rpn2_mp2_part1_code

March 4, 2019

1 Common imports

```
In [1]: %matplotlib inline
        import numpy as np
        import matplotlib
        import matplotlib.pyplot as plt
        from mpl_toolkits.mplot3d import Axes3D
        from PIL import Image
        import copy
        from scipy import ndimage
        import cv2
```

2 Provided functions

2.0.1 Image loading and saving

```
In [2]: def LoadInputImages(subject_name):


            def load_image(fname):
                ''' Read and convert the image to grayscale'''
                im = Image.open(fname, 'r')
                img = im.convert('L')
                return np.asarray(img)

            img1 = load_image(subject_name + "_a.jpg")
            img2 = load_image(subject_name + "_b.jpg")
            return img1/255, img2/255

In [3]: def save_outputs(subject_name, hybrid_image):
            ''' Save outputs to disk'''
            im = Image.fromarray((hybrid_image*255).astype(np.uint8))
            #op = (((hybrid_image - hybrid_image.min()) / (hybrid_image.max() - hybrid_image.m

            im.save("%s_hybrid.jpg" % subject_name)
```

```
In [4]: def plot_two_images(img1,title1, img2, title2):
            """
            Plot two images side by side in grayscale
            """
            fig = plt.figure()
            ax = plt.subplot(1, 2, 1)
            ax.axis('off')
            ax.set_title(title1)
            im = ax.imshow(img1,cmap="gray")
            ax = plt.subplot(1, 2, 2)
            ax.axis('off')
            ax.set_title(title2)
            im = ax.imshow(img2,cmap="gray")

In [5]: def plot_one_image(subject_image, title):
            fig = plt.figure()
            plt.imshow(subject_image*255, cmap='gray')
            plt.axis('off')
            plt.title(title)

In [6]: def filter_lp(input_image, sigma_image = 1.2, truncate_image = 4):
            ''' Low Pass Filter of image'''
            lpf_image = ndimage.gaussian_filter(input_image, sigma = sigma_image, truncate = t
            plot_two_images(input_image,"Input image", lpf_image , " LPF output")
            print(lpf_image.shape, np.amin(lpf_image), np.amax(lpf_image))
            return lpf_image



In [7]: def filter_hp(input_image, sigma_image = 16.2, truncate_image = 4):
            ''' High Pass Filter of image, negative values are adjusted by adding the minimum
            hpf_image = input_image - ndimage.gaussian_filter(input_image, sigma = sigma_image
            print(hpf_image.shape,np.amin(hpf_image), np.amax(hpf_image))
            hpf_image_adjusted = np.clip(hpf_image + abs(np.amin(hpf_image)), 0, 1)
            print(hpf_image_adjusted.shape,np.amin(hpf_image_adjusted), np.amax(hpf_image_adju
            plot_two_images(input_image,"Input image", hpf_image_adjusted, " HPF output")

            return hpf_image_adjusted

In [8]: def generate_hybrid(lpf_image, hpf_image,subject_name):
            ''' Generate hybrid image'''
            hybrid_image = np.clip((lpf_image + hpf_image)/2,0,1)
            plot_one_image(hybrid_image, "Hybrid Image of " + subject_name)
            print(hybrid_image.shape)
            save_outputs(subject_name, hybrid_image)
            return hybrid_image


In [9]: def vis_hybrid_image(hybrid_image):
          ''' Reference code : https://www.cc.gatech.edu/~hays/compvision/proj1/'''
```

```
    ''' Code to downsample image for visualization'''
    scales = 5
    scale_factor = 0.5
    padding = 5
    original_height = hybrid_image.shape[0]


    output = np.copy(hybrid_image)
    cur_image = np.copy(hybrid_image)
    for scale in range(2, scales+1):
      # add padding
      output = np.hstack((output, np.ones((original_height, padding),
                                          dtype=np.float32)))

      # downsample image
      cur_image = cv2.resize(cur_image, (0, 0), fx=scale_factor, fy=scale_factor)

      # pad the top to append to the output
      pad = np.ones((original_height-cur_image.shape[0], cur_image.shape[1]), dtype=np.fl
      tmp = np.vstack((pad, cur_image))
      output = np.hstack((output, tmp))

    return output
```

3 Main function

In [10]:
```
subject_name = 'cereal'
img1, img2 = LoadInputImages(subject_name)
plot_two_images(img1,"Input for LP", img2, "Input for HP")
```

