Assignment-1E3-Nachiketh-nxp251

February 21, 2018

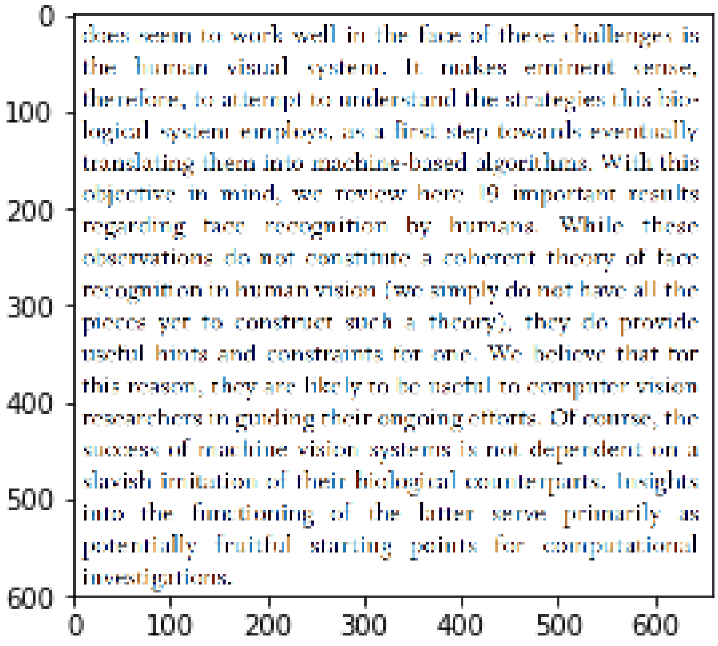
Question - Notebook for feature detector. For this I have done it in three ways, one is by just matching pixel intensities and the other by convolution and other by using open cv match template.

```
In [3]: import numpy as np
        import matplotlib.pyplot as plt
        import matplotlib.patches as patches
        import cv2 as cv
```

```
In [20]: image = plt.imread('../characters.png')
         image_gray = image[:,:,0]
         template = plt.imread('../template.png')
         template = template[:,:,0]
```

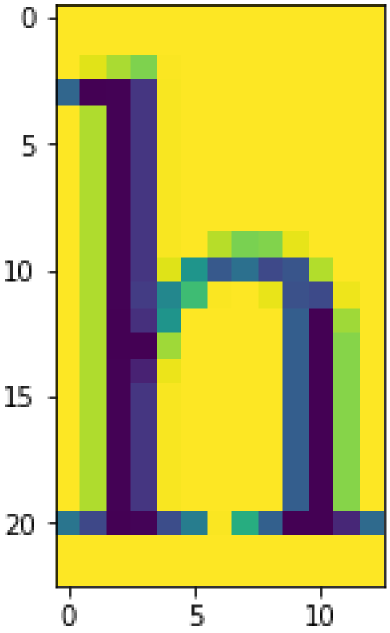
```
In [21]: image_height = image_gray.shape[0]
         image_width = image_gray.shape[1]
         template_height = template.shape[0]
         template_width = template.shape[1]
```

```
In [6]: plt.imshow(image)
        plt.show()
```


0
100
200
300
400
500
600
0
100
200
300
400
500
600

does seem to work well in the face of these challenges is the human visual system. It makes eminent sense, therefore, to attempt to understand the strategies this biological system employs, as a first step towards eventually translating them into machine-based algorithms. With this objective in mind, we review here 19 important results regarding face recognition by humans. While these observations do not constitute a coherent theory of face recognition in human vision (we simply do not have all the pieces yet to construct such a theory), they do provide useful hints and constraints for one. We believe that for this reason, they are likely to be useful to computer vision researchers in guiding their ongoing efforts. Of course, the success of machine vision systems is not dependent on a slavish imitation of their biological counterparts. Insights into the functioning of the latter serve primarily as potentially fruitful starting points for computational investigations.

```
In [7]: plt.imshow(template)
        plt.show()
        print(template.shape)
```



```
(23, 13)
```

```
In [8]: def threshold(sub_img, template):
            equals = 0
            total = 0
            for i in range(0, template.shape[0]):
                for j in range(0, template.shape[1]):
                    total += 1
                    if sub_img[i,j] == template[i,j]:
                        equals += 1
            return equals / float(total)
```

