Problem_1

April 15, 2018

```
In [46]: %matplotlib inline
         import cv2 # tested with the 3.1.0 version
         import numpy as np
         import matplotlib.pyplot as plt
         import os
         import scipy.misc
         import matplotlib
```

1 1. Basic Image Operations

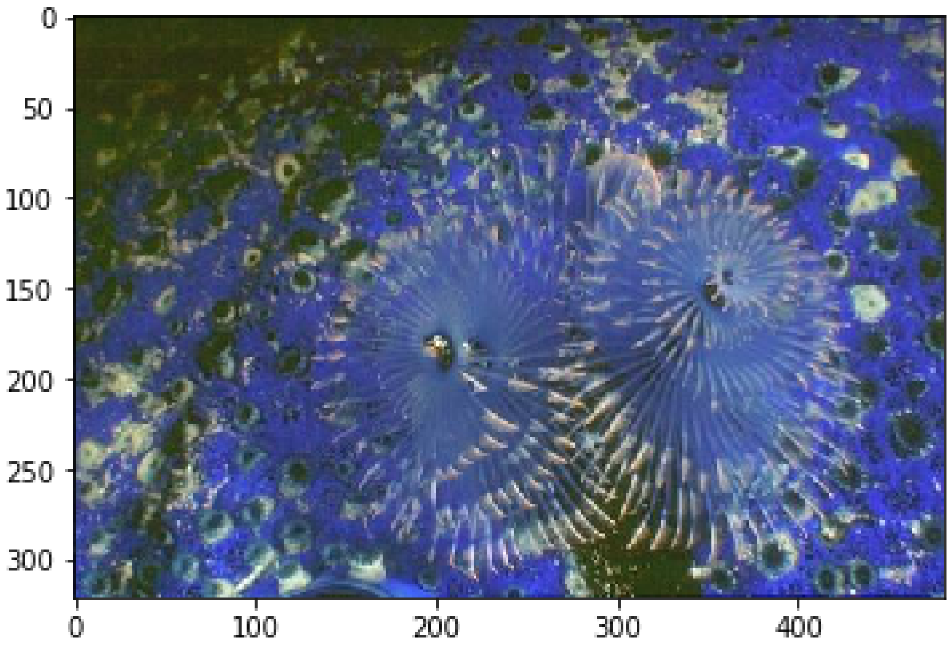
1.1 1.1 Image Read/Write

```
In [37]: # a) read image.
         def my_imread(imagepath):
             image = cv2.imread(imagepath) # Read the image from imagepath.
             return image

         IMG_NAME = '12084.jpg' # Choose an image filename from "data/img/"
         IMG_PATH = os.path.join('data/img/', IMG_NAME)
         image = my_imread(IMG_PATH)
```

```
In [38]: # Optional: uncomment those lines to display the image using cv2.
         #cv2.imshow('image', image)
         #cv2.waitKey(0)
         #cv2.destroyAllWindows()
```

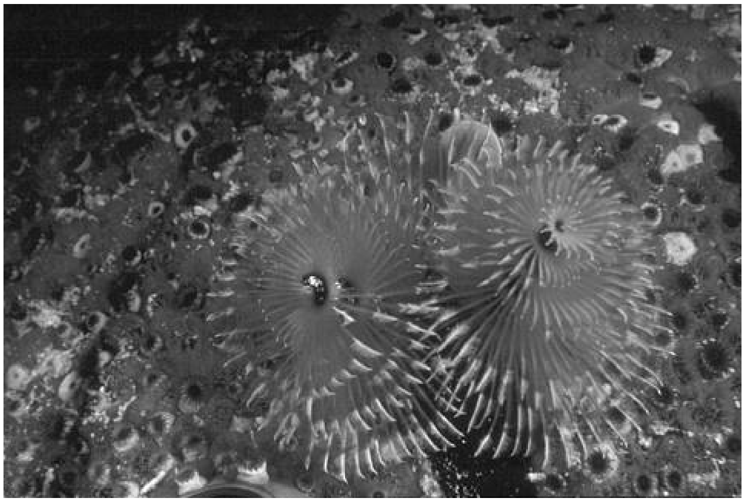
```
In [39]: # Optional: uncomment those lines to display the correct color
         # image using pyplot
         plt.imshow(image)
```

```
Out[39]: <matplotlib.image.AxesImage at 0x11cb46ad0>
```



```
In [49]: # b) Write the same image in RGB and Grayscale and save as
         # "problem1_rgb.jpg" and "problem1_gray.jpg".
         RGB_FILENAME = "problem1_rgb.jpg"
         GRAY_FILENAME = "problem1_gray.jpg"

         def convert2RGB(image):
             image = cv2.cvtColor(image, cv2.COLOR_BGR2RGB)
             return image

         def convert2Gray(image):
             image = cv2.cvtColor(image, cv2.COLOR_BGR2GRAY)
             return image

         def writeToFile(filename,image,gray='False'):
             #scipy.misc.imsave(filename, image)
             if not gray:
                 matplotlib.image.imsave(filename,image)
             else:
                 matplotlib.image.imsave(filename,image,cmap='gray')

         rgb_image = convert2RGB(image)
         writeToFile(RGB_FILENAME,rgb_image)

         gray_image = convert2Gray(image)
         writeToFile(GRAY_FILENAME,gray_image)
```

