important – Read before starting

- The deadline for **completing and submitting** your assignment is strictly Friday 21st January 2022.
- **VLE will be set up to not accept late submissions** meaning that you will get zero marks if late.
    - Please plan ahead (it is recommended that you try and **upload and verify your work a day before**).
    - Technical problems, internet connectivity issues, lost backups, cats eating laptops, etc… are not valid excuses.
- You must complete a plagiarism declaration form and include it in your report. **Submissions without the form will not be considered.**
- **Projects must be submitted using VLE only.** Physical copies or projects (including parts of) sent by email will not be considered.
- For your convenience, a draft and final submission area will be set up in VLE. **Only projects submitted in the final submission area will be graded.** Projects submitted to the draft area are not considered.
- It is suggested that after submitting your project, you re-download it and check it just in case. **It is your responsibility to ensure that your upload is complete, valid, and not corrupted.** You can re-upload the assignment as many times as you wish **within the deadline.**
- **Your project must be submitted in ZIP format without passwords** or encryption. Project submitted in any other archiving format (e.g. RAR, 7Z, etc…) will not be considered.
- The total size of your ZIP file should not exceed 38 megabytes.
- Your submission should include your report in PDF format, your source code, and executable file(s).
- It is expected that you submit a quality report with a proper introduction, discussion, evaluation of your work, and conclusions. Also, make sure you properly cite other people's work that you include in yours (e.g. diagrams, algorithms, etc…).
- In general, I am not concerned with which programming language you use to implement this project. However, unless you develop your artifact in BASIC, C, C++, Objective C, Swift, Go, Pascal, Java, C#, Matlab, or Python, please consult with me to make sure that I can correct it properly.
- This is not a group project.
- Plagiarism will not be tolerated.

Project

- This project is concerned with **fast frontal face and eye detection using the Viola-Jones object detection method**.

- Note regarding any artifacts you develop – do not implement the training or classification components yourself. Use OpenCV (https://opencv.org).

- You are required to implement the following two artifacts:
    - Obtain a dataset containing faces and non-faces (you'll find plenty of these datasets on the internet) and use OpenCV to train a Cascade classifier. OpenCV have a user guide to help you get started. Present and discuss your results in the evaluation section of your report.
    - Obtain frontal face and eye cascades from here: https://github.com/opencv/opencv/tree/master/data/haarcascades. Write a program which uses these two cascades to detect faces and eyes in images you input to the program. Faces should be outlined with a green rectangle, and eyes should be outlined in red. For this artefact, use your webcam to do real-time video face and eye tracking (if you don't have a webcam, you can use prerecorded videos taken with your phone).

Report:

- As part of your report, write a technical section about how Viola-Jones Object Detection/Haar Cascades work. Discuss why they are especially useful for real-time applications such as face detection in digital cameras. Three to five pages worth of good material should suffice. Don't rip off Wikipedia or some other blog. In this section, you should convince me that you understand the method.
- In your report, make sure that you describe the methodology you used when developing each of the two artifacts.
- In your report, briefly discuss one or more alternative approaches which are suitable for face/eye detection in images (you choose). Compare them to Viola-Jones.
- You should perform a good evaluation and provide a good discussion regarding the results you obtained. I expect proper experimental procedure discussing your setup, expected outcomes, results, and a good discussion.

Statement of completion – MUST be included in your report

Item	Completed (Yes/No/Partial)
Artefact 1	
Artefact 2	
Artefact 2 – real time face/eye tracking	
Technical discussion on Viola-Jones method	
Experiments and evaluation	
If partial, explain what has been done	

Marking Breakdown

Description	Marks allocated
Artefact 1	30%
Artefact 2	30%
Artefact 2 – real time face/eye tracking	10%
Experiments and evaluation	15%
Overall report quality	15%