ECE4580 Homework #8

Due: Mar. 16, 2017

Problem 1. (30 pts) Using Matlab's cross-correlation function, find the occurences of a template patch `tI` in the image `I` found when loading the `template.mat` Matlab file. Where in the image is the template found? What would you like to have seen returned?

Note: Matlab actually has two ways to perform the cross-correlation. Through the function `xcorr2`*, or through* `imfilter` *with the added option* `'corr'` *passed as an argument. Peaks in the cross-correlation indicate strong matches against the template.*

Problem 2. (25 pts) With the homework, you will find a Matlab file called `templates.mat` which has two templates `temp1` and `temp2` plus three images `I1`, `I2`, and `I3`. Your job is to find a template location in each of the three images. You are to turn in, not only the three locations, but also your parameters (`c`, `nsteps`, and `pos`), and the lines of code that you have modified in the findTemplate program. Note that the gradient function has been provided to you as `gradTempMatch.m` so all you have to do is work out the gradient descent optimization.

Play around with the initial condition and try to estimate how close to the target you need to be for the gradient descent to work. Find an initial condition that you think should work but doesn't and turn in the script for that case with `loseTempMatch.m` as the script name. In the homework submission document, specify the initial point and the final (converged) point. Also turn in the plots of the functioning and failing gradient descent attempts. Make sure to include the code in your submission document, or the code portions added.

Note: You can also play around with the blurring/smoothing of the image to see what effect that has on the convergence of the gradient descent.

Problem 3. (25 pts) Consider the template matching problem from earlier, but rather than perform gradient descent of the nonlinear energy, utilize the quadratic approximation. The quadratic approximation leads to an iterative optimization problem, meaning that multiple iterations are needed much like gradient descent, however the path taken does not necessarily match that of gradient descent. If possible, consider the same questions as before with this same algorithm, and compare how the linear version fares. In particular, how quickly/slowly does it converge? Is the basin of attraction as big, or is it smaller? Use the same zip-file as before.

The gradient function has been provided to you as `gradTempMatchQA.m` so all you have to do is work out the gradient descent optimization. Turn in two example scripts as before `findTemplateQA.m` and `loseTemplateQA.m`, the first of which works and the second of which doesn't work but you thought it should.

Problem 4. (20 pts) Move on to the Week #5 activities of the learning module. It is possible that the learning module only goes up to #4, in which case there should be a Module #2, Week #1 to continue with. From now on, the activity will be to finish up with the following weeks activities. A number wont be explicitly given, but should be implicitly known from the learning module chosen.

The group submission should reflect the work of the group, and should also be submitted individually with the name of your partner in the document. If submitting video or links to video for the pair, then only one member need to do so, while the other member should just note as much. The prior expectaction for deliverables continues to hold

Note: I have received a couple requests to change topic and start with the first module of a different topic, rather than continue to the next module of the first topic. I am not sure what to think, but I suppose it will be OK. Given that others have already done it, you are forbidden from talking to anyone what has already completed that module. You are also expected to write in each submission that you are following the GT Honor Code and have not discussed the activity with anyone who has already completed that Module.