

CS552 Project 1

Fourier Methods

Assigned: Tuesday February 15, 2005

Due: Thursday February 24, 2005

Description

Consider the images `~jgregor/cs552/matlab/circuit1.tif` and `circuit2.tif`. Look at these images in Matlab using `imread` and `imagesc`. You may have to use `colormap('gray')` to ensure graylevel images being displayed instead some that are pseudo-colored. Alternatively, look on the back of this handout and you will notice that `circuit2` is a cropped, rotated version of `circuit1`. Basically, your task is to figure out the amount of rotation and offset so that you can overlay the two properly.

Hints

Use Matlab to do all the hard work. That is, use functions such as `imrotate` to rotate the `circuit2` image once you have determined the value for the rotation angle. And how might you do that? Perhaps now would be a good time for your to (re)read the sections in the text book that talk about Fourier transform properties. With a bit of luck, you just might find one that talks about rotation. In the meantime, if you are really eager and can't wait for that, try to compute and display the Fourier spectrum of both images. That should give you an idea. If not, go to start but do not collect any money. Oops. That's Monopoly. Same principle though. It should be obvious.

Having rotated `circuit2` the appropriate amount (don't worry if you crop some of it in the process) you need to figure the displacement out. And how might you do that? You might want to compute the cross-correlation between your template and the original. If you look carefully at this data, you ought to be able to determine how the cropping was done. Or at least come close. This job can be done using `convn` in which case `fliplr` and `flipud` will come in handy. Or poke around and you might find a better alternative in the Matlab Image Toolbox. Regardless, in the end you must implement the cross-correlation computation using the Fourier transform. Use `conj` to conjugate as needed. In any case, you must determine the location of the peak in the cross-correlation image. Try `find` or some such function. Be very careful with respect to shifting the input and/or outputs appropriately.

When computing the FFTs, keep in mind that these are images. Also keep in mind that the images are not necessary sized to be powers of two. Also, zeropad as necessary for other reasons.

While you don't need to turn in a picture book, take the time to display intermediate results to become more involved in the computation and to get a better feel for what is going on. And what needs to be going on. These are not always one and the same thing.

Turn in

Email me a single Matlab m-file that does the job. Insert appropriate `pause` statements to slow down various display operations. Use `input` to prompt and receive user input as necessary. If so, print out a line or two before hand, eg using `disp`, to let me know what I'm supposed to do now.

