Course Project

ICS2207 - Machine Learning, Classification, Search & Optimisation

Submission Checklist - Very Important (seriously) *Failure to satisfy these submission requirements may result in non-acceptance of your submission or reduced marks.*	
	The deadline is **strictly** on Friday 19th January 2024 at 23:59.
	You included the **complete** **plagiarism declaration form**.
	You included the **completed** **statement of completion** (template below).
	Report is in PDF - **no Word documents or any other format**; **no exceptions**.
	Source code is included in the submission. **No links to Dropbox, GitHub, or anything else; no exceptions**.
	Archives are in **ZIP format** - **no RAR, 7z, or any other format**; **no exceptions**.
	Uploaded size limit is **100Mb** - the PDF report, source code, and any relevant datasets must fit. If there is no space, you may provide an external link to the **datasets ONLY** (e.g., Dropbox, GitHub, etc..). **Report and source code must always be in your VLE submission**. **Don't let external links expire until you have been graded**.
	Your **name** and **student ID** are both on the front page of the report.
	Projects must be submitted only through VLE – **submissions made by email or any other way apart from VLE will not be considered**; **no exceptions**.
	A **draft** and **final** submission area is set up in VLE. Only projects submitted in the final submission area will be graded. **Projects submitted to the draft area will not be considered at all**; **no exceptions**.
	It is your responsibility to ensure that your upload is complete, valid, and not corrupted. You can reupload the assignment as many times as you wish within the deadline. Double-check! **Corrupted uploads cannot be graded**.
	Plagiarism is a serious offence and will not be tolerated.
	This is **NOT** a group project.

Live face, eye, and mouth detection using Viola-Jones

- In this project you are required read about, understand, and implement the **Viola-Jones object detection method** to detect faces, eyes, and mouths in real-time webcam feeds.
- If you absolutely do not have access to a webcam, you can perform detection on static images. However, you will need to benchmark and document the performance of your solution to show that it can be used in a 'live' scenario.
- There are two main deliverable components:
    - **Reading component**: a report showing that you understand the method.
    - **Practical component**: an implementation and evaluation of method on a real-time webcam feed.

- **Practical component**:
    - You are not required obtain or build datasets of faces, mouths, and eyes, and train a model yourself. You can find many pretrained models on the internet yourself.
    - Use Python and OpenCV. OpenCV have a user guide to help you get started.
    - Write a program which uses the pretrained models/cascades (you'll need to learn about what cascades are) to detect faces, eyes, and mouths in real-time webcam feeds. Draw a red bounding box around all the faces in a frame, a green bounding box around all the eyes in a frame, and a blue bounding box around all the mouths in a frame.

- **Reading component**: your report should have introduction, background, methodology, evaluation, and conclusion sections.
    - In the background, when you are describing how the Viola-Jones object detection method works, make sure to, at least, discuss:
        - The general motivation.
        - What AdaBoost is and how it is related to the Viola-Jones method.
        - What cascading classifiers are and how they are trained.
        - A comparison to other methods including, but not limited to, CNNs and YOLO.
        - The fact that Viola-Jones tends to produce false positives.
    - When writing your background section, you are expected to make extensive use of and **refer to high-quality academic sources**.
    - In the methodology section, make sure that you present, explain, and justify your design decisions.
    - You are expected to **evaluate** the practical component of this project properly. This involves presenting your experimental procedure(s) discussing your setup, expected outcomes, results, and discussions.
    - Whether in the evaluation or/and conclusion sections, you are required to describe and discuss what improvements you propose to improve detection performance (i.e., improve accuracy).
    - A proper conclusion covering important and interesting observations.

Important stuff on the next page

Statement of completion – MUST be completed and included in your report

Item	Completed (Yes/No/Partial)
Implemented the Viola-Jones method to detect faces, eyes, and mouths in real-time webcam feeds	
Thorough background section describing the Viola-Jones method and, at least, addressing the points suggested	
A good methodology section covering the overall architecture and design decisions made	
Evaluation presenting the results obtained and a discussion	
Proposed realistic improvements and/or alternative methods	
If partial, explain what has been done	

Marking Breakdown

Description	Marks allocated
Implementation of the Viola-Jones method to detect faces, eyes, and mouths in real-time webcam feeds	40%
Background section quality	20%
Methodology section quality	10%
Evaluation quality	10%
Comparison of Viola-Jones to other methods	10%
Overall report quality (introduction, conclusion, writing style, references, and so on)	10%