"rgb"



"gray"

```
# Once the two images have been generated in the current directory,
# run the next block to show your results.
```

1.1.1 Display saved RGB image from current folder.

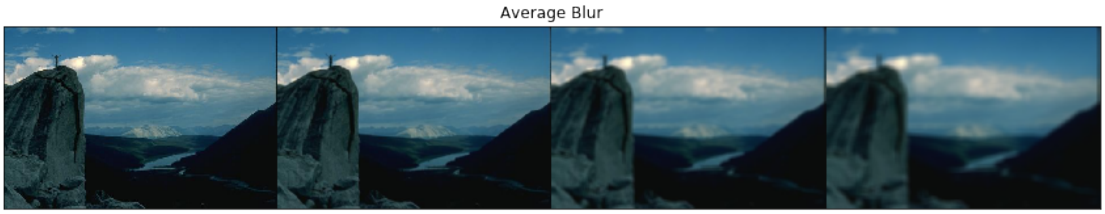
1.1.2 Display saved grayscale image from current folder.

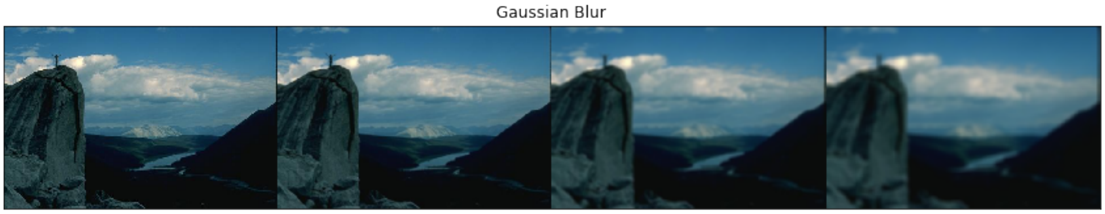
1.2 1.2 Image Smoothing

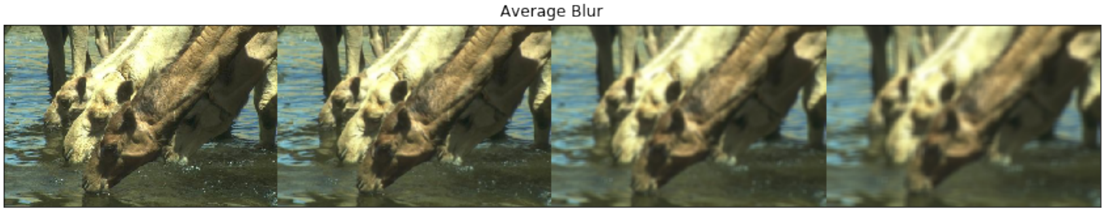
```
In [50]: # Optional: plots an image
         def plot_helper(rgb_img, title):
             plt.figure(figsize=(15, 15)) # the figure size can be adjusted to make sure the ima
             plt.subplot(111),
             plt.imshow(rgb_img),
             plt.title(title)
             plt.xticks([]),
             plt.yticks([])
             plt.show()
```