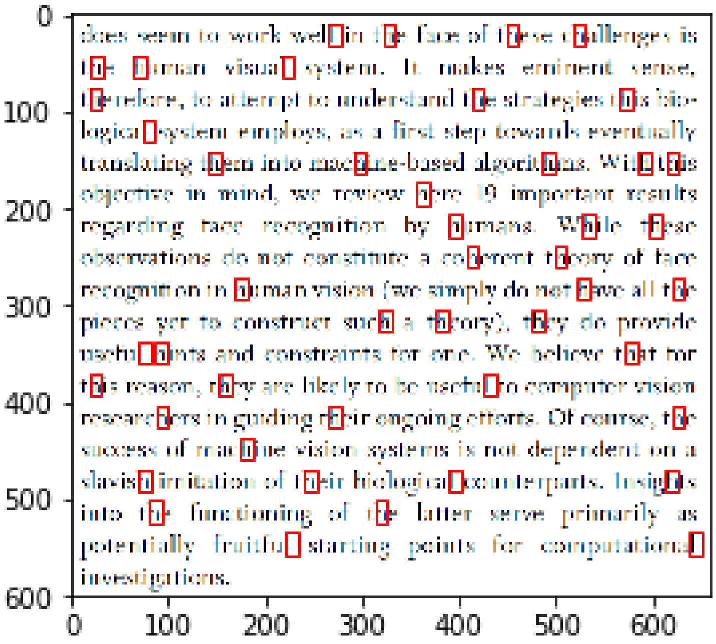
```
In [9]: def detect_feature(image_gray, template, limit):
            fig, ax = plt.subplots(1)
            max_thresh = 0.0
            image_height = image_gray.shape[0]
            image_width = image_gray.shape[1]
            template_height = template.shape[0]
            template_width = template.shape[1]
            for i in range(0, (image_height - template_height)):

                for j in range(0, (image_width - template_width)):

                    sub_img = image_gray[i:template_height+i, j:template_width+j]
                    threshold_val = threshold(sub_img, template)
                    if max_thresh < threshold_val:
                        max_thresh = threshold_val
                    if threshold_val > limit: #Adding a rectangle box
                    #count += 1
                        bottom_left_x = j
                        bottom_left_y = i
                        rectangle = patches.Rectangle((bottom_left_x,bottom_left_y), template_
                        ax.add_patch(rectangle)
            print(max_thresh)
            ax.imshow(image)
            plt.show()
```

```
In [10]: detect_feature(image_gray, template, 0.63)
```

```
0.6521739130434783
```



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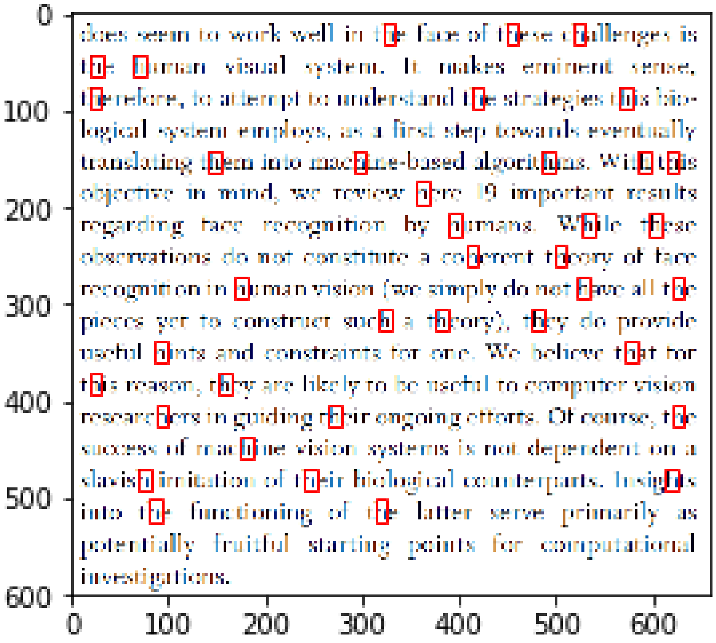
```
In [20]: detect_feature(image_gray, template, 0.64)
```



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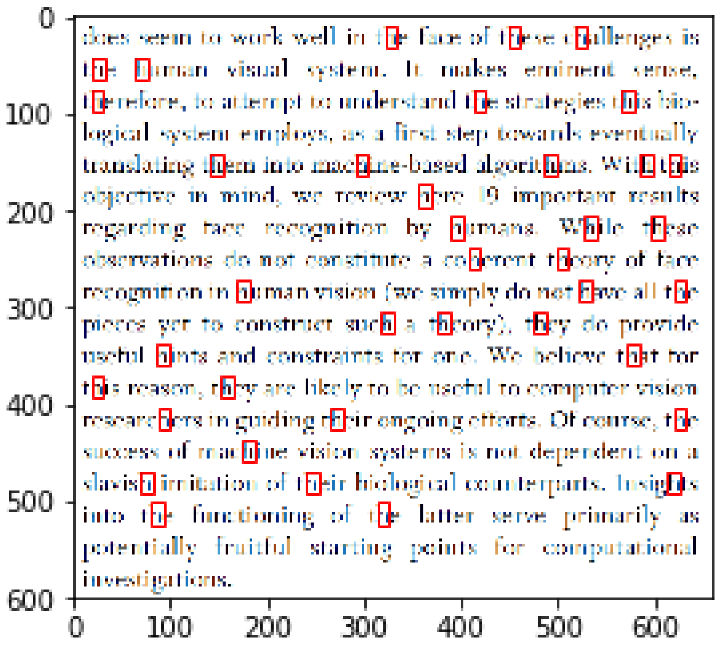
```
In [21]: detect_feature(image_gray, template, 0.65)
```



