CO543-2024: Image Processing

Dep. of Computer Engineering

Mini Project Guidelines

Image Processing and Computer Vision Project

Task Description

This project challenges students to select and work on their own image processing and computer vision projects. Students have the freedom to choose a project based on their interests and objectives within the domain. The overarching goal is to apply concepts learned throughout the course and outside to develop innovative solutions, whether it involves implementing state-of-the-art algorithms, exploring novel techniques, or addressing real-world applications.

Example Projects:
- Super-Resolution for Image Enhancement
- Weather Effect Removal from Images
- Image In-painting (Restoring Damaged Areas)
- Colorization of Grayscale Images
- Image Style Transfer
- Rain Streak Detection and Removal
- Shadow Removal from Images
- Facial Super-Resolution
- Image De-noising
- Haze Removal from Aerial Images
- Blur Removal (De-blurring)
- Video Stabilization
- Foggy Image Enhancement
- Watermark Removal from Images
- Low-Light Image Enhancement

Goals

1. **Create innovative solutions**: Encourage students to design and implement novel approaches in image processing and computer vision, fostering creativity and originality in their projects.
2. **Evaluate and analyze experimental outcomes:** Challenge students to critically evaluate the effectiveness of their implemented algorithms, analyze experimental results and draw insightful conclusions about the performance and limitations of their approaches.
3. **Synthesize knowledge and skills**: Provide students with opportunities to synthesize their understanding of image processing and computer vision concepts, as well as their technical skills in algorithm development and implementation, to tackle complex real-world problems and develop comprehensive solutions.

Group Formation

Teams of up to **five** students are permitted to collaborate. Projects undertaken by teams of five members are expected to demonstrate more extensive and impressive.

- [Update Group Details here](#)

Specifications

1. Problem Definition: Clearly define project objectives and task requirements.
2. Dataset Preparation: Collect and preprocess diverse datasets for training and evaluation.
3. Algorithm Selection or Development of a new one: Choose or design suitable algorithms for the task.
4. Model Architecture: Design efficient network architectures for implementation.
5. Training Strategy: Develop effective training procedures for model optimization.
6. Hyper parameter Tuning: Optimize model performance through systematic hyper parameter tuning.
7. Evaluation Metrics: Define and compute relevant evaluation metrics for performance assessment.
8. Validation Techniques: Implement robust validation methods to ensure model generalization.
9. Benchmarking: Compare model performance against baseline methods and state-of-the-art approaches.
10. Documentation: Provide comprehensive documentation covering dataset details, algorithm implementations, results, and conclusions.

Milestones

1. Proposal Presentation (Week 3):

   - Students will present a proposal outlining their chosen project, including the problem statement, objectives, and proposed approach.
   - The proposal should also include details on datasets, methodologies, expected challenges, and potential solutions.
   - Feedback will be provided to guide students in refining their proposals and ensuring feasibility.

2. Milestone Progress Presentation (Week 8):

   - Students will deliver a presentation showcasing their project progress, highlighting implemented methods, experimental results, and insights gained.
   - The presentation should effectively communicate the project's objectives, methodology, and current status, allowing for constructive feedback.
   - Feedback provided will assist students in refining their implementations and preparing for the final stages of the project.

3. Final Report Submission (Week 12):

- Students will submit a comprehensive final report documenting their entire project, including background, methodology, experimentation, results, and conclusions.
- The final report should demonstrate a thorough understanding of the chosen topic, the rationale behind the approach, experimental setups, and analysis of outcomes.
- Adherence to proper academic writing standards and inclusion of references to relevant literature are expected. Follow the **IEEE template** (double column).

4. Final Presentation (Week 14):

- Each student group will deliver a final presentation summarizing their project work, emphasizing key contributions, findings, and implications.
- The final presentation should effectively communicate the project's objectives, methodology, results, and any lessons learned throughout the process.
- Incorporation of feedback received during milestone presentations and demonstration of any final improvements or insights gained are encouraged.

Evaluation Criteria (14.5/100):

1. Proposal Presentation and Report (20%)

Evaluation Criteria	Excellent (4)	Good (3)	Fair (2)	Poor (1)
Clarity of Problem				
Feasibility of Proposed Approach				
Proposal for Novelty				
Benchmarking Plan				
Report Submitted				

2. Final Presentation, Demonstration and Report (80%)

Evaluation Criteria	Excellent (4)	Good (3)	Fair (2)	Poor (1)
Background/Problem Statement/Aims & Objectives				
Methodology				
Novelty				

Benchmarking Results				
Adherence to Template				

- ➢ Project Proposal Report (3 Page):
  - Title, Author(s)
  - Introduction: this section introduces your problem and the overall plan for approaching your problem
  - Problem statement: Describe your problem precisely specifying the dataset to be used, expected challenges, and potential solutions.
  - Objectives: Clearly state the goals of the project
  - Methodology: Describe the approach and strategy to achieve the objectives, and also Tools, technologies, or methodologies to be used
  - Proposed Timeline
  - Expected Outcomes and Benefits
  - References: This is necessary.

- Proposal Presentation
  - The contents of the presentation should be similar to the contents of the Proposal project report.
  - Create a video of presentation. (Total of 5 minutes).

- Milestone Progress Presentation and Demonstration:
  - The contents of the presentation should be aligning with the progress of your project. (4 minutes)
  - Demonstrate your progress with more emphasis on your approach and results. (6 minutes)
  - Create a video of presentation and demonstration (Total of 10 minutes).

- ➢ Final Project Report (7 Page):
  - Title, Author(s)
  - Abstract: It should not be more than 300 words
  - Introduction: this section introduces your problem and the overall plan for approaching your problem
  - Background/Related Work: This section discusses relevant literature for your project
  - Approach: This section details the framework of your project. Be specific, which means you might want to include equations, figures, plots, etc
  - Experiment: This section begins with what kind of experiments you're doing, what kind of dataset(s) you're using, and what is the way you measure or evaluate your results. It then shows in detail the results of your experiments. It must include both quantitative evaluations (show numbers, figures, tables, etc) as well as qualitative results (show images, example results, etc).
  - Conclusion: What have you learned? Suggest future ideas.
  - References: This is necessary.

- ➢ Final Project Presentation and Demonstration:
  - The contents of the presentation should be similar to the contents of the final project report, with more emphasis on your approach and results.

- A rough suggested allocation of time is the following:
  - Presentation
    - Introduction: Introduce the motivation and your problem, and then relevant prior work and approaches for this problem (3 minutes)
    - Approach: Provide an overview of your approach and highlight the key technical aspects you worked on. (5 minutes)
  - Demonstration
    - Experiments and evaluation: Explain the experimental setup and summarize the quantitative results (numbers, figures, tables, etc) and qualitative results (images, example results, etc). (7 minutes)
- Create a video of presentation and demonstration (Total of 15 minutes).

- ❖ **You may consult any papers, books, online references, or publicly available implementations for ideas and code that you may want to incorporate into your strategy or algorithm, so long as you cite your sources in your code and your write-up. However, under no circumstances may you look at another group's code or incorporate their code into your project.**

- ❖ **Be prepare with the documents, and videos in the deadlines. Submitting and uploading criteria will be informed to you.**