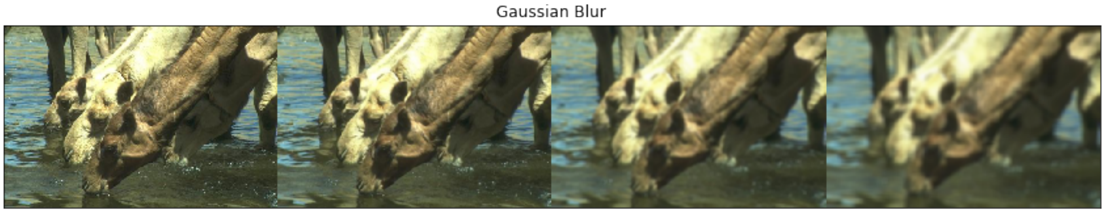
```
In [52]: IMAGES = ['14037.jpg', '16077.jpg', '19021.jpg'] # choose 3 images from "data/img"
         KERNEL_SIZES = [3, 7, 11] # choose at least 3 different filter sizes
         print "kernel sizes are:", KERNEL_SIZES
         for i in range(len(IMAGES)):
             imagepath = os.path.join('data/img/', IMAGES[i])
             image = my_imread(imagepath)
             avg_blurs = [convert2RGB(image)]
             gaus_blurs = [convert2RGB(image)]
             for j in range(len(KERNEL_SIZES)):
                 kernel_size = KERNEL_SIZES[j]
                 # a) average smoothing
                 avg_blur = convert2RGB(cv2.blur(image, (kernel_size,kernel_size)))
                 avg_blurs.append(avg_blur)
                 # b) gaussian smoothing
                 gaus_blur = convert2RGB(cv2.GaussianBlur(image, (kernel_size,kernel_size), kern
                 gaus_blurs.append(gaus_blur)
             avg_stack = np.hstack(avg_blurs)
             gaus_stack = np.hstack(gaus_blurs)
             # Optional: you could choose to use plot_helper to plot avg_stack and gaus_stack.
             # Make sure they are in RGB before using plot_helper.
             plot_helper(avg_stack, "Average Blur")
             plot_helper(gaus_stack, "Gaussian Blur")
```

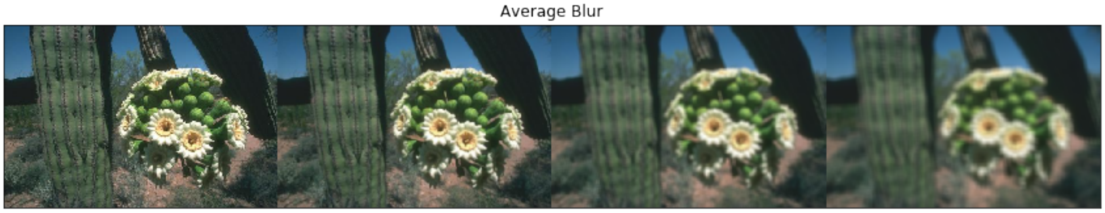
```
kernel sizes are: [3, 7, 11]
```

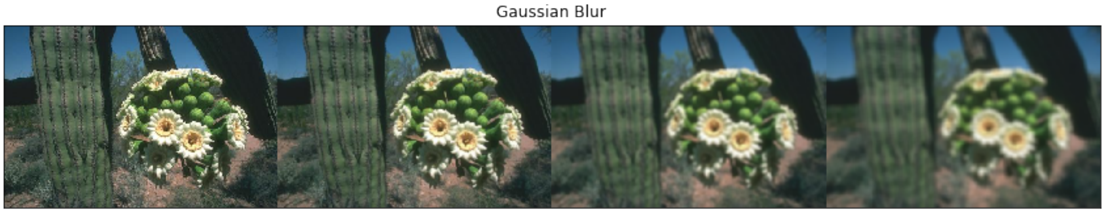





Average Blur


Gaussian Blur


Average Blur


Gaussian Blur

1.2.1 c) What do you observe? (Please briefly answer this question in this block)

