Computer Vision

Image Hybridization | Image Pyramids | Edge Detection

Part 1: Hybrid image

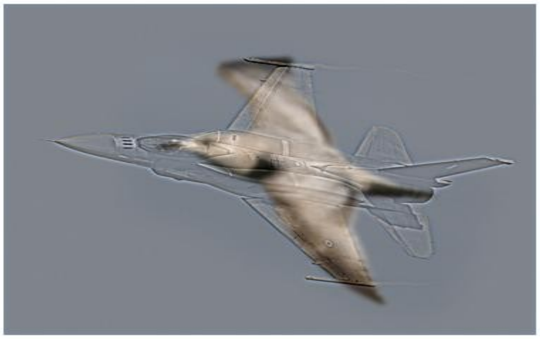


Figure 1.1 Hybrid Image of a Bird(Low Frequency) and a Plane(High Frequency)

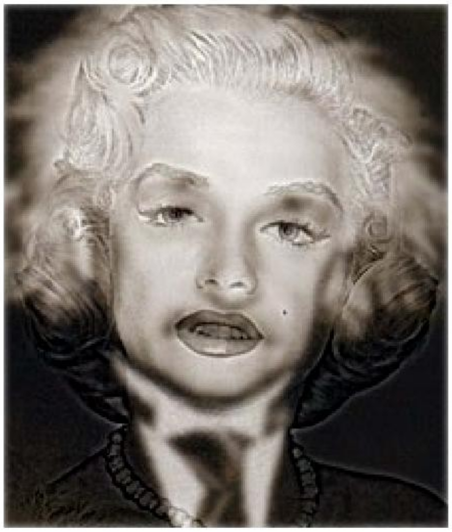


Figure 1.2 Hybrid Image of Marlyn(High Frequency) and Einstein(Low Frequency)

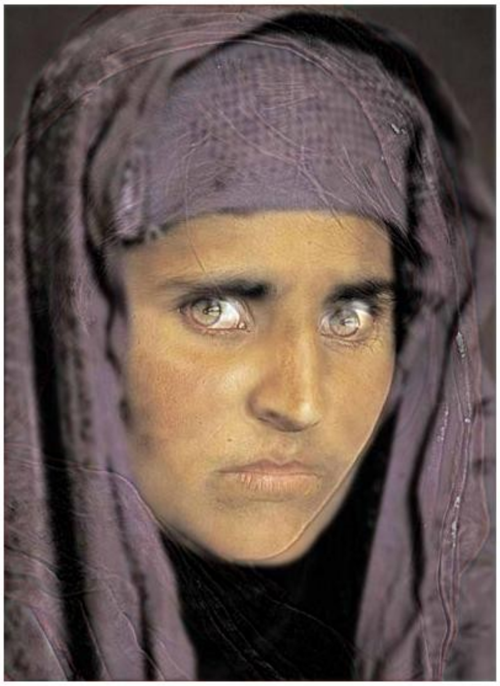


Figure 1.3 Hybrid Image of After(High Frequency) and Afghan Girl Before (Low Frequency)

Working of the code:

- The code initially reads two aligned images using imread.

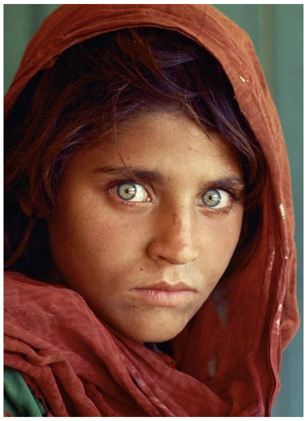


Image 2 : Afghan Girl Before

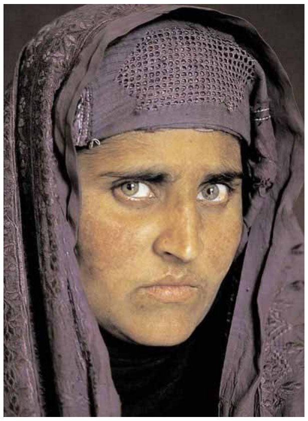


Image 1: Afghan Girl After

Figure 1.4 Original Images

- It applies Gaussian Filter to the first image and allows low frequencies to pass through it. This is stored in the variable low_frequencies.