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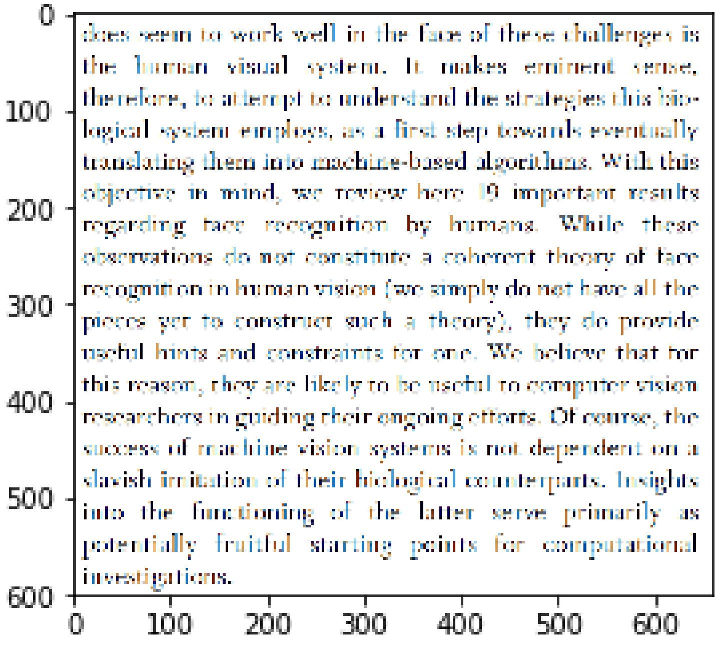
```
In [22]: detect_feature(image_gray, template, 0.7)
```



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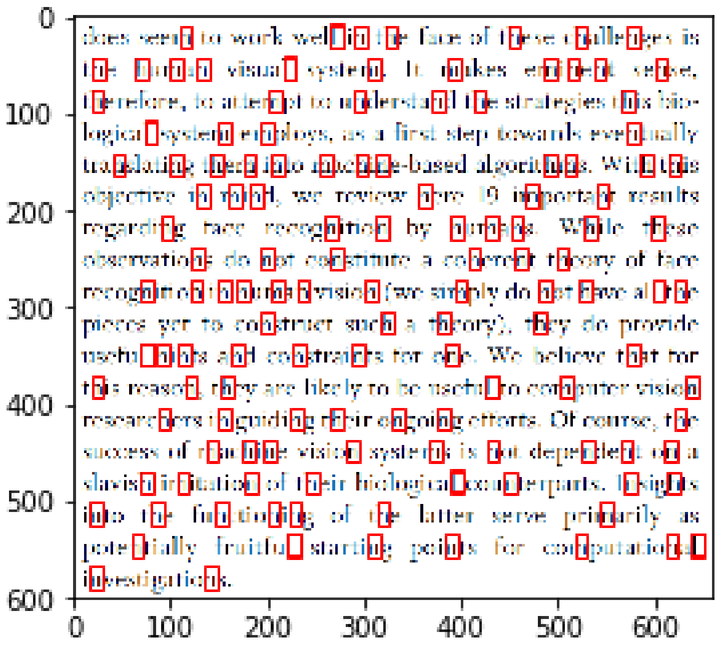
```
In [23]: detect_feature(image_gray, template, 0.60)
```



