

20EECE6042/5142 DIP Final Project

Spring 2022

This is an open-ended project related to digital image processing. Your team needs to come up with a DIP project idea and then implement it and present your work to the class. The goal is to develop your research/application capabilities by exploring a problem/topic related to digital image processing. Upon the completion of your final project, you should gain not only in-depth knowledge but also hands-on experience in a subfield of DIP.

Generally speaking, your projects may fall into one of these two categories.

- (1) Applications. If you came to this class with a specific background and interests (e.g. biomedical engineering, bio-medical image processing, non-destructive evaluation, deep learning, AI, traffic flow estimation, driverless car, remote sensing, etc), I encourage you apply novel DIP methods to problems related to your particular domain of interest. You can pick up a real-world problem and apply the techniques covered in the class or beyond the class to solve it!
- (2) Modeling. You can build a new model (algorithm) for DIP, or a new variant of existing models, and apply it to tackle DIP problems. This track might be more challenging.

If you are a graduate student or ACCEND student, you may consider the possibility to extend this project into a M.S. thesis or MENG capstone project. You are encouraged to discuss this with me during my office hours (webex).

Project Format

This is a team project. Please see team assignment on Canvas. If you have any question for your team assignment, please contact TA, Mrs. Maha Mohammed Khan. mahamofu@mail.uc.edu

Proposal

Each team will turn in an approximately one-page proposal describing their project. It should include the following information:

1. Your team members
2. What is the problem that you will be investigating? Why is it interesting? What are your project goals? Be as specific as possible. Describe what the inputs to the system are, and what the outputs will be.
3. Brief description of your approach. If you are implementing or extending a previous method, give the reference and web link to any resource you may use. Describe what you are going to implement, or How do you plan to improve or modify existing implementations?
4. Responsibility of each team member.
5. What data or equipment may be needed? Do you have the equipment or dataset?
6. References

Final Presentation

Each group will give a short (10 minute) PowerPoint presentation on their project to the class. You need to record your video presentation and make it available to the class. The contents of the presentation should be similar to the contents of the final project report, with more emphasis on your approach and results. Your slides/presentation should include the following parts with recommended time for the presentation:

- (1) Introduction: Introduce the problem you select, and then related work and previous solutions/approaches for this problem (2 minute);
- (2) Your Approach: Provide an overview of your approach and highlight the key technical aspects you worked on. If you have not fully finished implementing your approach, highlight what parts are done and which are still planned for the final report (4 minutes);
- (3) Experiments and evaluation: Explain the setup for your experiment and summarize the quantitative results. Include numbers, figures, tables, etc and qualitative results such as images. If the results are not as expected, explain what the challenges are and how you plan to improve the results in the final report. (4 minutes)

Final Report

Reports must include a cover page and the main report.

- (1) A cover page includes project title and team members.
- (2) The main report needs to include the following sections
 - **Abstract** - A paragraph that summarizes the problem and the results.
 - **Introduction** - Sets the context, describes the problem, and describes the related work with references
 - **Project Description** Your solution in details including the algorithm.
 - **Results & Discussion**, strengths and limitations of your algorithms should be described as well.
 - **Future work** and what you would do if you had more time.
 - **Summary and conclusion**---Summarize what you did and what interesting things you learned from the project.
 - **References you used for your project**

Use the attached template and follow the technical report guidelines by IEEE to prepare your final report.

Suggested topics

I have included several ideas that would make appropriate final projects. You can do your research and select variations of these, and then narrow down a project of your own.

- Novel image processing application development for mobile devices, for example, develop an application to take multiple photos with different exposures and combining them on the phone.

- Use of RGB and Lidar image for indoor positioning where GPS does not work.
- Lidar image processing techniques for non-destructive evaluation (i.e., high speed mobile platform to measure highway cracks)
- Digital object insertion
- Face recognition.
- Human detection and tracking in real-time videos
- Pedestrian detection for autonomous driving, driver sleepiness detection
- Automated recognition for various objects (traffic signals, identification of number of drive axles of vehicles)
- Traffic flow estimation based on real-time videos
- Lane detection
- Medical image processing and analysis
- Autofocus you can implement an algorithm to recognize faces in the image and implement an autofocus algorithm for a mobile phone
- Character recognition
- Image denoising
- Automated Human Head Counts
- New Edge detection method
- New segmentation method
- Image registration
- Automated gesture interpretation

Honor Code

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 clearly cite your sources in your code and your writeup. However, under no circumstances may you look at another group's code or incorporate their code into your project.

If you are doing a similar project for another class, you must make this clear and write down the exact portion of the project that is being different from the work used in another course.

Grading

We will be grading for completeness and clarity more than the quality of your results. The rubric will be split into the following categories:

- (1) 25% for problem statement, motivation, and background
- (2) 30% for technical approach
- (3) 30% for sufficient and informative quantitative and qualitative results
- (4) 15% for visual style

Important Dates

- Assigned date: March 24, 2021

- Proposal due: April 1, 2021 (Submission thru canvas)
- Final presentation slides: April 22, 2021 (submission thru canvas)
- Final Presentation video: April 23, 2021 (submission thru canvas)
- Final Report, April 28, 2021 (submission thru canvas)