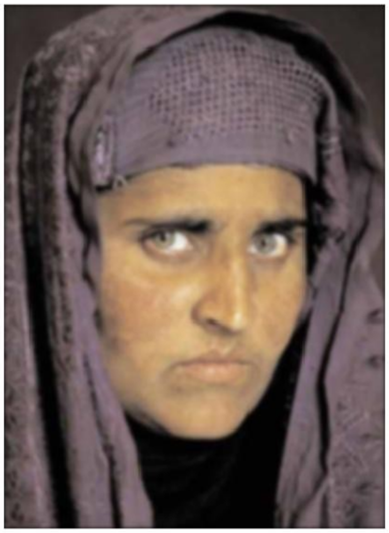


Figure 1.5 Gaussian Filter applied to Image 1. Result is a blurred image with low frequencies.

- It applies Gaussian Filter to the second image, this is subtracted from the original image and hence we are left with the high frequencies. This is stored in high_frequencies.

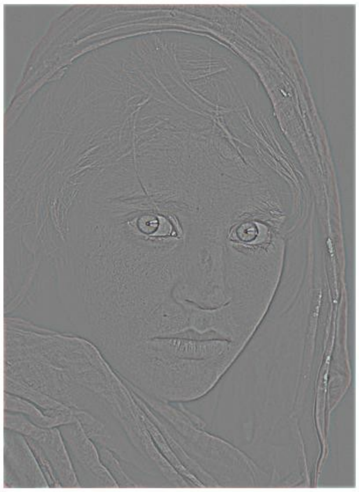


Figure 1.6 Gaussian Filter applied to Image 2 and subtracted from itself. Result is a high frequency image.

- Hybrid image is a combination of low and high frequencies of the respective images. Hence the two variables, low_frequencies and high_frequencies are summed together to get hybrid_image.

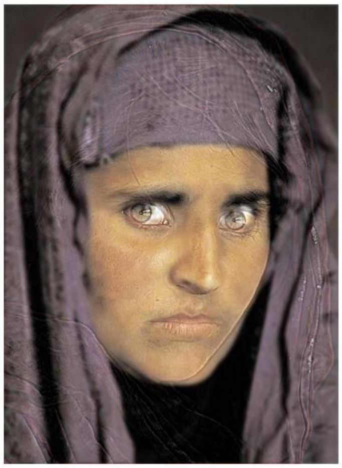


Figure 1.7 Hybrid Image

- The hybrid image is further scaled down using the given visualization function vis = vis_hybrid_image(hybrid_image).

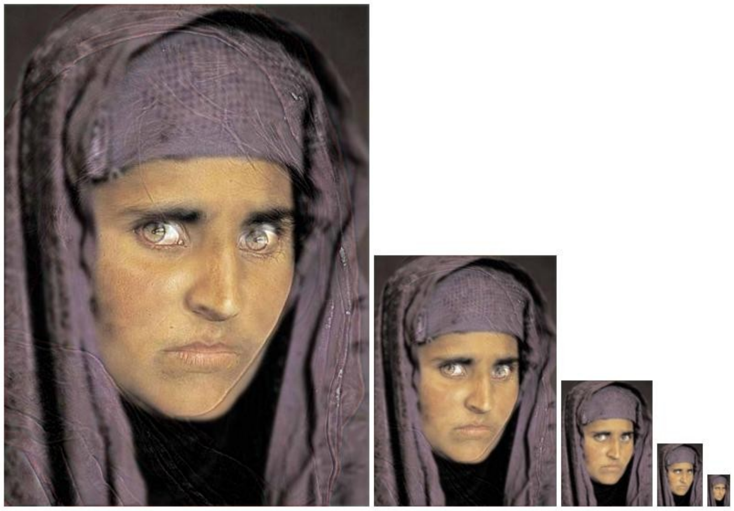


Figure 1.7 Hybrid Image scales

Images in Frequency Domain

These were obtained by using the `fft2()` in Matlab.

