Artificial Intelligence

Project Guideline

Summer 2025

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1. Project Goal

Build and *explain* a complete image-classification pipeline on your **assigned dataset**, moving from a hand-crafted CNN baseline to state-of-the-art transfer-learning and Vision-Transformer models, augmented with an XAI analysis and packaged as an interactive Streamlit application.

2. Mandatory Project Stages

Stage	What you must do	Minimum expectations
A. Data Prep.	• Verify class balance, image quality, train/val/test splits. • Apply sensible augmentations (flip, rotation, colour-jitter, . . .).	Clear EDA plots & justification for each augmentation.
B. Custom CNN	Design, train, and evaluate *one* convolutional network **from scratch**.	Explain architecture choices; reach $\geq 65\%$ test accuracy (or justify shortfall).
C. Transfer Learning	Fine-tune **four *different*** pretrained CNN backbones not shown in the sample code.	• ImageNet weights. • Document freeze / unfreeze strategy. • Compare metrics in one table.
D. ViT	Train *one* Vision-Transformer classifier (e.g. ViT-B/16, DeiT-S).	Either full fine-tune or linear probe + MLP head.

E. XAI	Apply ≥ 1 saliency method (Grad-CAM, Score-CAM, LIME, SHAP, ...) to the *best* model.	Heat-maps for ≥ 10 random test images + interpretation.
F. Streamlit	Interactive web app: upload/choose image $\rightarrow$ prediction $\rightarrow$ toggle XAI overlay.	Neat one-page UI; runs via `streamlit run app.py`.
G. Report & Viva	Concise scientific report + oral defence.	Follow template in §4.

3. Deliverables & Deadlines

Item	Format / Location	Due (BST)
Code repository	GitHub public repo `cse366-<groupID>-term-project`	23 Aug 2025 23:59
Streamlit demo	folder `streamlit_app/` inside repo	23 Aug 2025
Technical report	PDF `<groupID>_report.pdf`	23 Aug 2025
Viva-voce	Q&A	28–30 Aug 2025

Late policy: 10 % penalty per 24 h (max 72 h), no submissions afterwards without prior written approval.

4. Technical Report Template

Report Link : `https://www.overleaf.com/read/nvkyzchcjdjm#9493e8` Instruction to copy the report see figure 1.

1. Title page – project title, group members, IDs, date.
2. Abstract – ≤ 150 words.
3. Introduction & Problem Statement.
4. Related Work – 6–8 key citations.
5. Dataset & Pre-processing.
6. Methodology
   - Custom-CNN architecture diagram.
   - TL & ViT configurations (layers unfrozen, optimiser, scheduler).
   - Rationale for chosen XAI method.
7. Experiments & Results
   - Training/validation curves.
   - Comparative table – accuracy, precision, recall, F1, confusion matrix.

