CIS 5810 Extra Project

Spring 2023

1 Introduction

In this assignment, you will select one of the available tracks to develop a computer-vision based project.

The objectives of this project are for you to:

1. Develop a foundation to continue building your own computer vision and image processing projects.
2. Implement some of the computer vision and image processing techniques you have learned in this course.
3. Develop a self-learning approach for preparing and implementing a project, much like the real world where you will not have templates or walk-throughs.
4. Develop a research-based approach to study previous relevant work, analyze how your algorithms/models are performing, and how you can improve your performance.
5. Learn to work with libraries and frameworks such as PyTorch, OpenCV, etc.
6. Work with videos and not only images. Videos may include webcam feeds and other video file formats.

2 Project tracks

You will select one of the tracks provided. More detailed guidelines for each track will be provided in a separate PDF document.

1. **Track 1 - FACE SWAPPING**: This track will involve detecting and swapping faces in two videos. You will have to address the challenges of exposure, lighting, shadows, turning faces, etc. You will work on how to obtain visually seamless results.

2. **Track 2 - STYLE TRANSFER**: Neural style transfer (NST) represents a category of algorithms designed to take an input image and reproduce it with a specified artistic style. Through this track you will develop a modified version of the very first NST algorithm which starts off with being able to generate artistic style images before moving on to generating stylized videos.

3. **Track 3 - NO CAMERMAN LEFT BEHIND**: Here we address a common challenge where in taking group photographs, the group-member taking the photograph is left out of the image. You will tackle this challenge by detecting and extracting information from images, and conducting blending to achieve a natural and realistic final image.

4. **Track 4 - CELEBRITY RECOGNITION**: Do you have a favorite celebrity? This track will allow you to build and train a face recognition algorithm to identify a person by their facial features. You will have the opportunity to compile impactful training datasets and work on the challenges of recognition in videos.

5. **Track 5 - 360 IMAGE CREATION**: Demystify and create 360 degree images that can be viewed in a virtual reality (VR) headset. You will be working with image stitching and projection methods to output immersive panoramic experiences.

6. **Track 6 OPEN-ENDED**: This track is open-ended. You can formulate your own problem, as long as it is computer vision-related. We encourage you to use the techniques that you will learn and implement in this class, such as edge detection, warping, morphing, blending, image stitching, optical flow, and deep learning. You can add any features you wish to. The project scale should be similar to tracks 1-5.

Note: This project or the knowledge gained from this project is for educational purposes only and not to be used for unethical or illegal activities.

3 Logistics

1. This project is an individual or group assignment (team of 2 students).

2. TAs can help you with project guidance during TA private office hours, however please note we will emphasize more on your self-learning and experimentation to do your implementation.

3. You are encouraged to reuse projects to put this final project together. It is acceptable to use any open source code with proper attribution.

4 Important dates and submissions

1. **3/10** Proposal (20 points)
   – You need to turn in a PDF file up to 2 pages long, which will include the following sections: 1) Project title, 2) Project summary, 3) Goals and objectives, 4) Related works, 5) Proposed approach.
   – Include a timeline and duties.
   – Include an optional slide presentation for your project.

2. **3/31** Midterm report (20 points)
   – You need to turn in a PDF file up to 4 pages long which will include the sections as in the initial project proposal.
   – List progress, questions and future plan for the final project.
   – Include an optional slide presentation for your project.

3. **4/21** Final report and other materials (100 points)
   Your final submission should include the following:

   (a) A 5 minute video presentation and slide presentation.

   (b) A README.txt file that describes relevant implementation details and detailed instructions on how to run the code.

   (c) A requirements.txt file detailing the packages you used along with their versions.

   (d) The complete *.py code files for your implementation.

   (e) A detailed report (up to 6 pages long). You are free to chose any template for writing your report but it should be limited to six pages, excluding references. As a broad guideline your report should contain the following,

      i. A short abstract that acts like a TL;DR of your report, try to keep this under two hundred words and summarize your findings in this.

      ii. An introduction that describes what you are trying to achieve through this project and how you are different from the rest. Give a little context to the problem you are solving and ideally keep this approximately half to one page.

      iii. Related Works that details what other papers/resources did you refer to while making your project. Provide brief summary of everything you have used, ideally this should be one page long. It is good practice to actively keep track of all of the resources that you use while making the project, instead of trying to remember them in the end.

      iv. Describe your method next, what innovations did you make? Again keep this under a page, and remember to list all relevant

materials (such as equations, loss functions, network architectures, etc.) in this section.

v. Experiments and results, the most important section. Log all of the results you obtained here along with design choices, impact of design choices and any other thing that you added which impacts visual quality of your results. Remember to paste a lot of generated images here in a comparative sense so as to show how your design choices affect the outputs visually. Please note the important of bench marking to analyze the success of your outcomes. Take up to three pages for this section.

vi. Write a conclusion to your report detailing your learning experiences through the project. Finally, follow it up by putting the references to your project at the end.

The above are just rough guidelines you are free to include whatever you feel like and modify them. However a good academic report will have all of the above in some form or other.

(f) Result images/videos. If the file is too large, you can use shareable links.

5 Instructions for all tracks

(a) You must submit to Canvas/Gradescope. If some files are too large, you can use shareable links but you will have to make it clear in the report and README.txt file.

(b) This main programming language for this project is Python. You can use any package such as Pytorch, Numpy and OpenCV. As described in the previous section, you need to provide a requirements.txt to specify packages you use. You may build your project using a code editor and/or an integrated development environment (IDE) such as Microsoft VS Code or JetBrains PyCharm. You may also use Google Colab notebooks.

(c) Start early! If you get stuck, please post your questions on Ed Discussion or come to office hours!

6 Grading

Projects will be assessed on the quality of your presentation and write-up, the overall degree of difficulty, and on the project outcomes. A well-researched, ambitious project that is ultimately not successful, but is well explained and presented, may receive a better grade than a project that

is a simple implementation of an existing algorithm.

Additionally all of the final reports will be graded roughly along the following six key criteria,

(a) Quality of presentation and write-up.

(b) Overall difficult of the project.

(c) Creativity and visual quality of results.

(d) Effort and commitment along the journey.

(e) Novelty, which is how much you deviated from previous approaches to the project challenge. You are encouraged to read newer works and incorporate designs from them to improve the quality of your results.

(f) Code quality and efficiency.