

EE 610 Image Processing (July-Nov 2021)

Assignment 1 : Basic Image Editor

- Build a form (GUI) in with the following elements (preferably in python) [6]:
 - Image display area
 - Image load button that opens a file selector.
 - It should be able to handle color as well as grayscale images. Color images should be converted to HSI/HSV or Lab, and only the I/V/L channel should be manipulated.
 - Several image manipulation buttons that do the following to the image being displayed:
 - Equalize histogram
 - Gamma correct (ask for input gamma upon pressing the button)
 - Log transform
 - Blur with a mechanism to control the extent of blurring
 - Sharpening with a mechanism to control the extent of sharpening
 - Undo last change
 - Undo all changes (revert to original image)
 - Save current image button
 - Submit the code that has the following best practices:
 - Proper indentation
 - Informative variable names
 - Comment about every single line of the code explaining the role of each variable, e.g.

```
## Initialize Co-occurrence matrices

poolFetSize = poolImSize*poolImSize*poolImDepth # Pooled feature size is the product of pooled
image squared and pool image number of channels (depth)

fets2Keep = min(fets2Keep,poolFetSize) # Just in case we chose too many features

coOcPos = np.zeros((fets2Keep,fets2Keep)) # Initialize positive co-occurrence matrix
coOcNeg = np.zeros((fets2Keep,fets2Keep)) # Initialize negative co-oc matrix

## Iterate through image pairs

for nIter in range(0,nBatches): # For all batches
    for nSample in range(0,nTrainBatchSize): # for all samples in a batch
        img1Class = 100 # some large number
        while img1Class > 5: # We only want to train for the first five
            img1Num = np.random.randint(nImages) # pick a random image
            img1Class = clas[img1Num,0] # Find its class

        img2Class = 100 # Pick class 100
        while img2Class != img1Class: # Loop till the classes of the two images are the same
            img2Num = np.random.randint(nImages) # Pick a random second image
            img2Class = clas[img2Num,0] # Find its class
```

- Add one more feature that is not listed above. You can be as creative as you want. [1]
- In addition to demonstrating the impact of each image processing operation in one image each, take at least one image through multiple steps to enhance it. [1]
- Write the following in a report [3]:
 - Abstract: Overall summary of the report
 - Introduction: Objectives, main parts of the code or assignment
 - GUI design: Overall approach, GUI features, code blocks

- Image Processing operations: List of image processing operations implemented, their purposes, their mathematical formulae, and the citations of their earliest use(s) in image processing.
 - Experiments and results: GUI screenshots, which images were selected for demonstration and why (e.g. you wanted to show a particular effect on an image with certain characteristics), before and after for example images.
 - Conclusion and discussion: What main challenges did you overcome, given more time what else would you have liked to do?
 - References: Key citations, other sources referred, such as code bases or blogs on the internet
- Notes:
 - You can look at code available on the Internet, but do not directly copy. Learn and implement on your own.
 - Comments in the code should be your own.
 - FR grade for copying from another person. Discussing with other people is fine.
 - Bonus marks will be given for writing good and efficient code. See vectorization example for code efficiency: <http://ufldl.stanford.edu/wiki/index.php/Vectorization>
 - More credit will be given for making common sense assumptions about things left unsaid in the assignment statement. For example, you should automatically handle display of negative pixels or images with pixels out of the display range.
 - Reports should look professional. Check out IEEE paper format: <https://www.ieee.org/content/dam/ieee-org/ieee/web/org/conferences/Conference-template-A4.doc> or <https://paginas.fe.up.pt/~jca/wrsc/templates/IEEE-Conference-A4-format.pdf> . You can use LaTeX by opening a free account on overleaf.com or sharelatex.com