

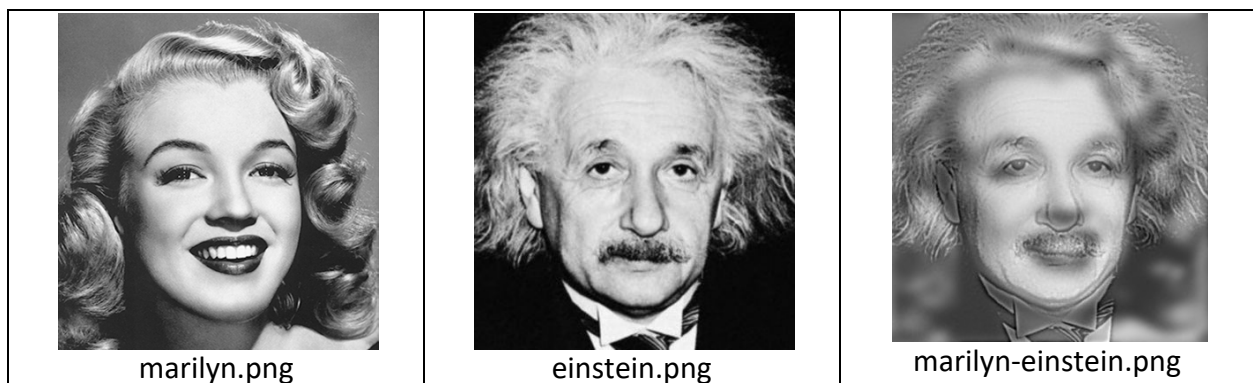
Lecture 2 Homework: Hybrid Images

Objective:

Your goal for this homework is to create hybrid images by applying and implementing the following concepts in Python:

- Gaussian Filter
- High/Low Pass
- Fourier Transform

Specifically, you want to create a hybrid image between physicist Albert Einstein and Hollywood star Marilyn Monroe. Below demonstrate the original images, and their results.



What is a Hybrid Image?

A hybrid image is an image composed of two different images of two different frequency. The image with the higher frequency will dominate at closer distance, while the one with the lower frequency will dominate at farther distance. Check out some demo images here:

http://cvcl.mit.edu/hybrid_gallery/gallery.html

Useful Libraries (Recommended):

- import numpy
- from numpy.fft import fft2, ifft2, fftshift, ifftshift
- from scipy import misc
- from scipy import ndimage
- import math

High-Level Guide:

- Apply a low pass filter on Marilyn.png
- Apply a high pass filter on Einstein.png
- Add the filtered version of Marilyn.png with Einstein.png to create Marilyn-Einstein.png

Further Break-Down:

- Apply a low pass filter on Marilyn.png
 - o Apply Fourier Transform to the image

- Apply Low Pass Filter
 - Note: A Gaussian filter ($g(x,y)$) can be used as a Low Pass Filter
- Apply Inverse Fourier Transform
- Apply a high pass filter on Einstein.png
 - Apply Fourier Transform to the image
 - Apply High Pass Filter
 - Note: A High Pass Filter can be found by performing this operation: $1 - g(x,y)$
 - Apply Inverse Fourier Transform
- Add the filtered version of Marilyn.png with Einstein.png to create Marilyn-Einstein.png

Gaussian Filter Function:

$$g(x, y) = e^{-\frac{(x-a)^2 + (y-b)^2}{2\sigma^2}}$$

Note that (x,y) corresponds to an image's row, column pixels; (a, b) is the center of an image; σ is a hyperparameter that may be tuned accordingly