Input for LP

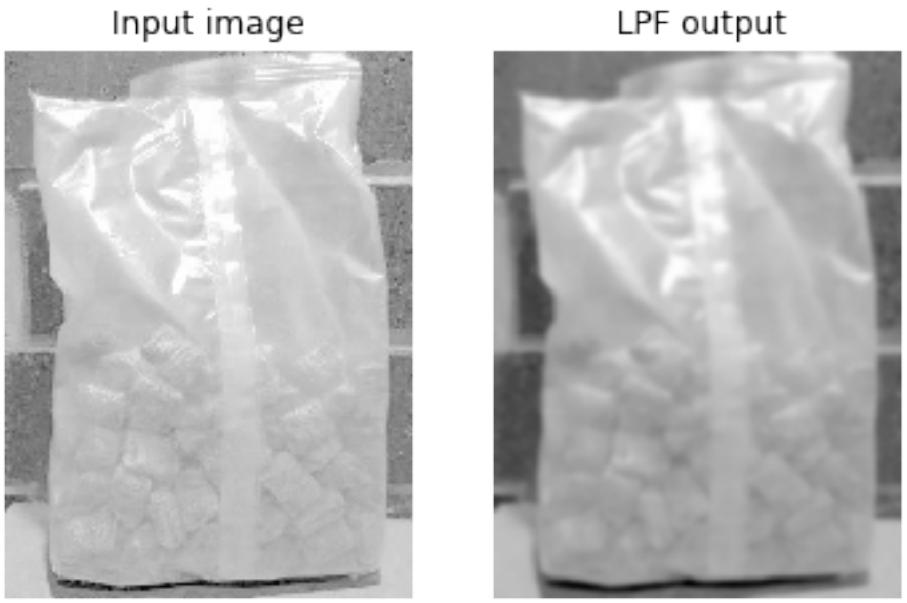
Input for HP


```
In [11]: #Debug hooks
         print(np.shape(img1), img2.shape)
         print(np.amax(img1), np.amin(img1))
         print(np.amax(img2), np.amin(img2))
         print(img1.dtype, img2.dtype)
```

```
(385, 286) (385, 286)
1.0 0.03137254901960784
0.9803921568627451 0.00784313725490196
float64 float64
```

```
In [12]: #Low Pass Filter
         lpf_image = filter_lp(img1, sigma_image = 2)
```

```
(385, 286) 0.2653648273199216 0.9980708522862243
```



In [13]:
```
#### High Pass Filter
hpf_image = filter_hp(img2, sigma_image = 5)
```

```
(385, 286) -0.6979547944362813 0.44729144591560926
(385, 286) 0.0 1.0
```

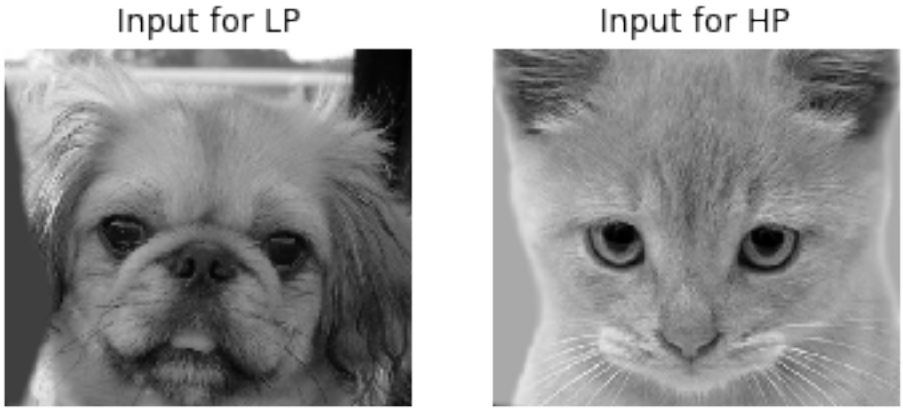
```
In [14]: hybrid_image = generate_hybrid(lpf_image, hpf_image, subject_name)
```

```
(385, 286)
```


```
In [15]: rescaled_hybrid_image = vis_hybrid_image(hybrid_image)
         print(rescaled_hybrid_image.shape)
         plot_one_image(rescaled_hybrid_image, "resized hybrid image")
         save_outputs('cereal_resized', rescaled_hybrid_image)
```

```
(385, 575)
```