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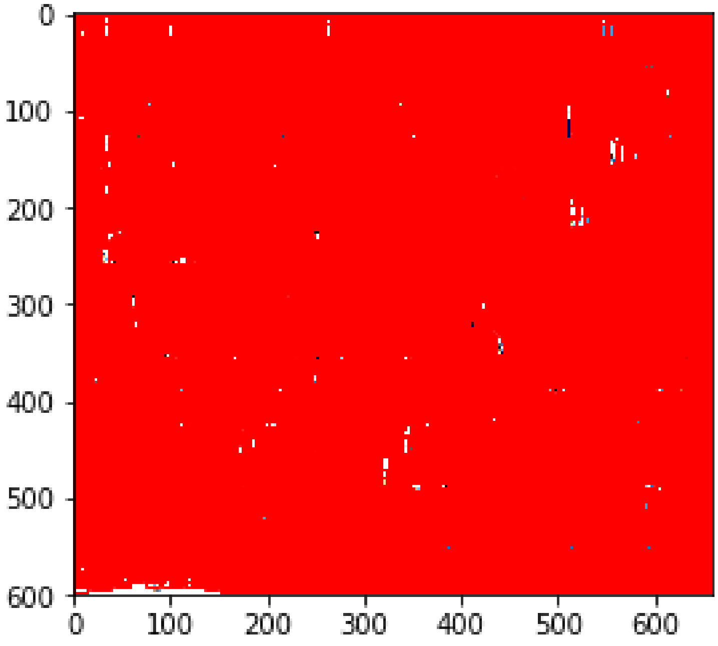
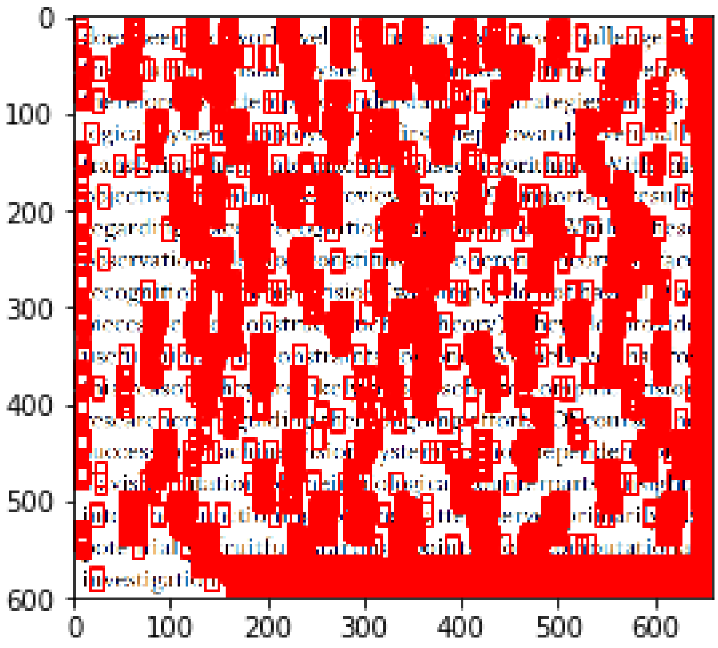
```
In [24]: detect_feature(image_gray, template, 0.50)
```



```
In [25]: detect_feature(image_gray, template, 0.55)
```



I have used the convloution method below to find the template.

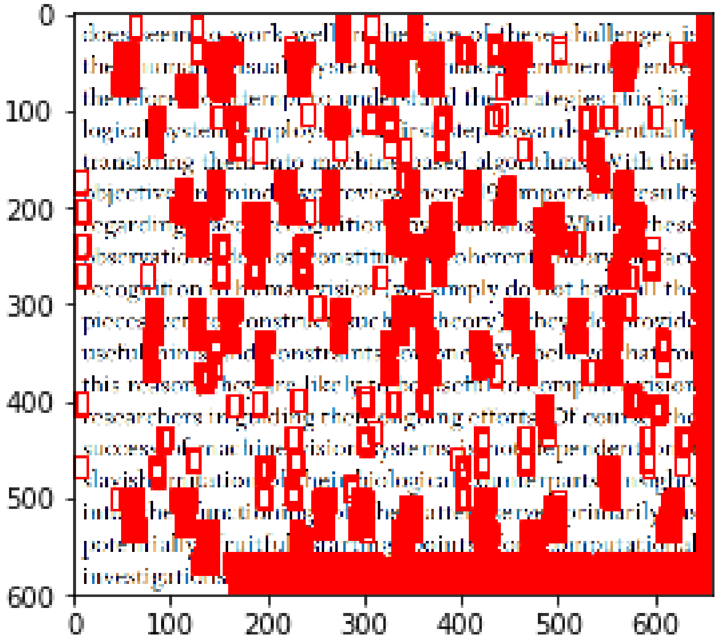
```
In [16]: def threshold_conv(sub_img, template):
             return np.sum(np.multiply(sub_img, template)) / float(template.size)
```

```
In [17]: def detect_feature_conv(image_gray, template, limit):
             fig, ax = plt.subplots(1)
             max_thresh = 0.0
             image_height = image_gray.shape[0]
             image_width = image_gray.shape[1]
             template_height = template.shape[0]
             template_width = template.shape[1]
             for i in range(0, (image_height - template_height)):

                 for j in range(0, (image_width - template_width)):

                     sub_img = image_gray[i:template_height+i, j:template_width+j]
                     threshold_val = threshold_conv(sub_img, template)
                     if max_thresh < threshold_val:
                         max_thresh = threshold_val
                     if threshold_val > limit: #Adding a rectangle box
                     #count += 1
                         bottom_left_x = j
                         bottom_left_y = i
                         rectangle = patches.Rectangle((bottom_left_x,bottom_left_y), template_
                         ax.add_patch(rectangle)
             print(threshold_val)
```

```
        ax.imshow(image)
        plt.show()
```

