EE641-Digital Image Processing II
Research Project
Spring 1996

Each student will be required to perform a unique project in image processing of her or his choice. Each project will be composed of three parts.

1. A brief written proposal describing your objectives and plan of action and evaluation of performance. **Due April 9, 1996**.

2. A writen report on the results of your experiments.

3. A oral presentation of your results.

Your performance will be graded based on the following criteria:

1. Accuracy of results.

2. Thoughness of investigation.

3. Validity of conclusions.

4. Novelty of approach.

5. Quality of written/oral presentations.

The topic of your project may be related to your current research, but should **not be the same.** For example, if you are currently doing research in segmentation, you might consider doing a project on multiscale segmentation algorithms which extends your current work. Alternatively, you might want to pick a topic which is very different from your current research. In either case, your proposal, report, and presentation should explain which components of your project are new, and which components are from existing research. Possible topics for the projects are:

1. Your own idea.

2. Image segmentation
   (a) Texture segmentation using MRF.
   (b) Segmentation using edge and region information.

3. Image analysis
   (a) Adaptive edge following using EM algorithm.
   (b) Depth from stereo using MRF.

4. Image reconstruction/restoration
   (a) Image restoration using continuous MRF.
   (b) Image deconvolution using EM algorithm.

(c) Image reconstruction from emission/transmission data.

5. Detection

   (a) Automatic detection of image features - (e.g. cars in arial photos).

   (b) Stochastic template matching.

6. Image coding

   (a) Lossless image coding using stochastic image models.

   (b) Heterogeneous image coding based on segmentation.

7. EM algoritm

   (a) Comparison of methods for estimation of mixture model parameters using agglomerative vs divisive clustering ; EM vs direct ML estimation; various methods of order identification; etc.

   (b) Application of hidden Markov models (HMM) to image features.

   (c) Parameter estimation for MRF's.

8. Fast computational methods

   (a) Multigrid/Multiscale algorithms for X.

   (b) Comparison of Conjugate Gradient vs. Gradient Assent.

   (c) Comparison of MAP, MPM and SMAP segmentation algorithms.

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Research Project Proposal

This proposal should outline a clear plan of attack to your research project. It is very important that the scope of your proposal be restricted so that you can complete your work. A simple completed project is better than a complex incomplete project.

1. *Introduction 100-500 words:* Describe the problem and your approach *in words*. Motivate the potential advantages of your method.

2. Give a formal mathematical description of your approach. For example, if you are doing MAP segmentation define the deterministic and random quantities in the problem, and give the formal expression for the MAP estimate. This section need not be complete, but it must set up the problem you wish to solve. It should also contain references to papers which you think will be useful.

3. Describe specific computer experiments which you will perform. Relate these experiments to your formal description of the problem. For example, if you are doing MAP segmentation you might say that you will perform ICM updates and simulated annealing updates and compare the results.

4. Bibliography - list of papers relating to your work.