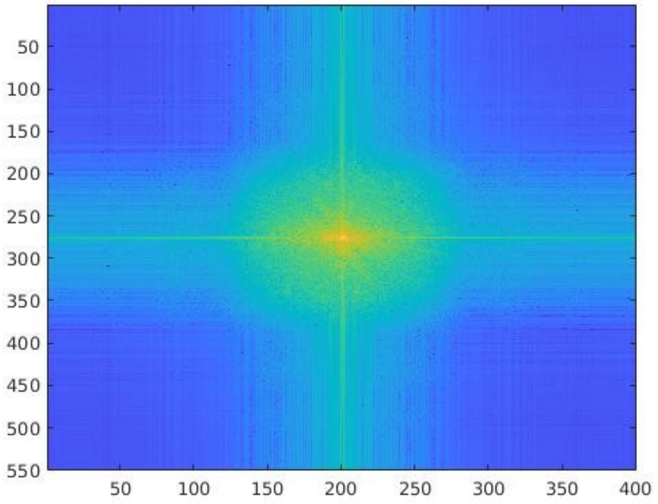


Figure 1.8 FFT of low frequency image

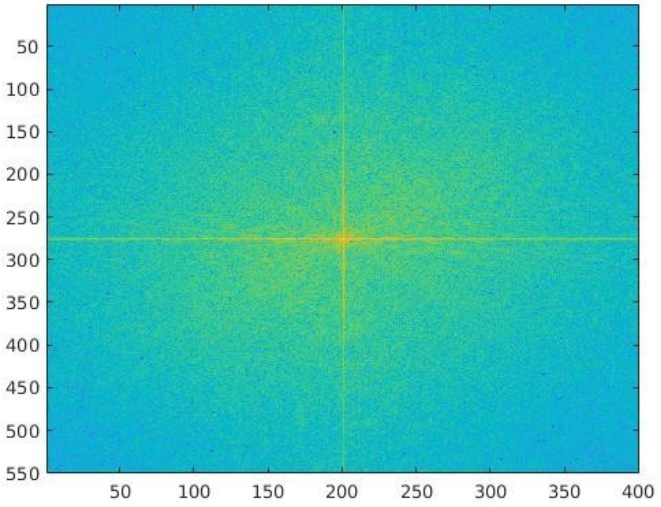


Figure 1.9 FFT of high frequency image

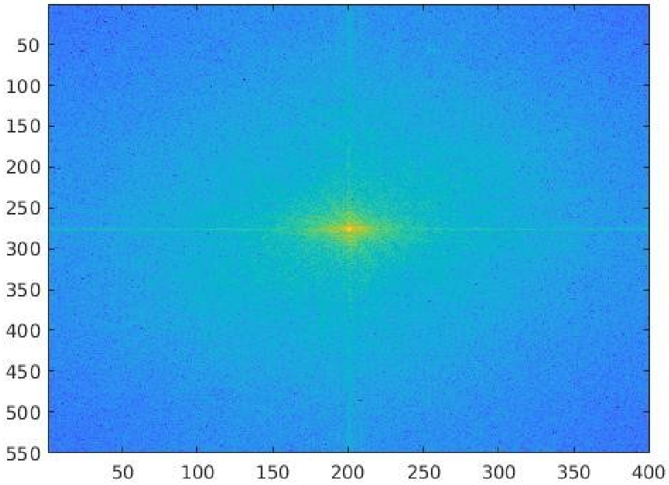


Figure 1.10 FFT of hybrid image

Part 2: Image Pyramids

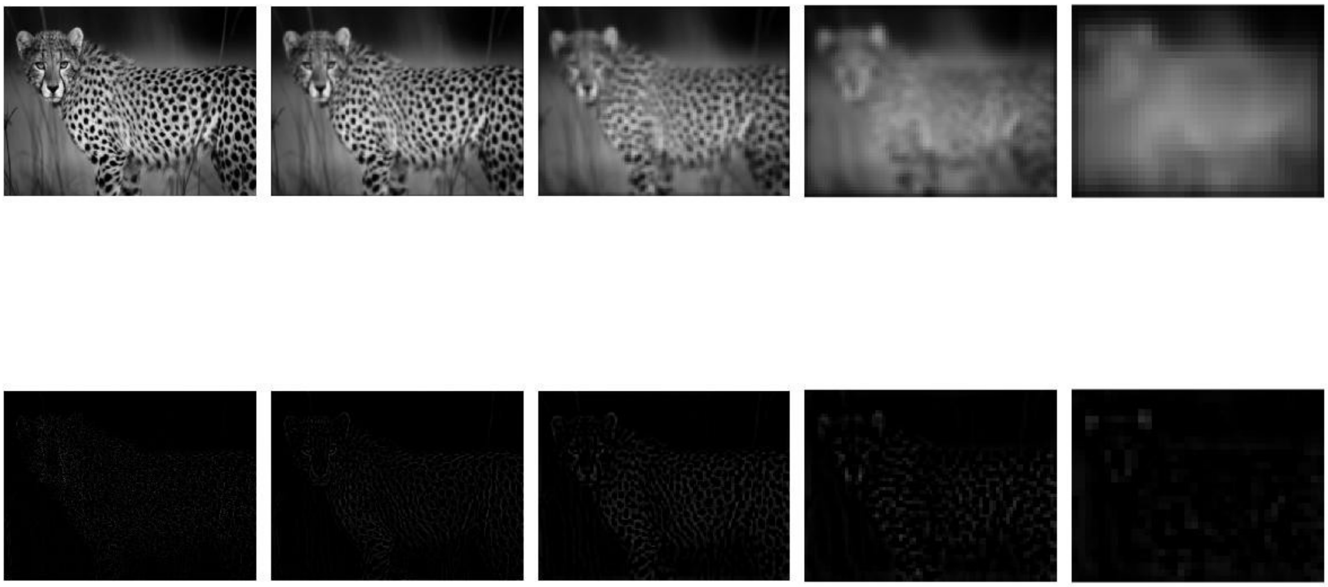


Figure 2.1 Gaussian and Laplacian image pyramids

The images below are FFT plots of the Gaussian image pyramid (First Row) and Laplacian image pyramid(Second Row):

The strong vertical and horizontal frequencies in the Gaussian pyramids reduce after iteratively applying Gaussian Filter. And exactly opposite takes place with the Laplacian image pyramid.

