EXTRA QUESTIONS – COMPUTER VISION

1. HYBRID IMAGES:

a) Coloured:

I did hybrid images by adding colour to the output. I also experimented change of expressions using hybrid images. I used 30 hsize for both high and low pass filters. I used sigma of 8 for low pass of happy face and sigma of 16 for the high pass of sad face.

Image that is to be low passed

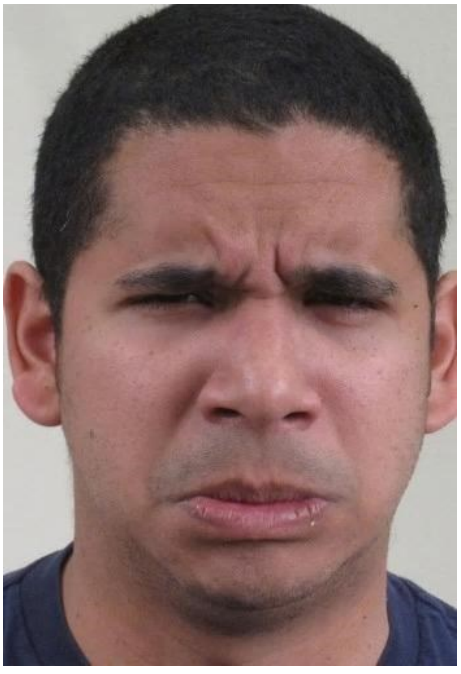
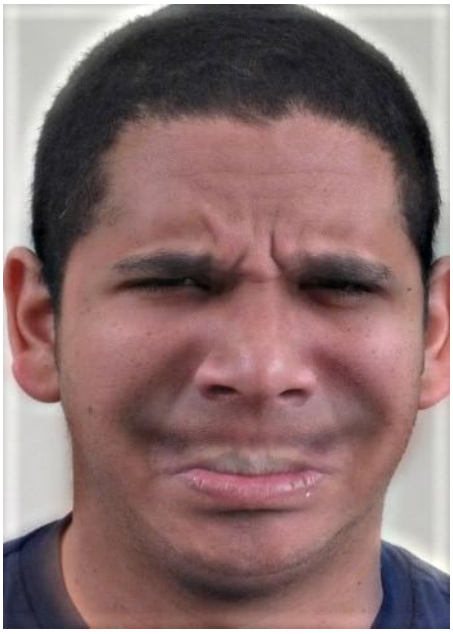


Image to be high passed



Hybrid Image

Vis image [1]

As it can be seen from the above image, the low frequency image which is happy is seen on the distant last image and sad low frequency image is found on the first closer image.

b) Laplacian and guassian pyramid for hybrid image

Laplacian and Gaussian pyramid

The proves that as we move from left to right the low frequency component increases due to blurring which is evident from the clarity of happy face (low pass filtered image) towards the right of pyramid. The first image in laplacian pyramid is appearing sad because comparatively it has lesser low frequency component as it's a difference of Gaussian filtered image from original image.

c) Additional examples for images from net:

Hybrid image of low pass filtered Steve Ballmer with sigma of 5 and high pass filtered Steve Jobs with sigma of 8.