In [16]:
```
subject_name = 'dog'
img1, img2 = LoadInputImages(subject_name)
plot_two_images(img1,"Input for LP", img2, "Input for HP")
```

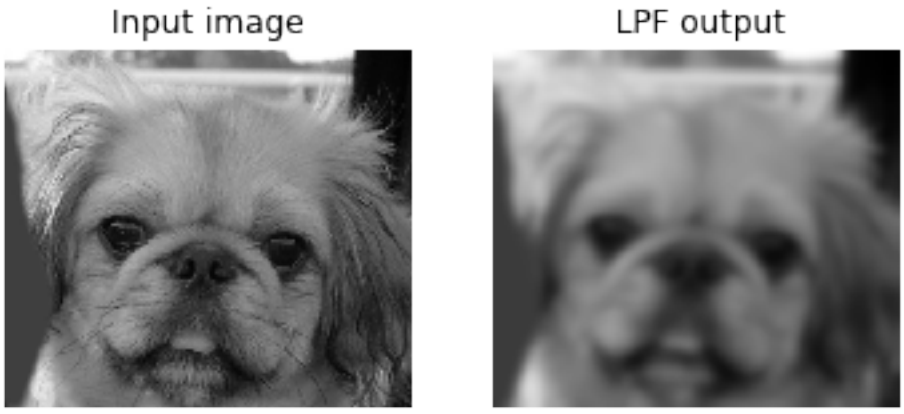


In [17]:
```
#Debug hooks
print(np.shape(img1), img2.shape)
print(np.amax(img1), np.amin(img1))
print(np.amax(img2), np.amin(img2))
print(img1.dtype, img2.dtype)
```

```
(361, 410) (361, 410)
1.0 0.08235294117647059
0.984313725490196 0.0
float64 float64
```

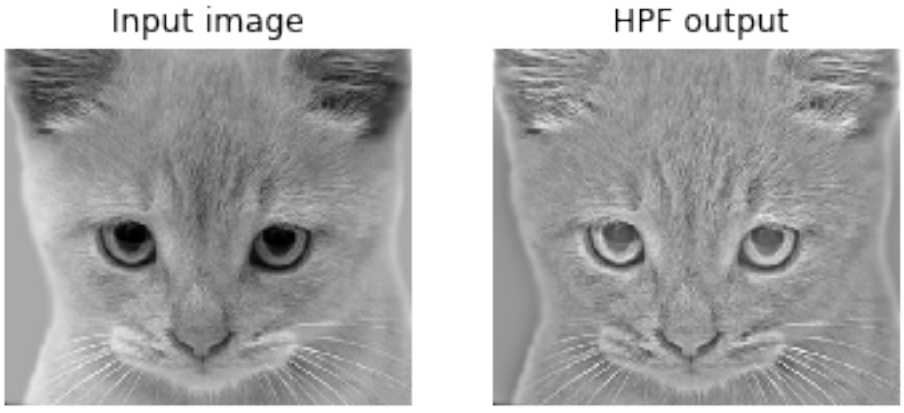
```
In [18]: #Low Pass Filter
         lpf_image = filter_lp(img1, sigma_image = 5)
```

```
(361, 410) 0.10267681830945598 0.9942133782101855
```



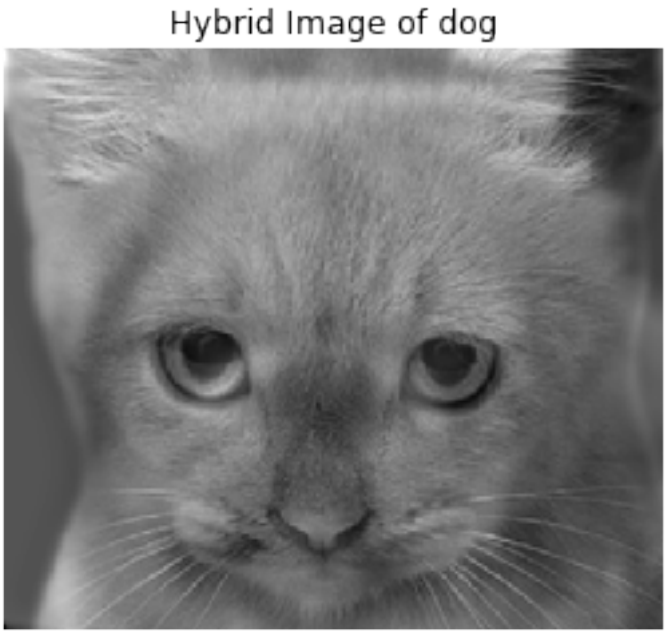

```
In [19]: #High Pass Filter
         hpf_image = filter_hp(img2, sigma_image = 11)
```

```
(361, 410) -0.46962371676412973 0.32320184207099256
(361, 410) 0.0 0.7928255588351223
```



