CSE 490 GZ
Project 2

Due Wednesday, March 6, 2001

Introduction:

The purpose of this project is for you to become familiar with some of the image compression algorithms that we are covering in the course. The project will explore JPEG, SPIHT, GTW, and JPEG-2000. The first is a DCT block transform based method from the 1980s which is probably the major image compression algorithm in use today. The latter three are more recent wavelet based algorithms that use different approaches to coding the wavelet coefficients. Because the end of the quarter is nearing this project will be more limited in scope. We are interested mostly in the compression performance of these algorithms, not so much in their running times. You will have a small set of gray scale images to work with so the time spent on the project should be less than the first project.

Experimental Methodology

We will provide you with the executable programs within some Perl wrappers to help you design your experiments. In addition, we will provide you with a suite of files on which to run the programs. However, it is up to you produce meaningful data from the programs and files. A Perl script is set up so that you can run a compression algorithm on a specific file for a specific bit rate or image quality (JPEG). You will want to experiment with the methods to find good ways to compare the algorithms' compression performance. Although running times are reported by the Perl scripts we are not going to study them for this project. We have included a facility to view the compressed images which may help in understanding what the algorithms do in distorting images.

Reporting Results:

Your project should include the compression performance for all the programs listed above on each of the files we provided for at least 4 different bit rates in the range 0.1 bpp to 1.0 bpp. Whichever bit rates you choose, they should be approximately the same for each algorithm. You may report the results in a table, chart, or graph which ever you think be conveys the information you want to convey.

Your report must be type written and no longer than 3 pages including the title page. As in the first project your report should have the following components: Title page, Introduction, Results, and Conclusion.

Additional Information for CSE 490GZ Project 2:

We are using the following compression algorithms in our study:
1) JPEG

2) JPEG2000
3) Set Partitioning In Hierarchical Trees (SPIHT)
4) Group Testing

JPEG is directly supported by Linux while the others are not. The binaries for the non-supported algorithms and other important project files is in the project directory located at:
/cse/courses/cse490gz/02wi/project02/

There are 4 directories within the "project02" directory:
1) bin – contains executables for the unsupported algorithms
2) docs – contains documentation for JPEG2000 and SPIHT
3) images – contains sample files to encode/decode
4) scripts – contains perl scripts used to run the experiments

Setup:

Create a working directory. You can create your working directory in the course project directory if needed. The project directory is:
/projects/instr/02wi/cse490gz/students/

From your working directory do the following two steps:
1) Copy the perl scripts as follows:
   cp /cse/courses/cse490gz/02wi/project02/scripts/* .
2) Add a symbolic link to the "images" directory as follows:
   ln -s /cse/courses/cse490gz/02wi/project02/images/ images

   This will create a directory called "images" in the directory that you executed the "ln" command from. This will allow you to easily access the files in the "images" directory that you need to encode/decode for the project.

Running Experiments:

We will be using the perl scripts that you copied to your working directory to run the experiments. All of the scripts take two arguments. The first argument is the file that you want to compress/decompress. For JPEG, the second argument is the quality from 0-100 (0 is the worst and 100 is the best). For the other scripts, the second argument is the desired bit rate in bits per pixel (bpp). Each script uses a different compression/decompression algorithm pair, and outputs timing, compression ratio, and PSNR information. As an example of how to run an experiment, typing the following will run experiments by compressing/decompressing the file called "lena.pgm". The first example will use JPEG with a quality level of "75" and the second example will use JPEG2000 and compress to 1 bit per pixel. Note that "%" is the Linux prompt and is not something you type in.

```
% ./jpeg-exp.pl images/lena.pgm 75
% ./jpeg2000-exp.pl images/lena.pgm 1
```

If you are interested in seeing what the images look like, use the command (see the man page for more information):
% xloadimage image.pgm

Where to get more information:
The scripts that we have provided for you use default parameters for each of the compression/decompression algorithms. If you are interested in changing some of these parameters, you need to directly modify the perl scripts. Below I list the location where you can get more information for each of the algorithms used in the study.

1) cjpeg/djpeg (JPEG)
   See the man pages on Linux.

2) jasper (JPEG2000)
   See the file "docs/jasper.pdf" or the web page:
   http://www.ece.ubc.ca/~mdadams/jasper/

3) codetree/decdtree (SPIHT)
   See the file "docs/SPIHT.pdf" or the web page:
   http://www.cipr.rpi.edu/research/SPIHT/spiht3.html

4) grouptestencode/grouptestdecode (Group Testing)
   Ask Justin.