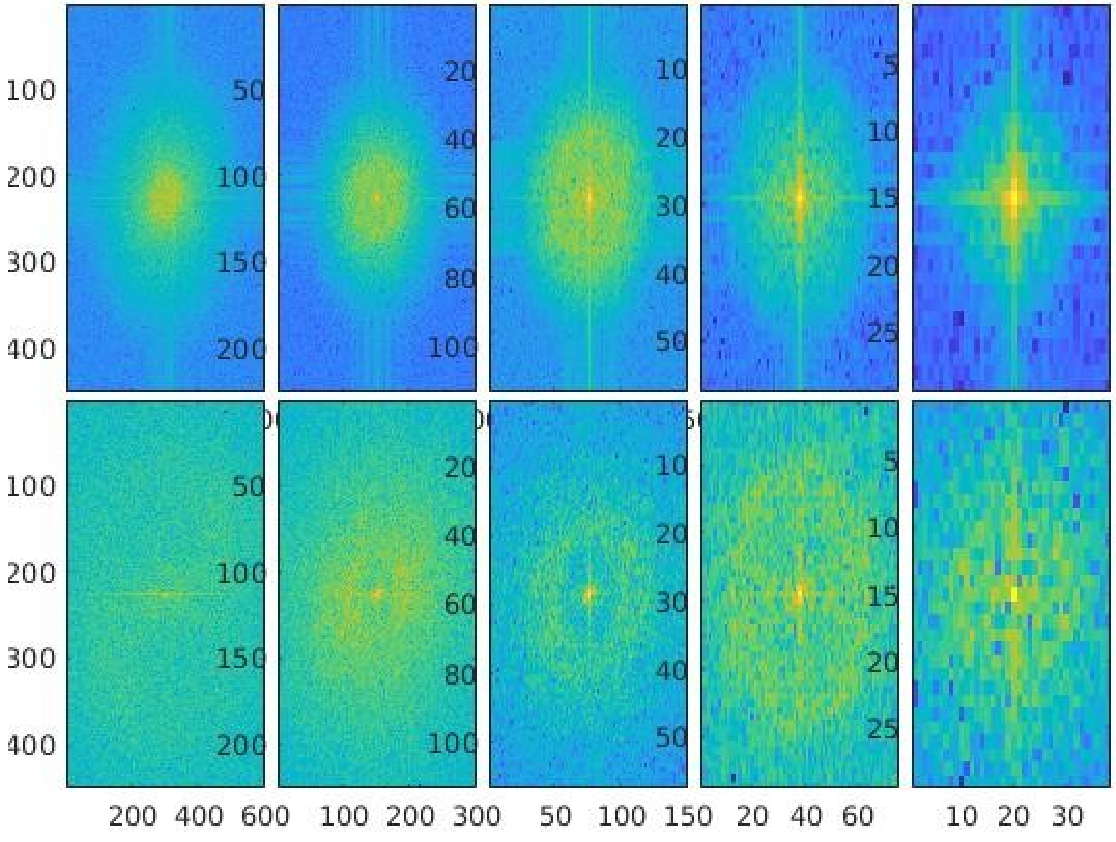


Figure 2.1 Image pyramids in frequency domain

Part 3: Edge detection

a. Parameters selected

standard deviation of Gaussian filter sigma, σ = 1

b. All the 4 orientations of the filters are of size 10 