Assignment2Notebook

February 14, 2019

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Question 1: Implement seam carving:

In [1]:
```
import numpy as np
import scipy as sp
import scipy.ndimage as ndimage
%matplotlib inline
import matplotlib.patches as patches
import matplotlib.pyplot as plt
from numpy import linalg as LA
from scipy.ndimage.filters import convolve
from scipy.ndimage.filters import gaussian_gradient_magnitude
from scipy.ndimage import sobel, generic_gradient_magnitude
from scipy import signal
import math
import cv2
```

In [2]:
```
def my_plot(image):
    plt.imshow(image, cmap='gray')
    plt.axis('off')
    plt.show()
```

In [3]:
```
def G_M(grad):

    M = grad.copy()

    r,c = grad.shape

    for i in range(1, r):
        for j in range(0,c):
            if j<1:
                min_num = np.min(M[i-1, 0:2])
            else:
                min_num = np.min(M[i-1, j-1:j+2])

            M[i,j] = grad[i, j] + min_num
    return M
```

```
In [4]: def find_path(M):

            min_arg = np.argmin(M[-1])

            delete_arg = []

            delete_arg.append([M.shape[0]-1, min_arg])


            for i in range(M.shape[0]-1, 0 ,-1):

                if min_arg < 1:

                    min_arg = np.argmin(M[i-1, 0:2])
                else:
                    min_arg = min_arg-1 + np.argmin(M[i-1, min_arg-1: min_arg+2])

                delete_arg.append([i-1, min_arg])

            return np.array(delete_arg)


In [5]: def grad_mag(img):
            img = img.astype('float32')
            eng = generic_gradient_magnitude(img, sobel)
            #eng = gaussian_gradient_magnitude(img, 2)
            return eng

In [6]: def find_seam(image):

            image = cv2.cvtColor(image, cv2.COLOR_BGR2GRAY)

            image_grad = grad_mag(image)
            M = G_M(image_grad)
            delete_arg = find_path(M)

            return delete_arg

In [7]: def plot_seam(image, delete_arg):
            plt.plot(delete_arg[:,[0]] ,delete_arg[:,[1]], c='red')
            #plt.imshow(image)
            #plt.show()

In [8]: def remove_seam(delete_arg, img):
            r,c, _ = img.shape
            i = 0
            mask = np.ones(img.shape, dtype=bool)
            for j in delete_arg[:,[1]]:
                mask[i, j[0], :]=False
```

```
            i+=1
        img = img[mask]
        return img.reshape(r,c-1,3)
```

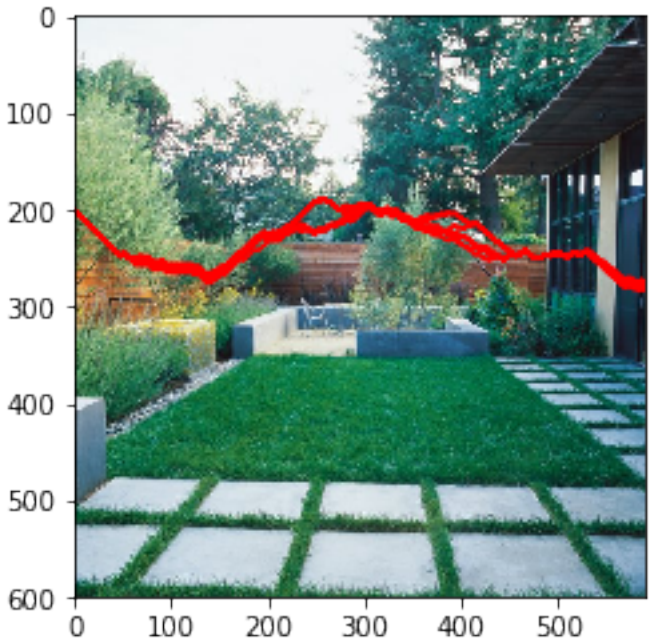
In [9]:
```
def get_new_image(image1rbg):

    delete_arg = find_seam(image1rbg)

    plot_seam(image1rbg, delete_arg)

    return remove_seam(delete_arg, image1rbg)
```

In [10]:
```
def delete_columns(img, n):
    for i in range(n):
        new_image = get_new_image(img)
        img = new_image
    return img
```