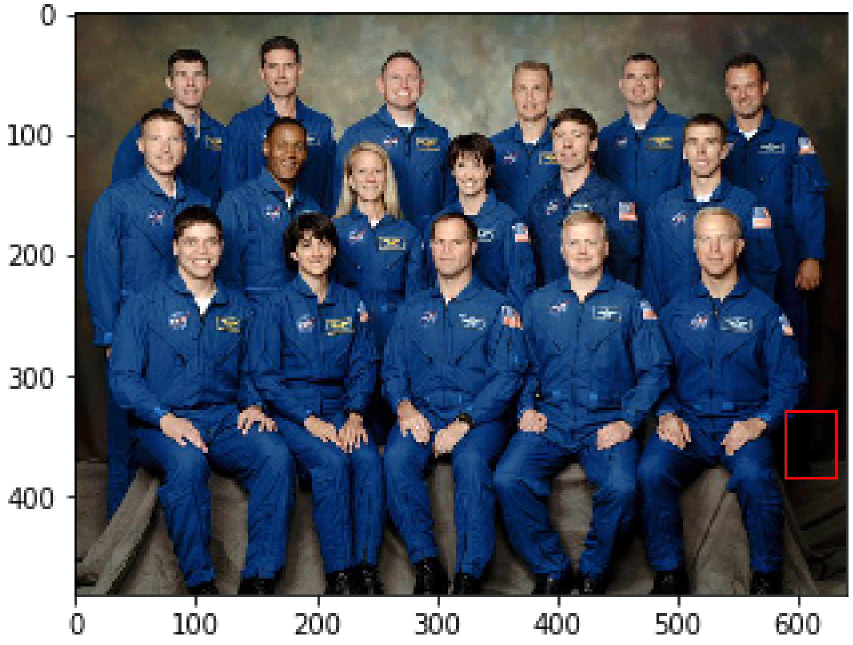
```
In [23]: detect_feature_conv(image_gray, template, 0.77)
```

```
0.775919732441
```



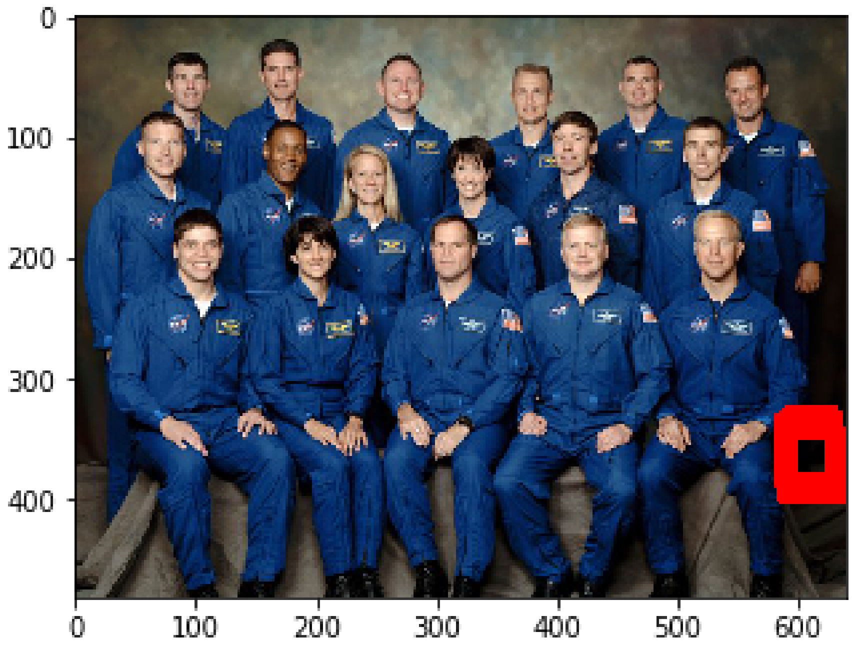
```
In [59]: detect_feature(image_gray, template, 0.05)
```

```
0.05064935064935065
```