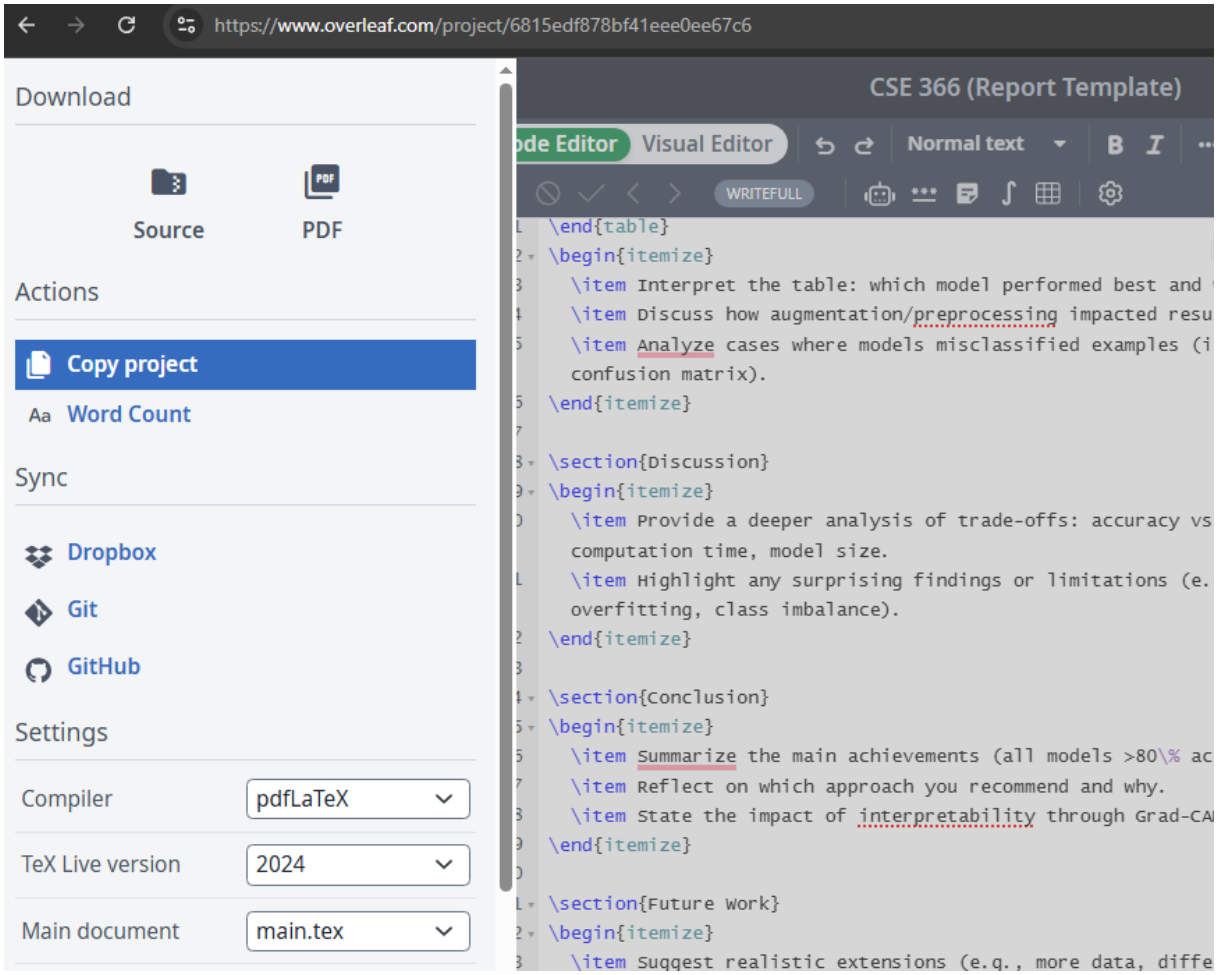

Figure 1: Copy Project from Overleaf

8. Explainability Analysis – discussion of heat-maps.
9. Streamlit Deployment Details – screenshot + workflow.
10. Conclusion & Future Work.
11. References – IEEE/ACM style.
12. Appendix – extended code, hardware specs.

5. Assessment Rubric

Component	Weight
Code quality & reproducibility	10 %
Custom CNN performance & discussion	10 %
Transfer-learning experiments (4 models)	10 %
Vision Transformer experiment	10 %
XAI implementation & insights	10 %
Streamlit app (functionality + UX)	10 %
Technical report	10 %
Viva-voce	30 %

6. Submission Checklist

- All notebooks / scripts run end-to-end on GPU.
- Random seeds fixed; results reproducible.
- `README.md` with environment setup & model-zoo table.
- `requirements.txt` *or* `environment.yml`.
- Streamlit app launches with a single command.
- Report PDF present in repo root.
- Meaningful commit messages; final commit tagged `v1.0`.

7. Additional Transfer-Learning Restriction

- **Prohibited:** Any backbone architecture used in the instructor's sample notebook or code snippets (e.g. the class demo with ResNet-50 and MobileNetV2).
- Your four TL models *must therefore be different CNN architectures not present in that sample code.*
- Cite the original papers / model cards for each backbone in the report.
- Non-compliance → 15 % deduction on the TL rubric component.