x 10 and have following orientation values :

Filter No.	X-Filter	Y-Filter
1	pi/2	0
2	pi/4	0
3	0	pi/4
4	pi/4	pi/4

c.

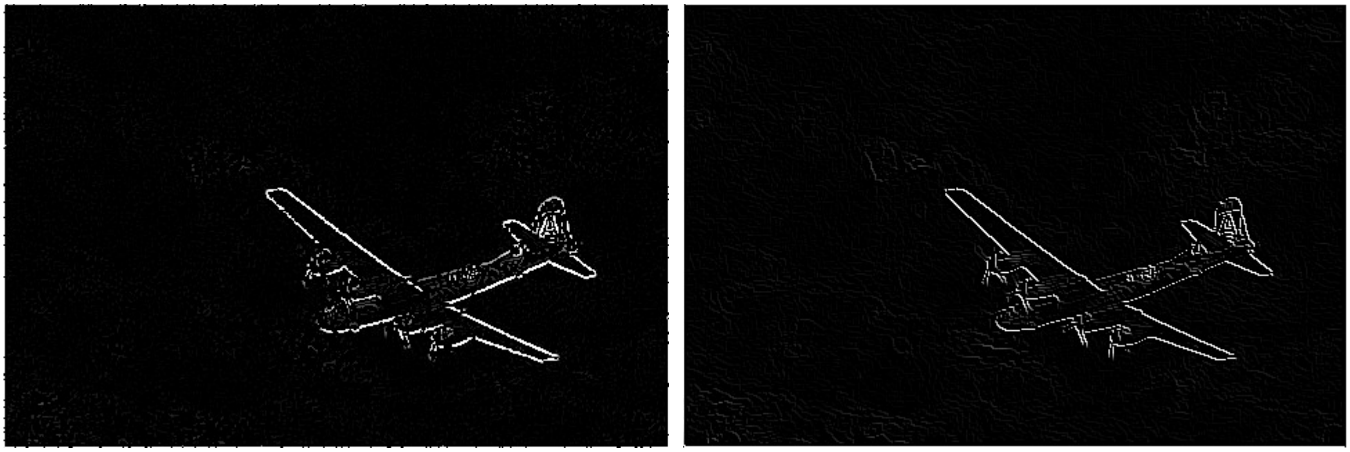
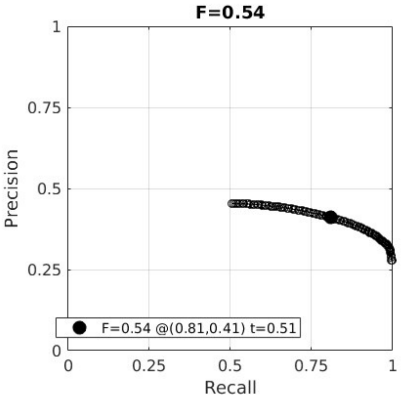
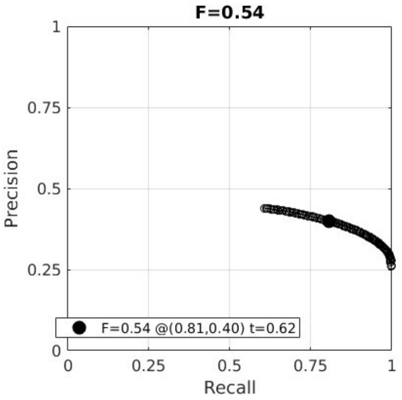