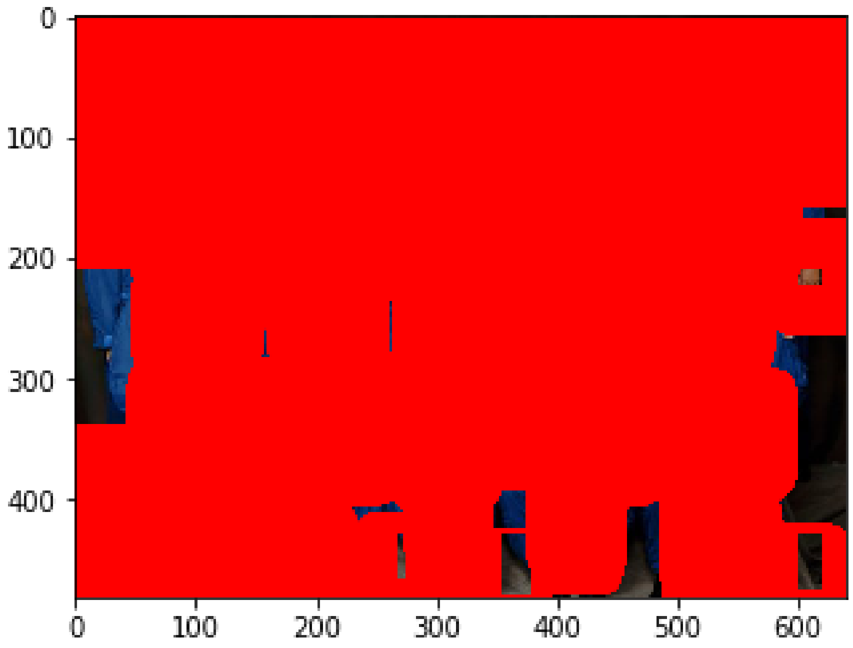
```
In [12]: image = plt.imread('../face.jpg')
         image_gray = image[:,:,0]
         template = plt.imread('../sample_face.png')
         template = template[:,:,0]
         detect_feature(image_gray, template, 0.03)
```

```
0.050649350649350655
```



```
In [69]: image = plt.imread('../face.jpg')
         image_gray = image[:,:,0]
         template = plt.imread('../sample_face.png')
         template = template[:,:,0]
         detect_feature_conv(image_gray, template, 17.16)
         #print(template.shape)
```

```
17.1686248647
```



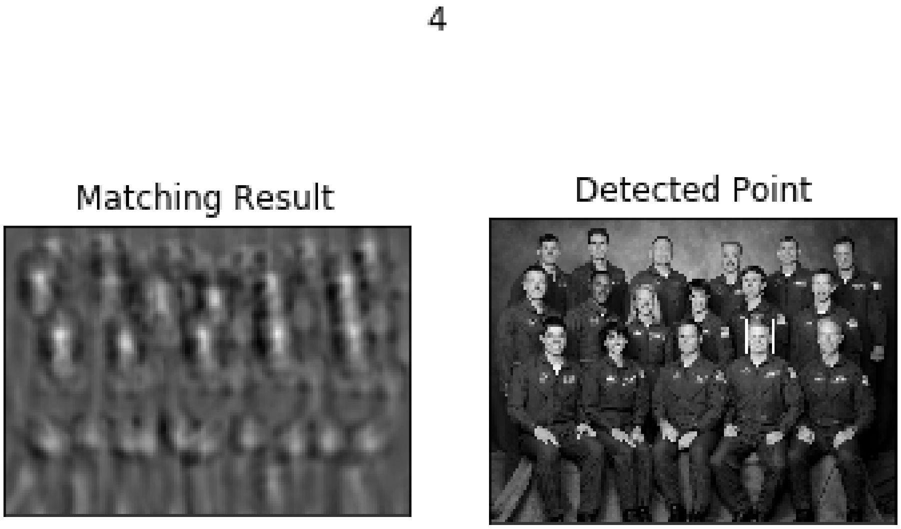
Below I have used the Open cv implementation of template matching and was able to get a good matching of the template. You can use 6 methods in Open cv to match template, I have used all 6 and displayed the results.

```
In [14]: img = cv.imread('../face.jpg',0)
         img2 = img.copy()
         template = cv.imread('../sample_face.png',0)
         w, h = template.shape[::-1]
         methods = ['cv.TM_CCOEFF', 'cv.TM_CCOEFF_NORMED', 'cv.TM_CCORR',
                     'cv.TM_CCORR_NORMED', 'cv.TM_SQDIFF', 'cv.TM_SQDIFF_NORMED']
         for method in methods:
             img = img2.copy()
             method = eval(method)
             res = cv.matchTemplate(img,template,method)
             min_val, max_val, min_loc, max_loc = cv.minMaxLoc(res)
             if method in [cv.TM_SQDIFF, cv.TM_SQDIFF_NORMED]:
                 top_left = min_loc
             else:
                 top_left = max_loc
             bottom_right = (top_left[0] + w, top_left[1] + h)
             print(bottom_right)
             cv.rectangle(img,top_left, bottom_right, 255, 2)
             plt.subplot(121),plt.imshow(res,cmap = 'gray')
             plt.title('Matching Result'), plt.xticks([]), plt.yticks([])
             plt.subplot(122),plt.imshow(img,cmap = 'gray')
             plt.title('Detected Point'), plt.xticks([]), plt.yticks([])
```