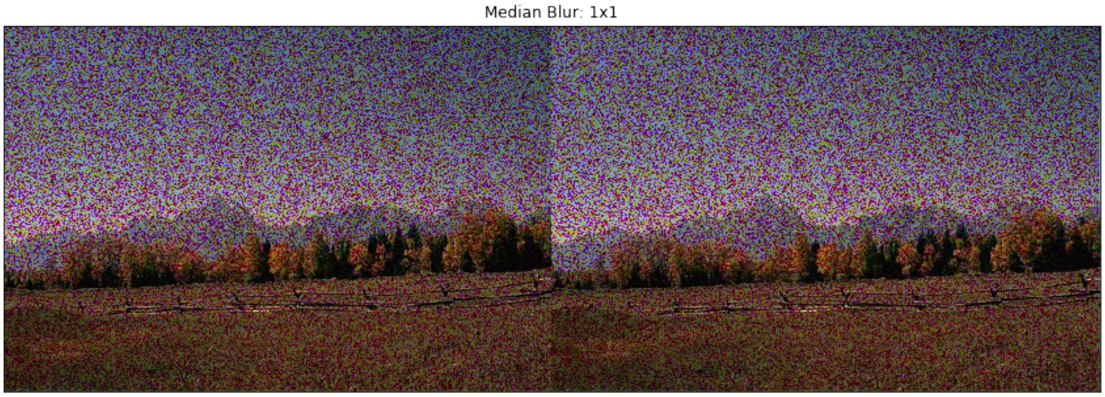
From the figures, it appears that Gaussian blurring still maintains more clarity in the smoothed imaged, while Average smoothing blurs the image to more extent. This may be because gaussian smoothing still weighs things in the center more than than on the edges. Also due to its equal-weighing-in-a-block scheme, the output of the average smoothing is also a little blocky. Apart from that as we increase the kernel size, the blurring increases in both the smoothing techniques.

1.3 1.3 Denoising

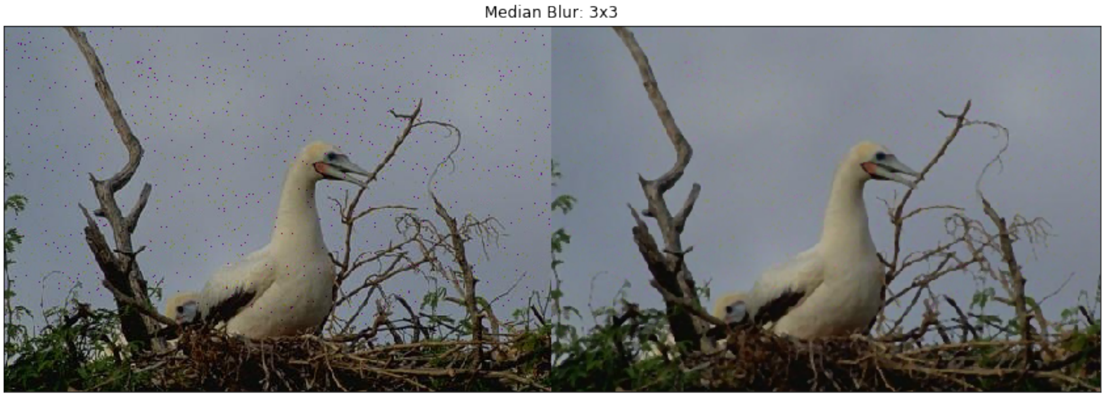
```
In [53]: import glob
         imagepaths = glob.glob('data/snp/*.jpg')
```

```
In [59]: MEDIAN_FILTERS = [1, 3, 5, 7, 9] # Filter sizes for each image.
         for i, imagepath in enumerate(imagepaths):
             image = my_imread(imagepath)
             print "Filter size", MEDIAN_FILTERS[i]
             median = convert2RGB(cv2.medianBlur(image,MEDIAN_FILTERS[i])) # Apply the median fi
             stack = np.hstack((convert2RGB(image), median))
             # Optional: you could choose to use plot_helper to plot stacked image.
             # Make sure it is in RGB before using plot_helper.
             plot_helper(stack, 'Median Blur: %dx%d'%(MEDIAN_FILTERS[i], MEDIAN_FILTERS[i]))
```

