A.C. Bovik **TERM PROJECT** Unique # **17990**

ECE 371Q **DIGITAL IMAGE PROCESSING** Fall 2023

The class project is intended to be a hands-on, creative learning experience. Each student will be expected to demonstrate his grasp of the material drawn from the lectures, text, or other sources, by applying digital image processing techniques to some problem of interest. In order to enhance creativity, considerable flexibility will be allowed, however. Most students will likely choose to actually implement some interesting image processing algorithm, or perhaps, a series of algorithms in a simulated image analysis application. Those students choosing to implement algorithms on a computer may use any system they like, including their home PC.

If you use your home PC, there are image processing programs, including LabVIEW, *Matlab* and its Image Processing Toolkit, and the National Institute of Health's *ImageJ,* which is **free**. Of course, projects that simply implement an already-available image processing subroutine are discouraged. Rather, it is more interesting to apply a combination of standard algorithms (possibly library routines) to a problem of interest. For those that do computer projects, **please note** that a copy of the software will be required to be handed in.

Labview-based projects are encouraged. Good ones may be used as demos in later versions of this class!

It is not absolutely necessary to do a computer project - if you are interested in doing some kind of engineering/mathematical analysis of an aspect of image processing, feel free to do so. However, be sure to explain it carefully in your project proposal.

Joint projects involving no more than 3 students are acceptable, but they must be cleared with me first.

Each project will be graded on the basis of (*i*) creative effort; (*ii*) a write-up not to exceed 6 pages of text (figures not included) ; and (*iii*) a 10-15 minute demonstration / presentation to the class near the end of the semester.

Sample Project Ideas

The following list is quite incomplete - your ideas may be quite satisfactory. The most important factor to consider is complexity - can I actually finish this project? Be sure to carefully prepare your project proposal so that I can comment on it.

1. Create Android or iOS Apps that: do various types of "computational photography," or that assess image quality, or that denoise images, or checks for blur and fixes it, or …. The list is endless.
2. Create Labview educational demo vi's for the class, on topics for which there are not yet demos.
3. Recognition of human by iris image
2. Recognition of handprinted characters or numerals entered using a mouse or tablet.
3. Analysis of fingerprint images or faces or palms for recognition.
4. Recognition of written signatures using energy features.
5. Implementation of wavelet-based image and video coding techniques.
6. Implementation of a real-time stereo image algorithm.
7. Digital watermarking of images.
8. Automatic coin counter; dice face recognizer; playing card reader; clock reader; etc.
9. Foveated image processing.
10. New image or video quality assessment algorithms.
11. Deep Learning of anything involving images
12. Generative Nets for image processing

GROUP PROJECTS

As mentioned earlier, joint group projects (involving no more than 3 students) are acceptable and are even encouraged. However, the following guidelines apply:

- Group projects must be cleared with me first. This may be done as part of the Project Proposal.

- In the Project Proposal, the creative effort, as well as other work, applied by each participant should be laid out as much as possible. Thus, each participant should be helping to solve the problem.

- Same holds for the Project Progress Report.

- There should be a single Final Project Report. PLEASE SEE THE HANDOUT ENTITLED "**Format for Project Reports**" for a clear explanation of how to prepare the paper in ICIP format. It is important that who-did-what is made very clear.

- Each group will give a demonstration / presentation to the class near the end of the semester. The group may select a single spokesman / presenter, or may divide the presentation into parts.

- The most important aspect of the project is "what you learned." This is what I will be most interested in. Therefore, I suggest that the project be selected based on your interest(s). While ambitious projects (within reason) are not discouraged, ambitiousness is not the basis for grading. Conversely, grading will not be based on the successfulness of a difficult project, but rather, on the effort applied and the amount learned.

Format for Project Reports and Presentations
ECE371Q Digital Image Processing

Professor Al Bovik

Project Reports

As an experience in professional writing, every project report, regardless of team size, must be written in the same form as are papers that appear at the *IEEE International Conference on Image Processing.* The template for the conference paper format, with small modifications, follows on the next few pages. Please read this carefully as you prepare your project reports.

Project Presentations

Your project presentation will be in the form of a five (5) minute video that will be played on one of the two final days of class. There are many resources that can be used: PowerPoint can make slides to videos; Zoom can record any presentation you like. And there are many free and easy video editing programs available. I really like the AVS4U suite since it is so comprehensive, although it does cost a one-time lifetime fee.

