# University at Buffalo
# Department of Computer Science and Engineering
# CSE 573 - Computer Vision and Image Processing

Spring 2025

CVIP Semester Project
Due: 02/20/25, 11:59PM

## 1 Instructions

- All project deliverables will be uploaded to UBLearns

## 2 Project Overview

- The project will require you to build a computer vision "application" that can be demonstrated.
- You will choose an appropriate project to complete by the end of the semester. Be careful not to over commit.
- You may NOT extend a previous project or combine this project with any other class project.

### 2.1 Projects Phases

The project will have four phases with a schedule defined below.

- Project proposal (Due: 02/20/25, 11:59 PM)

  You will submit a project proposal (see Section 2.4 for an overview) that we evaluate based on scope and feasibility and provide feedback to refine it further.

- Refined proposal and progress report 1 (Due: 03/06/25, 11:59 PM)

  Based on the feedback provided during the project proposal phase, you must re-submit a refined proposal (see Section 3 for an overview). By this time we expect you have already started working on the project. Based on that work, you would be expected to submit progress report 1 (see Section 3 for an overview).

- Progress Report #2 (Due: 03/27/25, 11:59 PM)

  You are expected to submit project report #2 based on the work done until then.

- Final Report and Demo Video (Due: 04/25/24, 11:59 PM)

  At the end, you would submit a detailed 2-4 page report on the project along with a 5-minute video (details in Section 4).

## 2.2 Teaming

You may work alone or on a team of two for the project.

- To specify your team for the project, follow this link to a Google form.
- LINK: Semester Project Team Selection.
- If you do NOT complete the form, we will assume that you are not teaming with anyone and submit the project.
- If you work as a team, assume that the scope should be significantly greater than a project that you would have if you only had one person.

## 2.3 Project Details

The goal of a semester long project is to have you ease into and enjoy computer vision. That is why we let you pick your project and define how you will approach it. There will be no restrictions on the "standard" libraries you use. However, you may not use repositories that implement your proposed application. Be careful not to fall into this trap!

## 2.4 Project Proposal

You will submit a project proposal that we evaluate based on scope and feasibility and provide feedback to manage expectations and allow you to refine it.

You should use the following headers in your project proposal, provide the requested details, and elaborate as much as possible.

### 2.4.1 Scope of the project

- Project Title: [title]
- The Application:

  A simple straightforward description of the application you intend to build.

  There are no jargon or solutions here, just what you want to produce Who will

  benefit from a solution to your project (other than you a student)?
- State of the Art:

  Have other solutions addressed this problem?

  What are you doing differently from the current state of the art, if anything?

  If this is an established problem, provide at least two previously published papers and/or GitHub repositories addressing this problem.
- Inputs and Outputs:

What are the inputs and outputs for the problem?

What are the intermediate outputs, if any?

It will be helpful to provide an illustrative system diagram here, including inputs and outputs.

### 2.4.2 Data

- What data will your project require?
- Will you be using your own data set or will you use an existing dataset?
- How do you plan to acquire such data?
- What is the scale of the data *e.g.,* the number of images needed, etc.
- NOTE:

  Collecting your own data will take a long time. Unless you are confident (and willing to take risks) that collecting data would take less time, you should use an existing dataset relevant to your problem.

### 2.4.3 Coding Resource Requirements

- What libraries or other code do you plan to use? *e.g.,* OpenCV-python, ...

  There are no limitations other than limitations on copying existing applications.

  For example, you cannot use a face recognition package to implement only face recognition. However, you could use it as a face recognition package as part of a security system. • Specify whether you intend to utilize any code from an open repository and, if so, what parts of the code you plan to use.

- Specify what parts/aspects of the project you will code independently.

### 2.4.4 Computational Resource and Effort Requirements

- What computational resources do you plan to use for the project?
- Estimate, if possible, how much compute resources and for how many days?
- What are the estimated man hours (per person) you anticipate for the project?
- NOTE: We will not be providing access to any GPUs. Make sure that you can get the computational resources of your own.

### 2.4.5 Evaluation

- How will you define the success of the project?

- How will you measure this success?
- Provide an evaluation metric (such as accuracy) that you would use to quantitatively evaluate your project.
- Please ensure that you have positive test-time results for a simpler case of your problem. Also, show failed test-time results for harder cases.

  If possible, describe what these cases would be and provide examples.)

#### 2.4.6 Project Expectations

- What are you most excited about for this project?
- What do you hope to learn the most?

