End-to-End Computer Vision Project

Introduction

The goal of this project is to design, implement, and evaluate an **end-to-end computer vision system** addressing a well-defined problem, preferably inspired by a **real-world or industrial application**. Students are expected to apply one or more **deep learning techniques for computer vision** covered during the course.

Each project must incorporate **at least one** of the following modules:

- Semantic segmentation
- Object detection
- Super-resolution and/or image denoising

Projects should go beyond isolated model training and instead demonstrate a **complete pipeline**, including data preparation, model design, training, evaluation, and critical analysis of results.

Evaluation Criteria

The project will be evaluated based on three complementary components:

1. Code (Implementation)

Students are expected to deliver a **fully functional and reproducible codebase**.

The code should:

- Implement the complete end-to-end pipeline
- Be well-structured, modular, and readable
- Use appropriate deep learning frameworks and best practices
- Include clear instructions to reproduce the experiments
- Allow correct execution of training and evaluation scripts

Code quality, clarity, and reproducibility will be explicitly assessed.

2. Written Report

Students must submit a **paper-style technical report** describing the project.

The report should:

- Clearly define the problem and its relevance
- Review related work and position the proposed approach
- Describe the dataset, methodology, and experimental setup
- Present quantitative and qualitative results
- Include a critical discussion of limitations and failure cases
- Follow a clear and coherent structure, using precise technical language

The report should reflect **scientific rigor**, not just implementation details.

---

3. Oral Presentation

Each project will be presented orally to the class.

The presentation should:

- Clearly explain the problem, methodology, and results
- Justify design choices and evaluation strategies
- Demonstrate understanding of the underlying techniques
- Address questions and critically discuss limitations

Both **technical content** and **clarity of communication** will be considered.

Paper-Style Report Template

1. Title
    - Concise and descriptive
2. Abstract (150-250 words)
    - Problem statement and context
    - Proposed method
    - Experimental setup
    - Key quantitative results
    - Main contributions
3. Introduction
    - Background and motivation
    - Objectives of the project
    - Explicit contributions (bullet points)
4. Related Work
    - Overview of relevant classical and deep learning approaches
    - Positioning of the proposed work with respect to existing methods
5. Problem Formulation
    - Formal definition of the task
    - Input/output specification
    - Assumptions and constraints
    - Evaluation metrics

6. Dataset
    - Dataset description and origin
    - Annotation process
    - Train/validation/test split
    - Preprocessing steps
    - Data augmentation strategies
7. Methodology
    - Overall approach
    - Pipeline diagram (mandatory)
    - Description of each module
    - Justification of design choices
8. Experimental Framework
    - Frameworks and libraries used
    - Model configurations
    - Training procedure
    - Hardware setup
    - Reproducibility details
9. Experimental study
    - Baseline models
    - Quantitative results
    - Ablation studies
    - Qualitative results
10. Conclusions and Future Work
    - Summary of findings
    - Future research directions
11. References
    - Use a consistent citation format