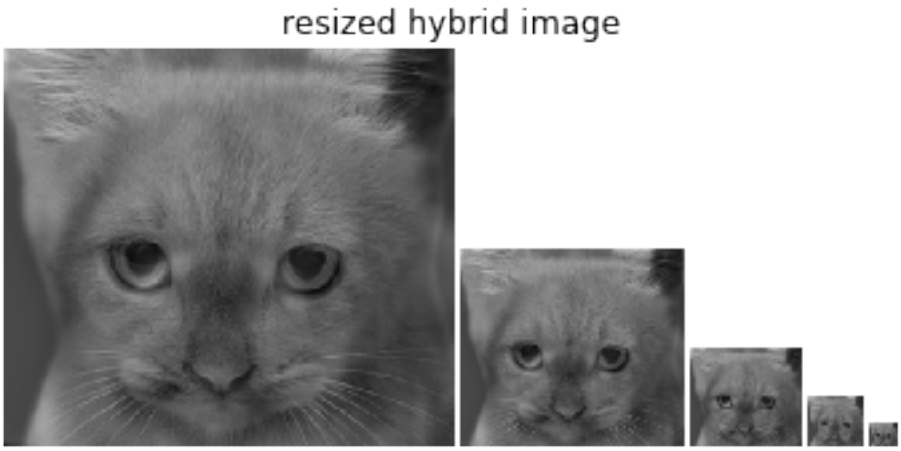
```
In [20]: hybrid_image = generate_hybrid(lpf_image, hpf_image, subject_name)
```

```
(361, 410)
```

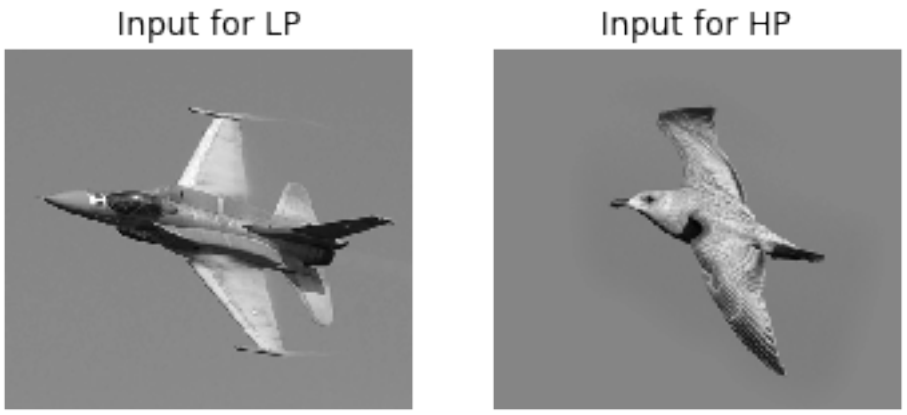



```
In [21]: rescaled_hybrid_image = vis_hybrid_image(hybrid_image)
         print(rescaled_hybrid_image.shape)
         plot_one_image(rescaled_hybrid_image, "resized hybrid image")
         save_outputs('dog_resized', rescaled_hybrid_image)
```

```
(361, 814)
```



In [22]:
```
subject_name = 'plane'
img1, img2 = LoadInputImages(subject_name)
plot_two_images(img1,"Input for LP", img2, "Input for HP")
```