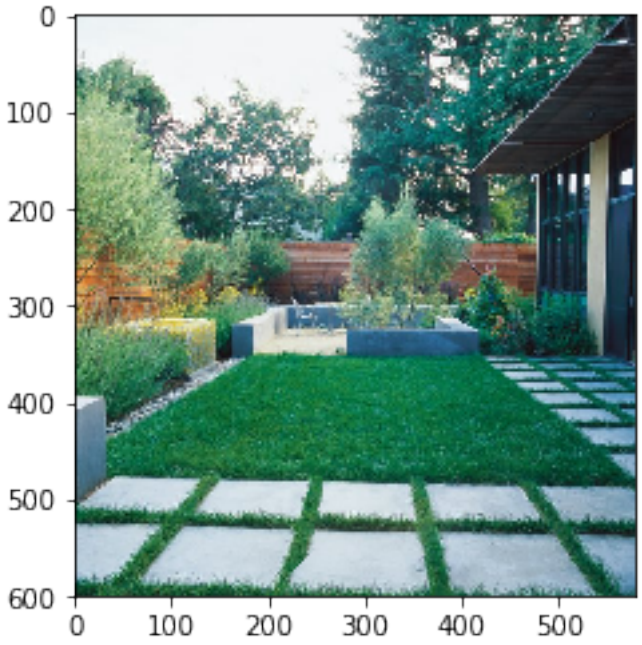
In [11]:
```
image1 = cv2.imread('image2.jpg', 0)
image1rbg = cv2.imread('image2.jpg', 1)[:,:,::-1]
```

In [12]:
```
new_image=delete_columns(image1rbg, 10)
plt.imshow(image1rbg)
```

Out[12]: <matplotlib.image.AxesImage at 0x130440ba8>



```
In [13]: print(image1rbg.shape) # shape before

(600, 589, 3)

In [14]: print(new_image.shape) #shape after

(600, 579, 3)

In [15]: plt.imshow(new_image) # plot new image

Out[15]: <matplotlib.image.AxesImage at 0x130706a20>
```




```
In [16]: from skimage.feature import peak_local_max
```

[Question 2] a)
Implement a function to perform Harris corner detection.

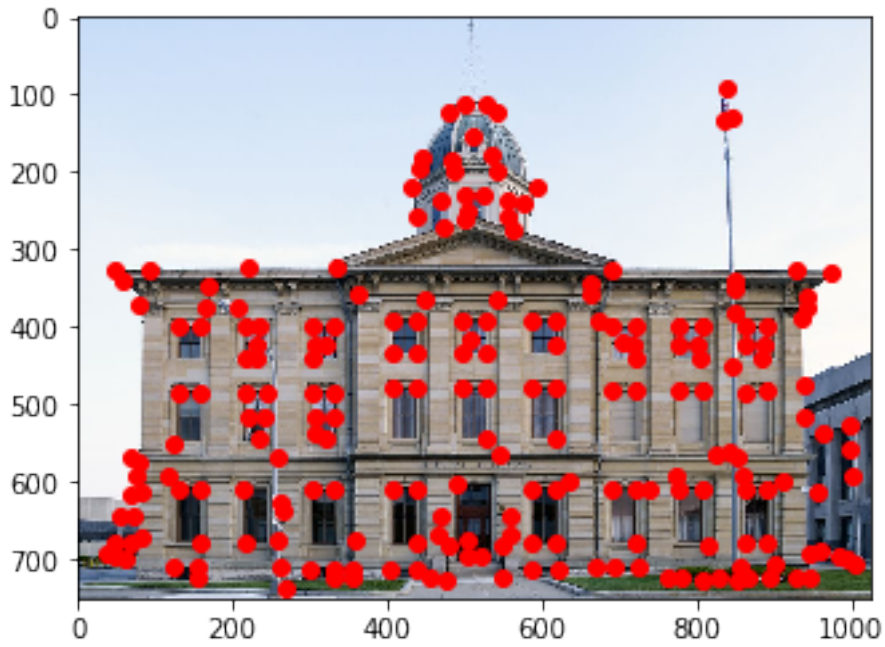
```
In [17]: def find_corner(img, alpha, threshold, min_dist):


            if len(img.shape) == 3:
                img = img.mean(axis=2)

            img = ndimage.gaussian_filter(img, 1)
```

```
            r, c = img.shape

            dy = ndimage.sobel(img, axis=1, mode='constant')

            dx = ndimage.sobel(img, axis=0, mode='constant')

            Ixx = np.square(dx)

            Iyy = np.square(dy)

            Ixy = dy * dx

            wIxx = np.zeros((r,c))
            wIyy = np.zeros((r,c))
            wIxy = np.zeros((r,c))
            traceM = np.zeros((r,c))
            detM = np.zeros((r,c))
            R = np.zeros((r,c))

            for y in range(1, r):

                for x in range(1,c):

                    wIxx[y,x] = Ixx[y-1:y+1,x-1:x+1].sum()
                    wIyy[y,x] = Iyy[y-1:y+1,x-1:x+1].sum()
                    wIxy[y,x] = Ixy[y-1:y+1,x-1:x+1].sum()
                    traceM[y,x] = wIxx[y,x] + wIyy[y,x]
                    detM[y,x]= wIxx[y,x]*wIyy[y,x]- wIxy[y,x]*wIxy[y,x]
                    R[y,x] = detM[y,x] - alpha*(traceM[y,x]**2)

            coordinates = peak_local_max(R, min_distance=10, threshold_rel=threshold)

            return coordinates
```

