GEORGIA INSTITUTE OF TECHNOLOGY
SCHOOL OF ELECTRICAL AND COMPUTER ENGINEERING
ECE 6258 - DIGITAL IMAGE PROCESSING
Fall 2014

Term Project

There are four topics to select from as your project this term. For each topic, you are given a primary paper and the task is to reproduce parts of the results in the paper. You are provided with certain pointers to get you started.

Due Dates:

- Reports are due on **December 04, 2014** at midnight
- 8~10-minute presentations by groups will take place starting the week of **November 18, 2014**; exact assignments will be made in early November

Teams:

- Each project team must consist of at least two students and at most of four students

Submission Material:

By **December 04, 2014**, each group must submit one report that shows their implementation of the algorithms in the paper. If a team comes up with a better algorithm than the one proposed in the paper, the report must provide all details. If the algorithm is plausible, we might co-author a paper to be submitted to the IEEE International Conference on Image Processing (ICIP) or another IEEE conference.
If the team re-produces all results in the paper, they will receive the full mark (i.e., 100 out of 100) for the project. If the team proposes and verifies a new algorithm that is verified by us as a viable direction, then the team will receive up to a 20-point bonus (i.e., up to 120 out of 100).

The specifications of the report are as follows:

- maximum of 10 pages (not including appendices; you can add as many appendices as you need); there is no minimum number of pages and please be concise
- 11 pt font with one-inch margins and double space lines
- The report should include:
    - description of the problem
    - description of the method and the idea outlined in the paper
    - the reproduced results with detailed assessment and comparison with the paper's results
    - the workload distribution among team members

Together with the report, you must submit all codes (they must be well commented) and a README file on how to run the codes and reproduce the results. If I cannot run the code on my machine and reproduce the results you present in the paper, then you grade will be zero. All materials have to be included into one ZIP file to be uploaded to t-square under Assignments by one of the team members. The submitted ZIP directory must include: (i) the presentation by the team in PPT or PPTx, (ii) the report in PDF, and (iii) all codes with readme files.

Presentations:

All presentations are limited to 8~10 minutes.

Grade Distribution:

Out of the 100 points, the report is worth 70% of the project grade and the presentation is worth 30% of the total project grade.

Locate papers on the IEEEXplore Database:

Go to http://gtsearch.library.gatech.edu/search/?base=databases&action=alphabetical#I , then click on IEEE Xplore. In the search window, you can paste the title of the paper to locate on the database.

Project Subject #1:

Ji Won Lee; Rae-Hong Park; Soonkeun Chang, "Tone mapping using color correction function and image decomposition in high dynamic range imaging," *Consumer Electronics, IEEE Transactions on* , vol.56, no.4, pp.2772,2780, November 2010.
doi: 10.1109/TCE.2010.5681168
keywords: {brightness;filtering theory;image colour analysis;bilateral filter;color correction function;color saturation control;high dynamic range imaging;image decomposition;luminance compression;tone mapping;Classification algorithms;Color;Dynamic range;Heuristic algorithms;Histograms;Image coding;Image color analysis;bilateral filter, color correction function, color constraint, high dynamic range image, image decomposition, luminance compression, tone mapping.},
URL: http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=5681168&isnumber=5681060

Links to Images, Videos, and Data:

The following links contain the needed images:

- Carnival: http://www.multimediaphoto.com/images/mask/
- Foyer: http://www.multimediaphoto.com/images/foyer/
- Sogang [not available], use: http://www.multimediaphoto.com/images/grandcanal/

Links to Available Codes:

- Debevek and Malik's code is described at the following URL: http://www.mathworks.com/company/newsletters/articles/rendering-high-dynamic-range-images-on-the-web.html
- Both Debevec and Malik and Reinhard et al. implementations http://cybertron.cg.tu-berlin.de/eitz/hdr/#downloads
- iCAM: http://www.cis.rit.edu/research/mcsl2/icam/hdr/
- Li et al.:http://people.csail.mit.edu/yzli/hdr_companding.htm

Deliverables:

You must produce the results in Figures 2 through 7.
You must also provide comparison results with two of the four algorithms listed in Table 1.

Project Subject #2:

Peng Ye; Doermann, D., "No-Reference Image Quality Assessment Using Visual Codebooks," *Image Processing, IEEE Transactions on*, vol.21, no.7, pp.3129,3138, July 2012
doi: 10.1109/TIP.2012.2190086
keywords: {Gabor filters;feature extraction;image coding;statistical analysis;Gabor-filter-based local feature extraction;complex statistics;computational model;feature space;full-reference image quality metrics;general-purpose NR-IQA approach;histograms;human-perceived image quality;image engineering IQA database;local image patches;natural image;no-reference objective image quality assessment;patch appearances;peak signal-to-noise ratio;quality score;structural similarity index;video engineering IQA database;visual codebooks;Databases;Feature extraction;Image coding;Image quality;Training;Transform coding; Visualization;Gabor filter;no-reference image quality assessment (NRIQA);texture analysis;visual codebook},
URL: http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=6165361&isnumber=6217330