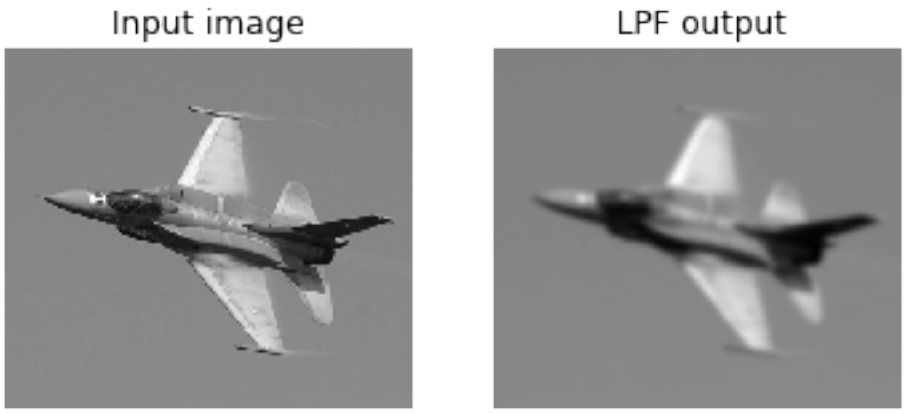
In [23]:
```
#Debug hooks
print(np.shape(img1), img2.shape)
print(np.amax(img1), np.amin(img1))
print(np.amax(img2), np.amin(img2))
print(img1.dtype, img2.dtype)
```

```
(331, 375) (331, 375)
1.0 0.054901960784313725
0.9411764705882353 0.050980392156862744
```

```
float64 float64
```

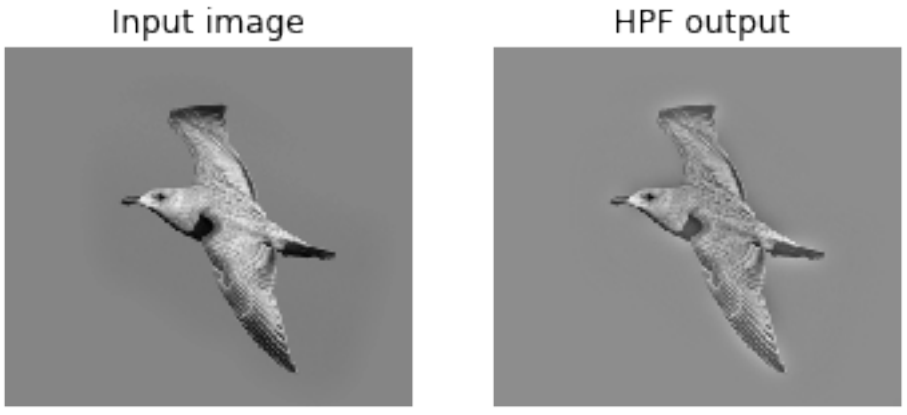
```
In [38]: #Low Pass Filter
         lpf_image = filter_lp(img1, sigma_image = 3)
```

```
(331, 375) 0.13313021739512113 0.943744775953471
```



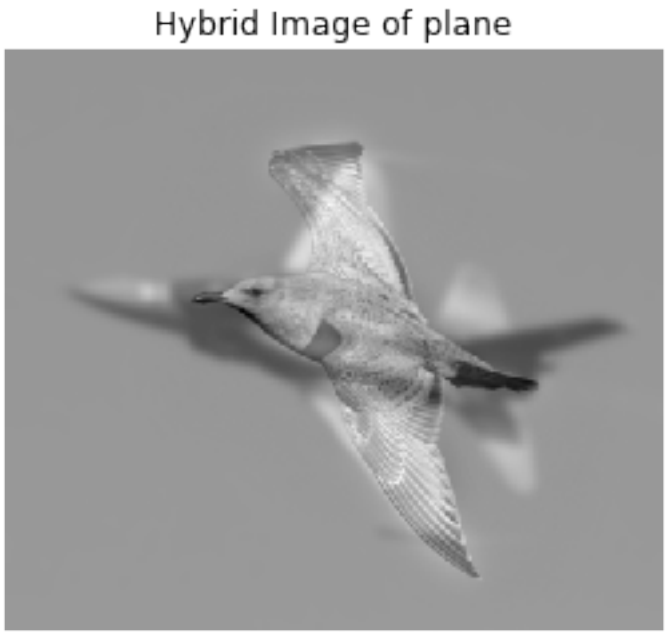

```
In [39]: #High Pass Filter
         hpf_image = filter_hp(img2, sigma_image = 9)
```

```
(331, 375) -0.5158186317575261 0.4196711043810203
(331, 375) 0.0 0.9354897361385464
```



In [40]:
```
hybrid_image = generate_hybrid(lpf_image, hpf_image, subject_name)
```

```
(331, 375)
```



In [41]:
```
rescaled_hybrid_image = vis_hybrid_image(hybrid_image)
print(rescaled_hybrid_image.shape)
plot_one_image(rescaled_hybrid_image, "resized hybrid image")
save_outputs('plane_resized', rescaled_hybrid_image)
```

```
(331, 748)
```