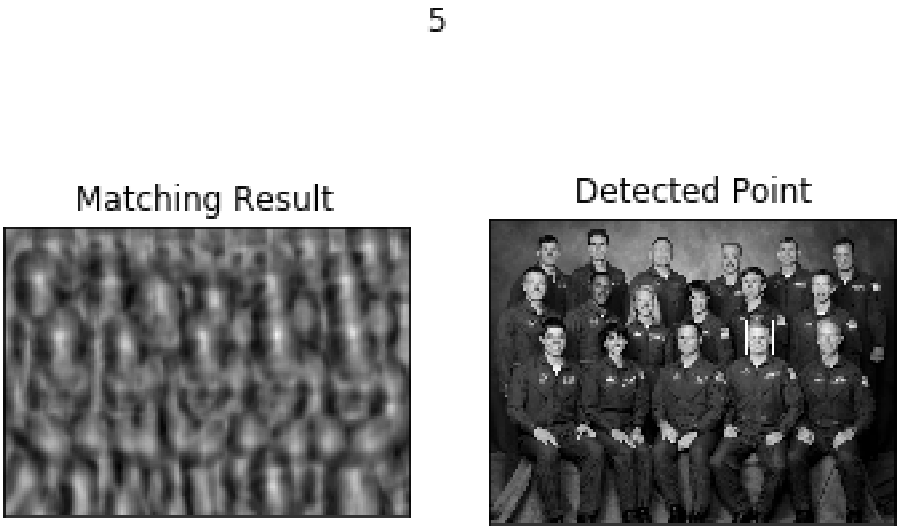
```
        plt.suptitle(method)
        plt.show()
```

```
(444, 218)
```

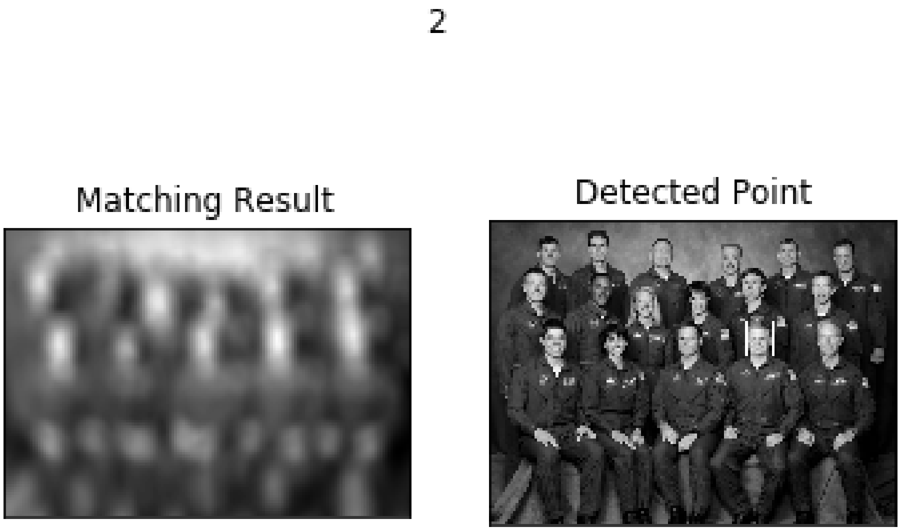
```
/usr/local/lib/python3.6/site-packages/matplotlib/cbook/deprecation.py:106: MatplotlibDeprecat
  warnings.warn(message, mplDeprecation, stacklevel=1)
```



