Edge_Detection

February 27, 2018

1 Problem

Create an edge detector using convolutions.

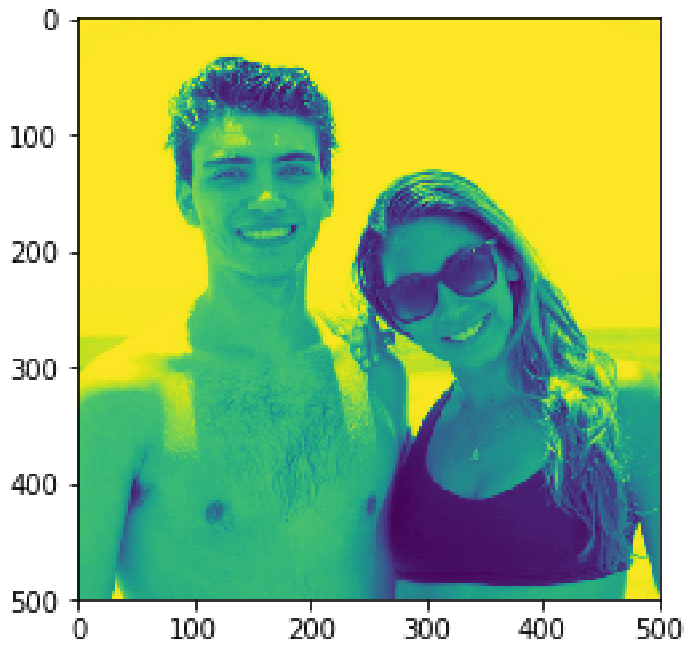
2 Setup

Import libraries and load the image.

```
In [33]: from PIL import Image
         import math
         import numpy as np
         from matplotlib.pyplot import imshow
         %matplotlib inline
```

```
In [34]: original = np.asarray(Image.open('sam.jpg').convert('L'))
         print('Shape:', original.shape, '| dtype:', original.dtype)
         imshow(original)
         print('Hella hawt')
```

```
Shape: (500, 500) | dtype: uint8
Hella hawt
```



Modify the functionfrom our blurring project earlier so that it accepts in a function

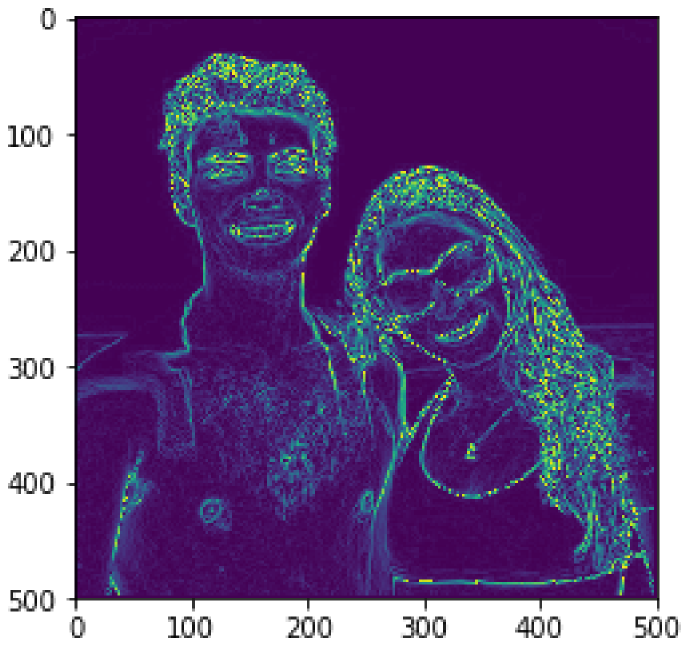
```
In [8]: def apply_transformation(tensor, transform, size, step):
            """
            Applies a transformation to each subtensor throughout the image based on the given

            --Parameters--
            tensor: a numpy tensor with dimension greater than or equal to 2 (3d, 4d, 5d...)
            transform: the transformation function to apply on the subtensor
            size: size of the convolution square
            step:
            """
            w = tensor.shape[0]
            h = tensor.shape[1]
            margin = int(size/2)
            transformed = np.zeros_like(tensor)
            for x in range(0, w, step):
                for y in range(0, h, step):
                    # define the reg3ion to extract the submatrix from
                    xmin = x-margin if x-margin >= 0 else 0
                    xmax = x+margin+1 if x+margin+1 < w else w
                    ymin = y-margin if y-margin >= 0 else 0
                    ymax = y+margin+1 if y+margin+1 < h else h
                    # apply the transformation to the submatrix
                    transformed[xmin:xmax, ymin:ymax] = transform(tensor[xmin:xmax, ymin:ymax]
            return transformed
```

Define a sobel edge detector function using sobel kernels. Found sobel here: http://homepages.inf.ed.ac.uk/rbf/HIPR2/sobel.htm

```
In [36]: # requires step size 1? size 3
         def sobel_edge(submatrix):
             if submatrix.shape != (3,3):
                 return 0
             gx = np.array([[-1, 0, 1],
                            [-2, 0, 2],
                            [-1, 0, 1]])
             gy = np.array([[1, 2, 1],
                           [0, 0, 0],
                           [-1, -2, -1]])
             return math.sqrt(np.sum(np.multiply(gx, submatrix))**2 + np.sum(np.multiply(gy, su
```

```
In [37]: transformed = apply_transformation(original, sobel_edge, 3, 1)
         imshow(transformed)
```

```
Out[37]: <matplotlib.image.AxesImage at 0x7f35202a5320>
```



```
In [28]: # def vertical_edge_detector(subtensor):
         #     """
         #     Draws a vertical edge straight down the middle
         #     """
         #     mask = np.zeros_like(subtensor) # make a numpy tensor similar to subtensor but 
         # #     print(mask)
         #     width = mask.shape[0]
         #     middle_x = int(width/2)
         #     mask[middle_x,:,:] = 1 # set a vertical line of 1's down the middle
         # #     print(mask)

         #     return np.multiply(mask, subtensor)
         # vertical_edge_detector(np.ones((3,3,3)) * 2)
```

```
In [27]: # transformed = apply_transformation(original, vertical_edge_detector, 5, 5)
         # imshow(transformed)
```