EE 133 - Digital Image Processing
Department of Electrical and Computer Engineering
Tufts University Spring 2017
Term Project

The goal of the term project for EE-133 is to build on existing methods developed in the class or explore new avenues not discussed as part of the lectures and problem sets. The project is due by May 10, 2017 by 5 PM. The choice of topic must be approved by Prof. Miller by April 12, 2017. Feel free to discuss you ideas with Prof. Miller who may well be able to provide some help in finding references and such. Each project must include a written report of no fewer than 10 pages and no more than 15 pages formatted as follows:

- Single spaced
- 1 inch margins
- 12 point Times New Roman (Word) or Computer Roman (LaTeX) font

The report is to contain the following sections:

1. Introduction: a coherent and informative overview of the problem you are exploring, why it is interesting and relevant, and current methods for its solution References to the open literature are required.
2. Approach: a presentation of the theory and methods you employ in the analysis of the problem
3. Experiments: a section devoted to explaining the computational (or other experiments) you undertake including an analysis of the results
4. Conclusions: a summary of the work you did, what worked, what did not, why. Also please include a paragraph or two concerning next steps; specifically given what you have done now, what would you do next if you were to pursue this topic at the level of a Master's Thesis.
5. Bibliography

The project must draw on material from at least one paper in the open literature. Links to some good journals in this field are available at the end of this document with many (if not all) of these journals electronically accessible from Tufts.

Team projects are permissible. Reports will be expected to be commensurately longer and the contributions of each member of the team must be made clear. Details of these requirements will be worked out with Prof. Miller on a case by case basis.

The project is to analyze some aspect of the course in more depth. This can take several forms, including implementation and investigation of an approach from the literature or in your own field, experimental studies of some aspect of the course, etc. I would like to see a computational or implementation component in each project, but this is negotiable in special cases. It is hoped that your topic will arise from your own interests and ongoing work. Possible topics include but are not limited to

- Those listed here or any links from this page
- Some more specific ideas that may be of interest
    - Segmentation using snakes, active contours or level set methods
    - Determining 3D structure from 2D "cues" such as stereo, shading, texture, and the like
    - Inverse problems and deconvolution
    - X-ray tomography
    - Radar imaging: synthetic aperture methods
    - Use of partial differential equations to do image enhancement (non-linear and anisotropic diffusion as in this paper)
    - Inpainting
    - Wavelets and multiscale processing

- Curvelets and sparse image
- Dictionary and patch methods in image analysis like in this paper or this one
- Nonlocal image processing methods

These resources are intended only to provide some ideas. If you have specific projects in mind, are working on a thesis in this area, etc., please feel free to pursue a project for this class related to those interests or the work you are currently doing. Google is also an awfully good way of chasing down some of these topics. Prof. Miller can also provide help in narrowing down topics.

Schedule

The following documentation is required:

- Project proposal: No more than two pages due by April 12. Please provide a summary of the topic you have chosen, the work you intend to do and the resources from which you are drawing background and other inspiration.
- Interim report: No more than two page update of progress due April 26.
- Final report: May 10 per the specifications detailed previously.

All documents should be emailed to Prof. Miller as PDF attachments. All of these dates are hard. No extensions will be granted.

Grading

The grade for the project will be based on the following:

- 5% for handing in project proposal on time
- 5% for handing in project update on time
- 45% for technical content of final report
- 45% for written quality of final report. Some items to consider:
  - The report should be clearly written in grammatically correct English.
  - All requested sections should be included.
  - Discussion should be coherent and complete.
  - All experimental results should be discussed in some depth (why was each experiment done, what does it show, did things work as expected, if not why, etc.).

More Links

- Web resources for Gonzalez and Woods text including links to various image databases, the images from the text, and tutorials on various aspects of image processing
- The Mathworks including the image processing toolbox
- Computer Vision On Line (CVOnline) is a GREAT site with introductory information on just about everything we will be discussing in this class as well as a whole lot more. I highly recommend you take a look.
- Journals for imaging and image processing (woefully incomplete, but a start at least)
  - IEEE Transaction on Image Processing
  - IEEE Transactions on Pattern Analysis and Machine Intelligence
  - IEEE Transactions on Computational Imaging
  - IEEE Transactions on Medical Imaging

- IEEE Transactions on Geoscience and Remote Sensing
- Signal Processing Magazine
- arxiv computer vision and pattern recognition
- SIAM Journal on Imaging Sciences
- Image and Vision Computing
- International Journal of Computer Vision
- Journal of Mathematical Imaging and Vision
- Machine Vision and Applications
- Electronic Letters on Computer Vision and Image Analysis
- Image and Vision Computing
- Medical Image Analysis
- Computer Vision and Image Understanding
- Pattern Recognition
- Pattern Recognition Letters
- International Journal of Imaging Systems and Technology