Course Project

ICS3206 - Machine Learning, Expert Systems, and Fuzzy Logic

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 17th January 2025 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 <u>always</u> 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.
	If you use generative AI tools in this project **make sure to include a related Appendix**. See more at the end of this document.

Detection of Constellations in Astronomical Images

- This project involves four deliverables:

  1. Construction of a dataset.

  2. A template-based implementation.

  3. An investigation into deep learning approaches.

  4. A write up describing your approach, methodology, and findings.

- Dataset:

  - You can take screenshots of constellations to build a dataset from online planetariums such as https://in-the-sky.org/skymap.php or https://theskylive.com/planetarium or https://stellarium-web.org/.

  - Your dataset should include at least eight constellations.

  - You should augment your dataset using image processing techniqies including but not limited to: distortion (e.g., skew, scaling), noise, [slight] blur, brightness, and contrast. You should be able to automate much of this process.

  - The procedure to build the dataset is up to you (e.g., the amount of original images per constellation and the augmentation procedure).

  - You may choose to only have one constellation per image (i.e., the image will not have, say, two constellations in it; also, your implemenation can assume that there is only one constellation to classify in an image).

- Template-based implementation:

  - You can use pre-ecisting libraries in your implementation.

  - Template Matching is the process of identifying an object within an image by utilising another image that acts as the template for the object to be searched.

  - The template matching system to use is up to you.

- You should design and execute a series of experiments to determine how well your solution works.

- Investigate deep learning approaches:
  - The problem may be dealt with using deep learning methods (such as a CNN).
  - Write an investigation on how you would approach the problem using deep learning techniques (no need to implement this). What architecture would you go for? How will this affect things like the dataset size, it's augmentation, training time, expected results, and so on? How would the method be evaluated? Would you expect this to be better than a template-matching approach?
  - You should invistigate the literature for existing approches and document your findings.

- Make sure that your report is structured and written well.

More important stuff on the next page

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

Item	Completed (Yes/No/Partial)
Data set collection	
Data set augmentation	
Implementation of a template-matching system	
Good evaluation of the template-matching system	
Investigation of deep learning approaches	
High-quality report	
If partial, explain what has been done	

Marking Breakdown

Item	Marks allocated
Data set collection	10%
Data set augmentation	10%
Implementation of a template-matching system	30%
Evaluation of the template-matching system	10%
Investigation of deep learning approaches	30%
Overall report quality	10%

More important stuff on the next page

Using generative AI in this project

(this section is adapted courtesy of Dr. Dylan Seychell)

If you use generative AI in this project in any way whatsoever, you are required to include an appendix in your report covering the following.

The objective of this appendix is to critically examine and reflect on how generative AI was used in this project with an emphasis on it's contributions in improving your work.

- **Introduction**
  - Briefly describe the generative AI models you chose to use and the rationale behind that choice.
- **Ethical considerations**
  - Discuss the ethical aspects, if any, of using generative AI in your project. This should include issues like data bias and privacy.
- **Methodology**
  - Outline the methods and steps to integrate the generative AI model into your work. Which tools did you use, and in which sequence? Did you create your pipeline, or did you just use one tool? There is no wrong answer, and this journal aims for transparency and accountability.
- **Prompts and responses**
  - List down the specific prompts that were used with the generative AI tool and you found noteworthy. For each prompt, also include the generated response and explain how it contributed to improving your project. It is advisable to use screenshots for this part.
- **Improvements, errors, and contributions**
  - Discuss the areas where generative AI contributed to enhancing your work and/or instances where the output contained errors. This can include but is not limited to data analysis, formulation of ethical

considerations, literature review enhancement, or idea generation. Highlight specific cases where this happened.

- **Individual reflection**
  - Reflect on your personal experience using generative AI in your project. Discuss what you learned, what surprised you, and how your perspective on using AI in academic projects has changed, if at all. Did generative AI help you be more efficient? Do you feel you wasted more time when you used it? For which part was it most helpful? Literature review, debugging?

- **References and list of resources used**
  - Make sure to verify and include a list of references and resourses used in this project.