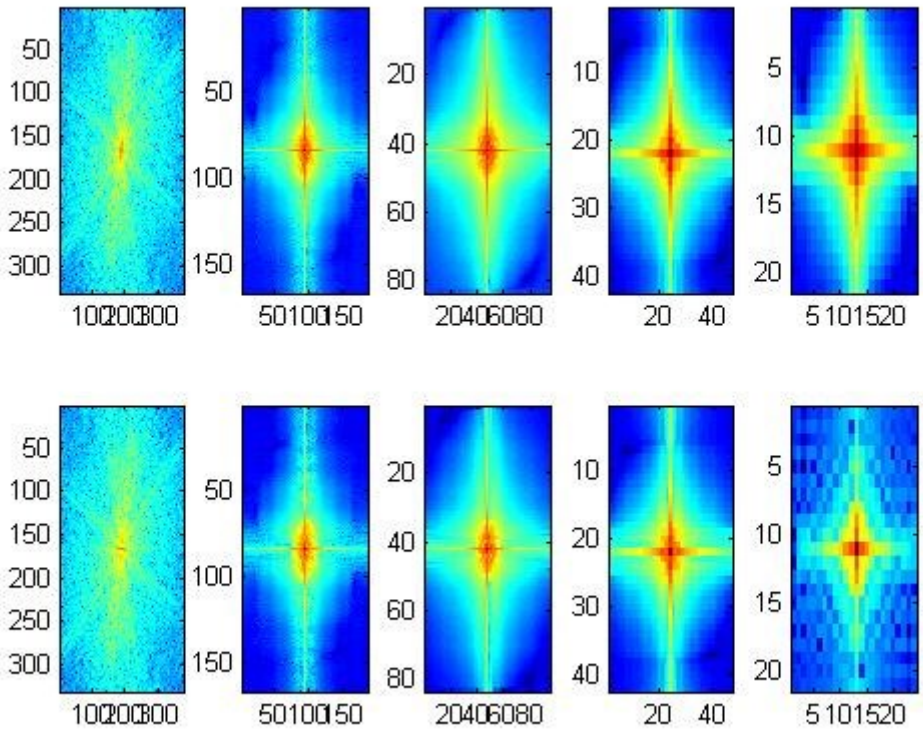
d) Failure result :

This is a failure example where the dog picture was high passed at sigma of 6 and cat picture was low passed at sigma of 8.5. However no single picture is seen clearly at a close or faraway distance. At close distance the dog icture is not clear except the tongue. The reason for this could be because both these animals share a common texture of their fur on the body (avoiding distinction) and the low passed cat dominated the high frequency image of dog.

The sad image was low pass filtered with sigma 3 and the smile face was high pass filtered with sigma 6. This is a failure because both the faces are well visible in the hybrid image. The high pass filtered image is not strong enough and the smiling face(low passed image) is dominating in the hybrid image.This is because, the original sad face was more lika water mark and not well defined to be seen in the hybrid image.

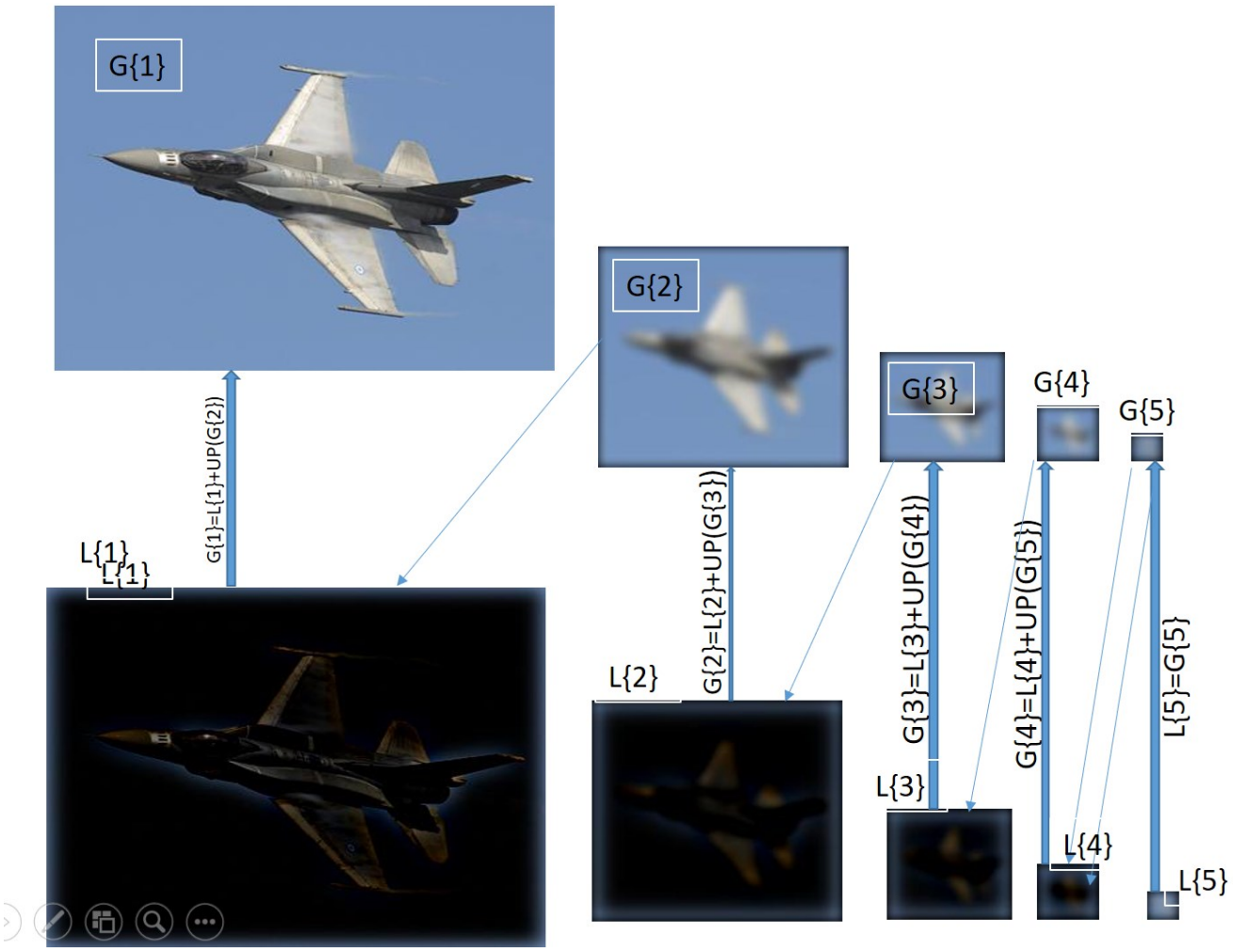
2. PYRAMIDS:

a)The Laplacian and Gaussian pyramid was constructed for coloured images. The features are clearer in this version than grayscale. An additional code snippet was used to ensure equal dimensions by padding zeros as the imresize did not work with 3D image.



The frequency response is similar to the that for grayscale image.

b) Reconstruction of original image from Laplacian pyramid:



Reconstruction Details from Laplacian pyramid

Reconstructed image from laplacian pyramid

Reconstructed image from laplacian pyramid where a level was scaled by 2

Sharpening filtered output

Workspace

Name	Value	Min
img1	331x375x3 double	-0.0442
img2	331x375x3 double	-0.0865
L	1x5 cell	
MSE_recon	0.0258	0.0258
MSE_recon2	0.0231	0.0231
MSE_sharpening	0.3804	0.3804
N	5	5

MSE Recon= scaled laplacian

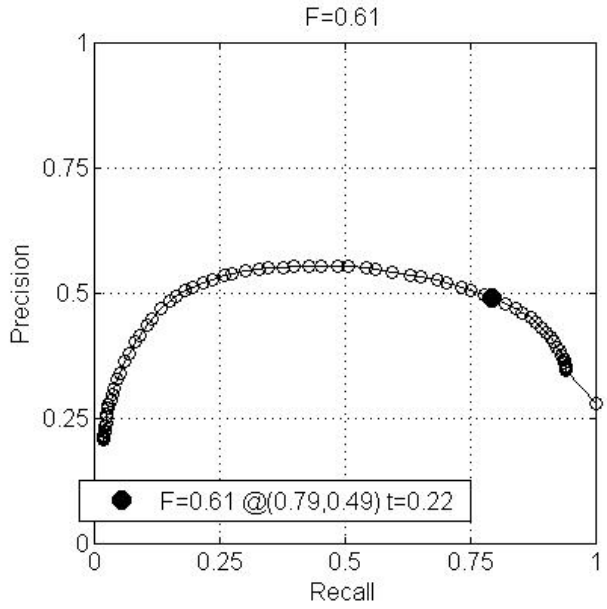
MSE= Sharpened image

The difference between sharpened image and the image obtained from reconstruction of laplacian pyramid whose first level is scaled by 2:

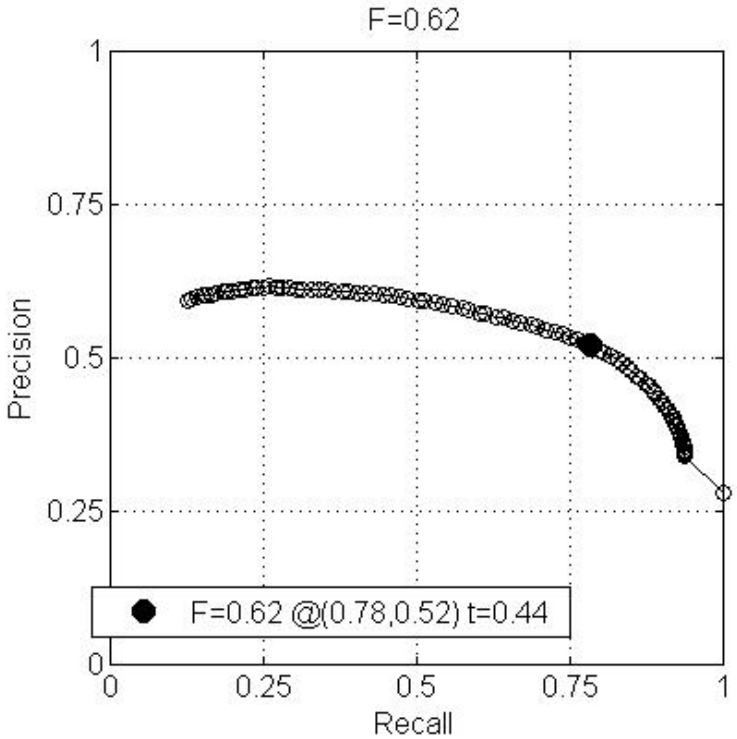
Sharpening filter basically adds the high pass filtered image to the original image to enhance the edges. A laplacian first level image is the difference of original image and low pass filtered subscaled image of original image. Hence compared to a sharpened image the scaled reconstructed image has lesser high frequency components. Hence the mean squared error for sharpening filter is more because the values of pixels in sharpened filter is higher than the original image by an amount that is greater than that of scaled reconstructed image from the original image.

3.EDGE DETECTION:

1. Changing colour space:
   The gradient calculation was performed in HSV space and the resulting overall fscore greater.
   Overall fscore=0.61



   The resulting fscore and fmax were greater.
2. Improvised the output of Orientation Filter:
   I changed the color space to hsv and used morphological transformation to the output of canny edge using the closing operator. It basically performs erosion after dialation which helps in enhancing the edges.

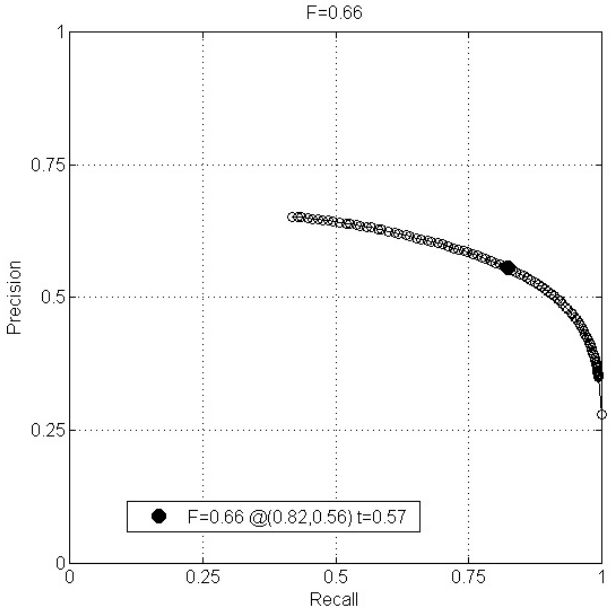


   The overall f score was 0.62 and average fscore was 0.644

3. Applying canny for individual channels with hsv colour space

The score improved when canny edge filter was applied for separate channels of the image converted to hsv colour space and when combined with the gradient value of oriented filter implementation. This idea was taken from[2]

Gradient= L2norm(canny(image) in h,s and v) * mag


F=0.66
Precision
Recall
F=0.66 @(0.82,0.56) t=0.57
0
0.25
0.5
0.75
1

The average score was 0.674 and f-score was 0.66 which is the highest.

References:

1. http://www.telegraph.co.uk/news/picturegalleries/howaboutthat/10736128/In-pictures-Scientists-map-21-facial-expressions-and-emotions.html

2. Xu, Wei, Michael Jenkin, and Yves Lespérance. "A multi-channel algorithm for edge detection under varying lighting." *2006 IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR'06)*. Vol. 2. IEEE, 2006.