AUTHOR GUIDELINES FOR ICIP PROCEEDINGS AUTHORS

Author(s) Name(s)

Author Affiliation(s)

ABSTRACT

The abstract should appear at the top of the left-hand column of text, about 0.5 inch (12 mm) below the title area and no more than 3.125 inches (80 mm) in length. Leave a 0.5 inch (12 mm) space between the end of the abstract and the beginning of the main text. The abstract should contain about 100 to 150 words, and should be identical to the abstract text submitted electronically along with the paper cover sheet. All manuscripts must be in English, printed in black ink.

***Index Terms*—** One, two, three

1. INTRODUCTION

These guidelines include complete descriptions of the fonts, spacing, and related information for producing your proceedings manuscripts. Please follow them and if you have any questions.

2. FORMATTING YOUR PAPER

All printed material, including text, illustrations, and charts, must be kept within a print area of 7 inches (178 mm) wide by 9 inches (229 mm) high. Do not write or print anything outside the print area. The top margin must be 1 inch (25 mm), except for the title page, and the left margin must be 0.75 inch (19 mm). All *text* must be in a two-column format. Columns are to be 3.39 inches (86 mm) wide, with a 0.24 inch (6 mm) space between them. Text must be fully justified.

3. PAGE TITLE SECTION

The paper title (on the first page) should begin 1.38 inches (35 mm) from the top edge of the page, centered, completely capitalized, and in Times 14-point, boldface type. The authors' name(s) and affiliation(s) appear below the title in capital and lower case letters. Papers with multiple authors and affiliations may require two or more lines for this information.

4. TYPE-STYLE AND FONTS

Please use Times-Roman font. Use a font that is no smaller than nine point type throughout the paper, including figure captions.

In nine point type font, capital letters are 2 mm high. If you use the smallest point size, there should be no more than 3.2 lines/cm (8 lines/inch) vertically. This is a minimum spacing; 2.75 lines/cm (7 lines/inch) will make the paper much more readable. Larger type sizes require correspondingly larger vertical spacing. Please do not double-space your paper. True-Type 1 fonts are preferred.

The first paragraph in each section should not be indented, but all following paragraphs within the section should be indented as these paragraphs demonstrate.

5. MAJOR HEADINGS

Major headings, for example, "1. Introduction", should appear in all capital letters, bold face if possible, centered in the column, with one blank line before, and one blank line after. Use a period (".") after the heading number, not a colon.

5.1. Subheadings

Subheadings should appear in lower case (initial word capitalized) in boldface. They should start at the left margin on a separate line.

5.1.1. Sub-subheadings

Sub-subheadings, as in this paragraph, are discouraged. However, if you must use them, they should appear in lower case (initial word capitalized) and start at the left margin on a separate line, with paragraph text beginning on the following line. They should be in italics.

6. PRINTING YOUR PAPER

Print your properly formatted text on high-quality, 8.5 x 11-inch white printer paper. A4 paper is also acceptable, but please leave the extra 0.5 inch (12 mm) empty at the BOTTOM of the page and follow the top and left margins as specified. If the last page of your paper is only partially filled, arrange the columns so that they are evenly balanced if possible, rather than having one long column.

7. PAGE NUMBERING AND PAGE LENGTH

Please paginate your paper. Your paper/project report should be between 4-6 pages in length. Use your available space judiciously. Your goal is to explain as best possible what you *learned* in doing this project, and what you *accomplished* in doing this project. Shorter papers (4 pages) might be appropriate for single-authored projects, while longer papers (6 pages) might be right for multi-author projects.

8. ILLUSTRATIONS, GRAPHS, AND PHOTOGRAPHS

Illustrations must appear within the designated margins. They may span the two columns. If possible, position illustrations at the top of columns, rather than in the middle or at the bottom. Caption and number every illustration. All halftone illustrations must be clear black and white prints. Do not use any colors in illustrations.

9. FOOTNOTES

Use footnotes sparingly (or not at all!) and place them at the bottom of the column on the page on which they are referenced. Use Times 9-point type, single-spaced. To help your readers, avoid using footnotes altogether and include necessary peripheral observations in the text (within parentheses, if you prefer, as in this sentence).

10. EXPLANATION OF WHO DID WHAT

For multi-authored project reports, you must explain who did what. The best way to do this is within Sections which might be called "**Methods**," where you explain your ideas, and what you did, and "**Results**," where you explain the results you got (often accompanied by images).

11. REFERENCES

List and number all bibliographical references at the end of the paper. The references can be numbered in alphabetic order or in order of appearance in the document. When referring to them in the text, type the corresponding reference number in square brackets as shown at the end of this sentence [1].

[1] A.B. Smith, C.D. Jones, and E.F. Roberts, "Article Title," *Journal*, Publisher, Location, pp. 1-10, Date.

[2] Jones, C.D., A.B. Smith, and E.F. Roberts, *Book Title*, Publisher, Location, Date.