Image 1: Simple edge detector

Image 2: Oriented filter edge detector

Figure 3.1 Comparison between simple gradient based edge detector and oriented filter edge detector (σ = 1)

d.

Image 1: Simple edge detector	Image 2: Oriented filter edge detector
 	
F-score = 0.54	F-score = 0.54
average F-score = 0.570	average F-score = 0.567

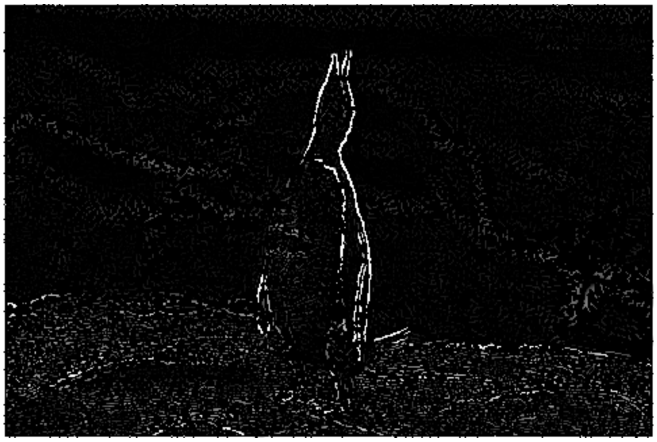


Image 1: Simple edge detector

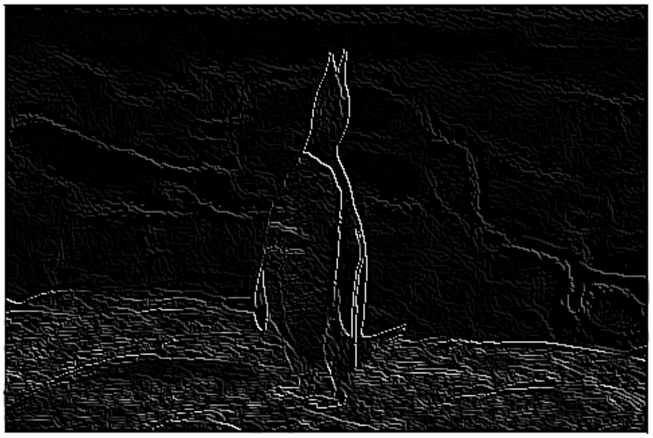


Image 2: Oriented filter edge detector

Note: With oriented filter, I get better image results, however the average F-score is less than that of the simple filter.