Links to Images, Videos, and Data:

- The LIVE IQA Database can be found at: http://live.ece.utexas.edu/research/quality/
- The CSIQ IQA Database can be found at: http://vision.okstate.edu/?loc=csiq

Links to Available Codes:

- The Gabor filter code can be found at: http://www.mathworks.com/matlabcentral/fileexchange/44630-gabor-feature-extraction
- The SVR/SVM codes can be found at: http://www.mathworks.com/matlabcentral/fileexchange/43429-support-vector-regression, http://www.csie.ntu.edu.tw/~cjlin/libsvm/
- The SSIM code can be found at: https://ece.uwaterloo.ca/~z70wang/research/ssim/
- The VIF code can be found at: http://live.ece.utexas.edu/research/quality/vifvec_release.zip
- The DIVINE code can be found at: http://live.ece.utexas.edu/research/quality/DIIVINE_release.zip
- The BLINDS2 code can be found at: http://live.ece.utexas.edu/research/quality/BLIINDS2_release.zip

Deliverables:

You must produce the results in Figures 4, 6, 7, 8, 9, and 10.
You must also provide comparison per Tables 2, 3, 5, 6, 7, and 8.

Project Subject #3:

Santoro, M.; AlRegib, G.; Altunbasak, Y., "Joint Framework for Motion Validity and Estimation Using Block Overlap," *Image Processing, IEEE Transactions on* , vol.22, no.4, pp.1610,1619, April 2013
doi: 10.1109/TIP.2012.2235452
keywords: {image sequences;interpolation;motion estimation;MV validity;block overlap;block-based validity metrics;complex optical flow methods;energy minimization framework;hybrid de-interlacer;image features;interpolation quality;motion estimation;motion field quality;motion vector validity;Context;Correlation;Image edge detection;Measurement;Minimization;Motion estimation;Vectors;Block matching;de-interlacing;motion vector (MV);reliability;true motion estimation;validity},
URL: http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=6389776&isnumber=6449327

Links to Images, Videos, and Data:

- Test images can be found at: http://vision.middlebury.edu/flow/data/

Links to Available Codes:

Download a Zip file from this URL: https://www.dropbox.com/s/phym9f3ig356bga/motion_estimation.zip?dl=0

Notes: There is a main file and a C++ class called "pair_motion". This class contains a lot of functionality, but most of it is not necessary to implement the paper. We removed the code that performs the block overlap minimization from pair_motion.cpp, and the function declarations need to be removed from pair_motion.h for the corresponding functions. This code uses OpenCV and the IplImage class to do some basic operations on images like reading/copying/…etc. The newer versions of OpenCV use the "Mat" data structure, but there should still be backward compatibility with IplImage.

Deliverables:

You must produce the results in Table 1, i.e., compare your endpoint error to the endpoint error generated by the algorithm in the paper. You should use the test sequences provided by Middlebury which have ground truth ".flo" files. There is code available on the Middlebury website which demonstrates how to read form the ".flo" file.

Project Subject #4:

Zujovic, J.; Pappas, T.N.; Neuhoff, D.L., "Structural Texture Similarity Metrics for Image Analysis and Retrieval," *Image Processing, IEEE Transactions on* , vol.22, no.7, pp.2545,2558, July 2013
doi: 10.1109/TIP.2013.2251645
keywords: {filtering theory;image retrieval;image texture;statistical analysis;PSNR;SSIM;cumbersome subjective tests;human visual perception;image analysis;image retrieval;known-item search;local image statistics;peak signal-to-noise ratio;query texture;sliding windows;standard statistical measures;state-of-the-art texture classification metrics;steerable filter decomposition;structural texture similarity metrics;subband statistics;substantial point-by-point deviations;systematic tests;texture analysis-synthesis;texture retrieval;texture stochastic nature;Correlation;Databases;Gray-scale;Humans;Image coding;Measurement;PSNR;Natural textures;perceptual quality;statistical models;Algorithms;Databases, Factual;Humans;Image Processing, Computer-Assisted;Models, Theoretical;Surface Properties;Visual Perception},
URL: http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=6476011&isnumber=6515702

Links to Images, Videos, and Data:

CUReT databases: Ref. [59] *CUReT: Columbia-Utrecht Refelctance and Texture Database*. (2002, Aug. 4) [Online]. Available: http://www1.cs.columbia.edu/CAVE/software/curet/

Links to Available Codes:

Some codes with a README file are provided, "Paper4_Texture_StartUPcode.zip."

Deliverables:

You must produce the results in Figures 6-9 (use CUReT instead of Corbis) and Tables I (for CUReT only), II (use CUReT instead of Corbis), III (use CUReT instead of Corbis).