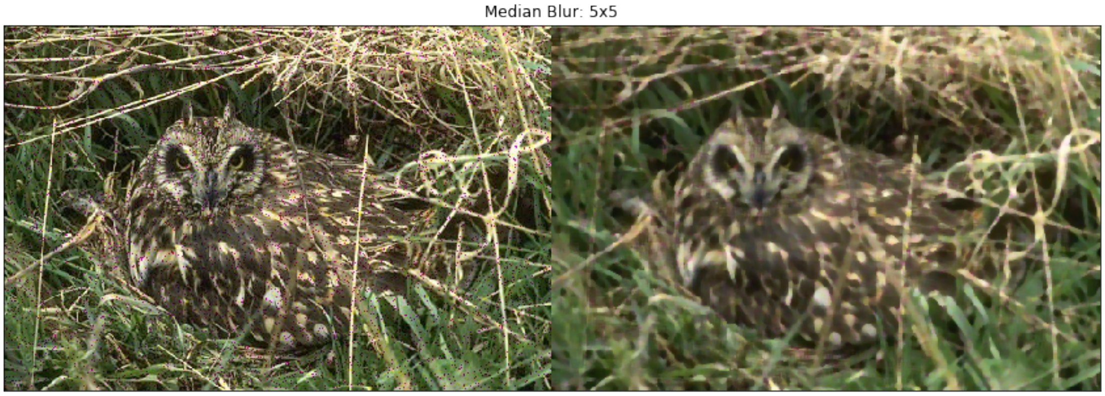
```
Filter size 1
```



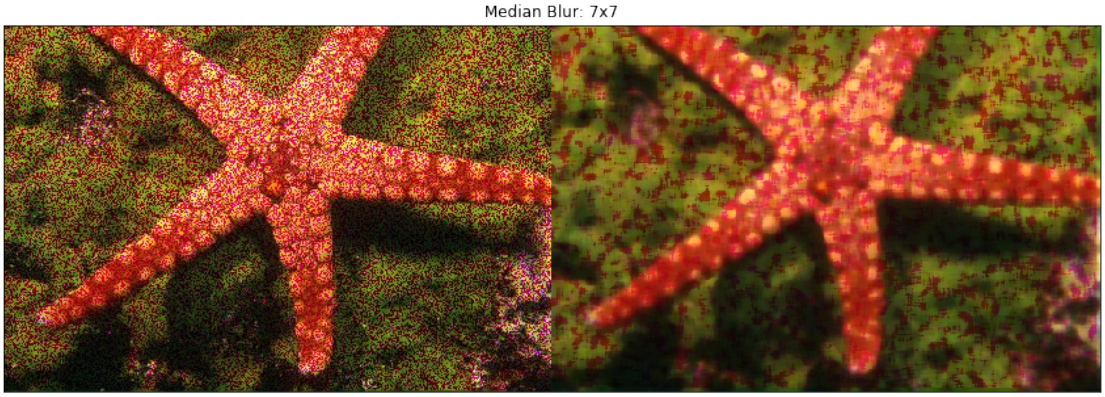
```
Filter size 3
```



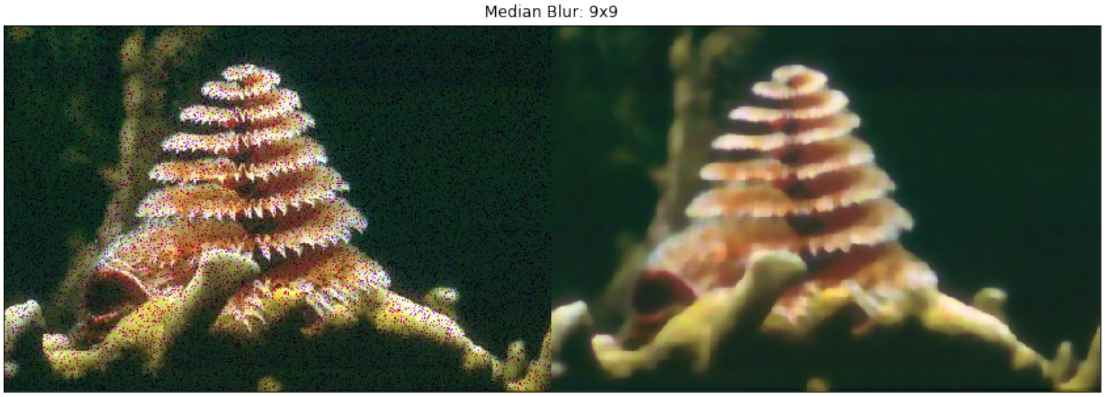
Filter size 5



Filter size 7



Filter size 9



```
In [ ]:
```