**2.4.7 Additional Guidelines** • If you are not adding any extra code of your own, but rather tie together existing tools, you must analyze the limitations/advantages of the algorithms used to solve the problem. You must analyze the algorithm's limitations corresponding to different levels of difficulty of input images. These different levels would depend on the problem. *Please mention what these would be for your problem (if possible, with examples)*.

- Note: Using an open source repository without adding your code will be considered plagiarism.

# 3 Updated Proposal and Progress Reports #1 and #2

Progress report 1 should include an updated project proposal based on instructor feedback and should be extended with the following sections.

- Section entitled "Progress Reports"
- A series of subsections

  Progress to date

  Changes to the original proposal

  Planned tasks

  Schedule through project completion

Progress report #2 should contain only progress since report #1 and not include any additional information on the proposal.

# 4 Final Report, Demo Video, and Code

Prepare a minimum of a two-page single column, single spaced, 11pt font (maximum of seven pages) project report. It should contain the following details.

- Title of the project
- Project Overview

  Summarize the application you are developing, the state of the art, and inputs and outputs for the project. Also, include a summary of your contributions here as well.

- Approach

  Share the details of the algorithms you used.

  What aspects of the algorithms you have coded on your own.

  What aspects of the algorithms have you used from the online resources? Cite them appropriately.

- Experimental Protocol

  Provide a summary of the data sets you used (if any), how you evaluated success (this may be qualitative), and what compute resources you needed.

  Do not put your results or analysis here, only your approach.

- Results

  Based on the previous section, demonstrate your projects successes.

  Report qualitative (visualization) results, if applicable.

  Please add a comparison of your results with the state of the art for the same task with the same dataset, if applicable.

- Analysis (if any)

  Share the analysis results on the limitations/advantages of algorithm used for developing your application.

  Share results on analysis of algorithm limitations corresponding to different levels of difficulty of input images (if any).

- Discussion and Lessons Learned

  Summarize what you learned from this project and how you hope it will help you in the future

  What else could be done to extend the project in the future

- Bibliography

  Add any references you might have used for the project.

## 4.1 5-minute Video

Please prepare a five minute video with voiceover that addresses all aspects of the report.

Please refer to this link (ComputerVisionFoundation) for ideas on the format on how you can prepare a 5-minute video.

### 4.2 Submission Folder Structure

Please add your code to the folder Code. Please include run.sh that can help us to run your code. Also, add a readme.txt file detailing how we can run your code.

- UBID final project.zip readme.txt

  / Report

  UBID final _report.pdf

  / Video video.mp4

  / Code run.sh

## 5 Grading Rubric (100 points total)

### 5.1 Final Report (25 Points)

Your final report will be the main summary of what you accomplished in the project. We would prefer that you write your report as a technical paper.

- Overview of the project (3 points)
- Approach (7 points)

  Details of the algorithm (3 points).

  Description of what aspects of the algorithm have you coded independently (2 points).

  Aspects of the algorithm you have used from online resources, with citations (2 points).
- Experimental Protocol (5 points)
- Results (5 points)

  Should provide an overview of what your application does, and examples of the output
- Analysis (if any) (2 point)

  Should be complete enough for readers to understand whether you succeeded.
- Discussion and Lessons Learned (2 points) should include a detailed discussion of what could be improved and what you learned
- Bibliography (1 point)

  Should be accurate and well formatted

### 5.2 5-minute Video (25 points)

Please prepare a five-minute video with a voiceover that mimics the final report. Will include the same point distribution as the report.

Please refer to this link (ComputerVisionFoundation) for ideas on the format on how you can prepare a 5-minute video.

## 5.3 Code (50 points)

- Used existing on-line or other code for training and development and provided only analysis (max 40 points)
- Coded many components on your own. (up to 50 points)

## 5.4 Novelty and Professionalism Bonus (10 points)

This is a subjective component in picking a project that has not been widely addressed or taking a new approach that advances state of the art. Solving a problem effectively or coming with really good results for the problem and/or producing a high-quality video that is both informative and captivating will earn up to 10 bonus points. If the project is simply an implementation of a common computer vision problem such as face recognition, you took a baseline approach simply retraining but did not advance the state of the art, you will not be eligible for the bonus.

## 5.5 Penalty for Non-Compliance

The proposal, the revised proposal w/ progress report #1 and progress report #2 are required and have specific due dates. If you do not submit them on time or do not address the required elements, each may be assessed a penalty of up to 10 points. So, if you are late on each, the final submission of the project will be graded out of 70 points.

Furthermore, you must submit the proposal before the first progress report and the first progress before the second. You cannot simply skip one of the deliveries! Please keep this in mind.