In [18]:
```
def show_corners(img, alpha, thres, min_dist):

            coordinates = find_corner(img, alpha, thres, min_dist)

            plt.imshow(img)

            plt.scatter(coordinates[:, 1], coordinates[:, 0], c='r')

            plt.show()
```

In [19]:
```
image4 = cv2.imread('building.jpg', 1)[:,:,::-1]
```

In [20]:
```
show_corners(image4, 0.05, 0.001, 7)
```



[Question 2]Implement a function for Lowe's scale-invariant interest point detection. Let the number of scales per octave be a parameter of your code.**c)**

```
In [31]: from skimage.feature import blob_dog
         from skimage.transform import pyramid_gaussian
         from scipy.ndimage.filters import gaussian_filter

In [32]: image4 = cv2.imread('building.jpg', 0)

In [33]: image4.shape

Out[33]: (751, 1024)

In [59]: def interest_point(image, num_octave, s, num_layers):

             k = 2**0.5

             final_sigma_all = np.zeros((1,))
             coordinates_all = np.zeros((1,2))

             pyramid = list(pyramid_gaussian(image, downscale=2, max_layer=num_octave, sigma=k

             for par in pyramid:

                 layers = []
                 layers.append(par)
                 sigmas = []
```

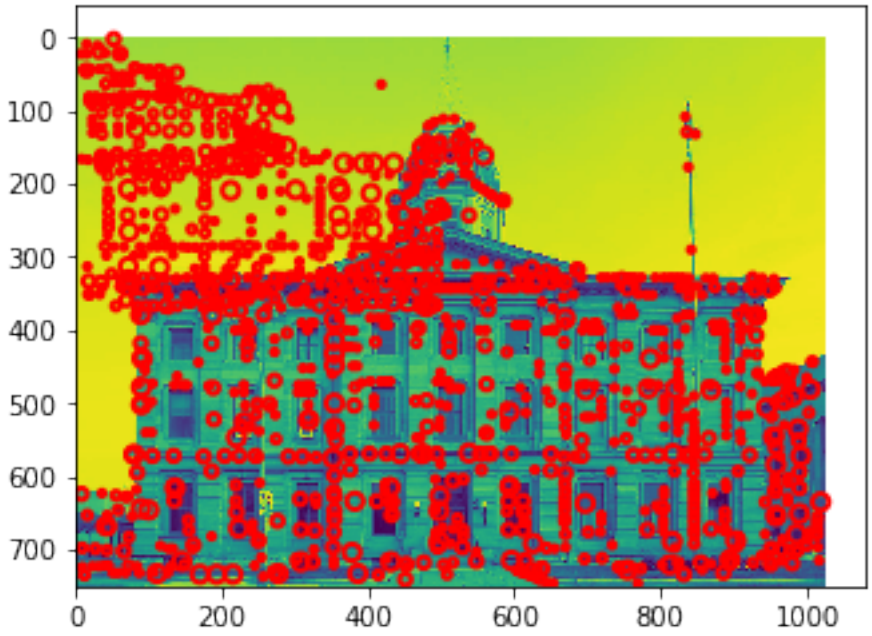
```
            sigmas.append(s)
            for i in range(1, num_layers):
                sigma_item = (k**i)*s
                sigmas.append(sigma_item)
                layer=gaussian_filter(par, sigma=sigma_item)
                layers.append(layer)

            layers = np.array(layers)

            dog = []

            for j in range(num_layers-1, 0, -1):

                dog_layer = layers[j] - layers[j-1]
                dog.append(dog_layer)

            dog = np.array(dog)

            sigmas = np.flip(np.array(sigmas), axis=0)

            cube_dog = np.stack(dog, axis=-1)

            local_maxima = peak_local_max(cube_dog, footprint=np.ones((3,) * (image.ndim +

            sigma_ind = local_maxima[:,-1] - 1

            final_sigma = sigmas[sigma_ind]

            coordinates = np.delete(local_maxima, 2, 1)

            if coordinates.shape[0] != 0:

                coordinates_all = np.concatenate((coordinates_all, coordinates), axis=0)
                final_sigma_all = np.concatenate((final_sigma_all, final_sigma), axis=0)

        return coordinates_all, final_sigma_all
```

In [60]:
```
def show_circles(coordinates,sigmas,img):
    ax=plt.gca()
    for i in range(0, coordinates.shape[0]):
        y, x = coordinates[i]
        r = sigmas[i]
        c = plt.Circle((x, y), r, color='r', linewidth=2, fill=False)
        ax.add_patch(c)
    plt.imshow(img)
    plt.axis('scaled')
    plt.show()
```

In [61]:
```
coord, sigmas = interest_point(image4, 5, 1, 8)
```

I don't know what I've done wrong.

```
In [62]: show_circles(coord, sigmas, image4)
```




```
In [ ]:
```

```
In [ ]:
```