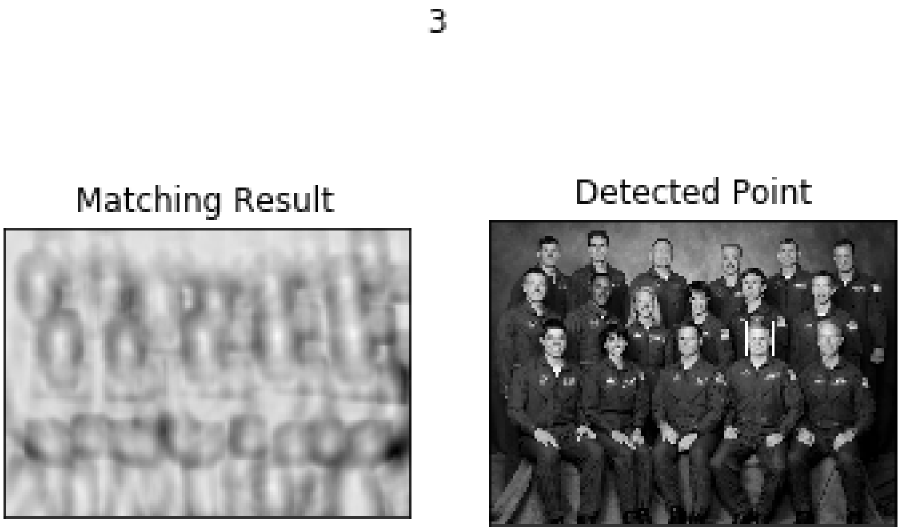
```
(444, 218)
```



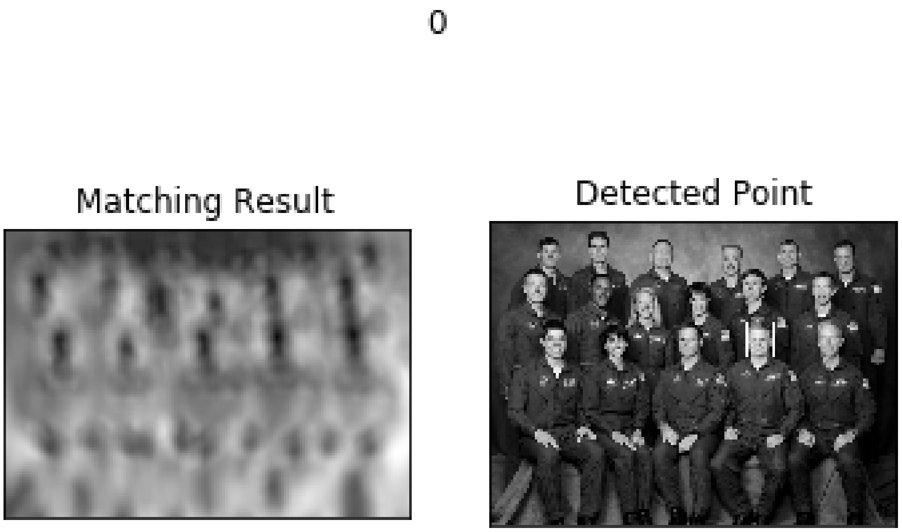
```
(444, 218)
```



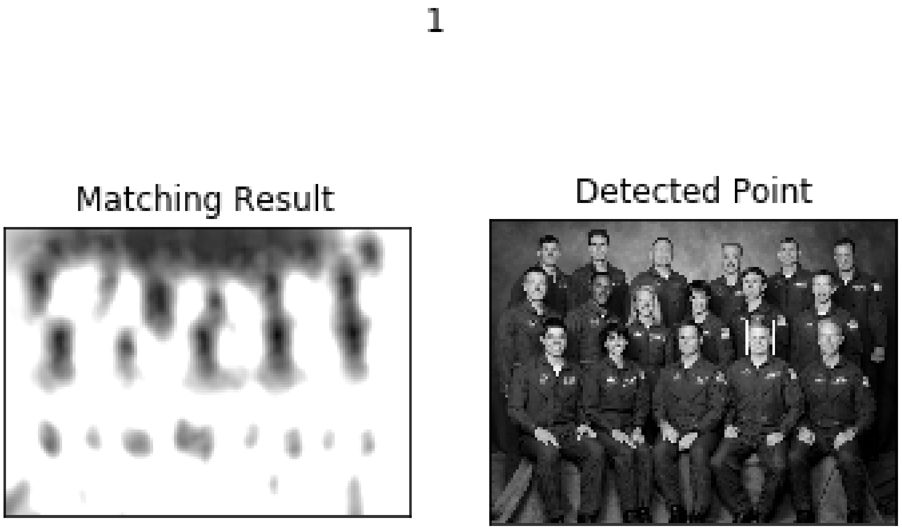
```
(444, 218)
```



```
(444, 218)
```


0
Matching Result
Detected Point

```
(444, 218)
```


1
Matching Result
Detected Point