02b.eigen_face_reduce

April 21, 2018

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In [56]: import matplotlib.pyplot as plt
         import numpy as np
         from eigenface.yalefaces import YaleFaceDb
         np.set_printoptions(precision=2, suppress=True, formatter={'float': '{: 0.2f}'.format

In [61]: def gen_images():
             images = np.empty(shape=(3,4,4))
             images[0,:,:] = np.array([[1,2,3,4],[5,6,7,8],[5,6,7,8],[5,6,7,8]])
             images[1,:,:] = np.array([[2,3,4,5],[6,7,8,9],[5,6,7,8],[5,6,7,8]])
             images[2,:,:] = np.array([[0,2,4,6],[3,5,7,9],[5,6,7,8],[5,6,7,8]])
             return images

         def convert_matrix_presentation(images):
             vector2d = []
             for image in images:
                 vector = image.flatten()
                 vector2d.append(vector)
             return np.array(vector2d)

         def calculate_eigen_vectors(vector_matrix):
             mean_vector = vector_matrix.mean(axis=0)
             vector_mean_matrix = vector_matrix[:,:] - mean_vector
             covariance_matrix = np.matmul(vector_mean_matrix,vector_mean_matrix.T) # vector_m
             u, eigen_value, eigen_vector_vi = np.linalg.svd(covariance_matrix)     # eigen_va
             # vector_mean_matrix.T (N^2 x M) x eigen_vector_vi.T (M x 1) = N^2 x 1
             # M eigen vectors with high values
             eigen_vector_ui = np.matmul(vector_mean_matrix.T, eigen_vector_vi[:,:].T).T
             # normalize eigen vectors
             norms = np.linalg.norm(eigen_vector_ui, axis=1)    # N^2 x 1
             norm_ui = np.divide(eigen_vector_ui.T, norms).T    # 1 x N^2
             return (vector_mean_matrix, mean_vector, eigen_value, norm_ui) # M x N^2, 1 x N^2

         def calculate_eigen_faces(images):
             vector_matrix = convert_matrix_presentation(images)
             (vector_mean_matrix, mean_vector, eigen_value, norm_ui) = calculate_eigen_vectors
             eigen_faces = norm_ui.reshape(images.shape)
             mean_images = mean_vector.reshape(images.shape[1], images.shape[1], 1)
             return (mean_images, eigen_faces), (vector_mean_matrix, mean_vector, eigen_value,
In [62]: # images = gen_images().astype(dtype=np.float)
         db = YaleFaceDb()
         images = db.get_list().astype(dtype=np.float)
         labels = db.get_label()
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In [63]: (mean_images, eigen_faces),(_,_,_,_) = calculate_eigen_faces(images)
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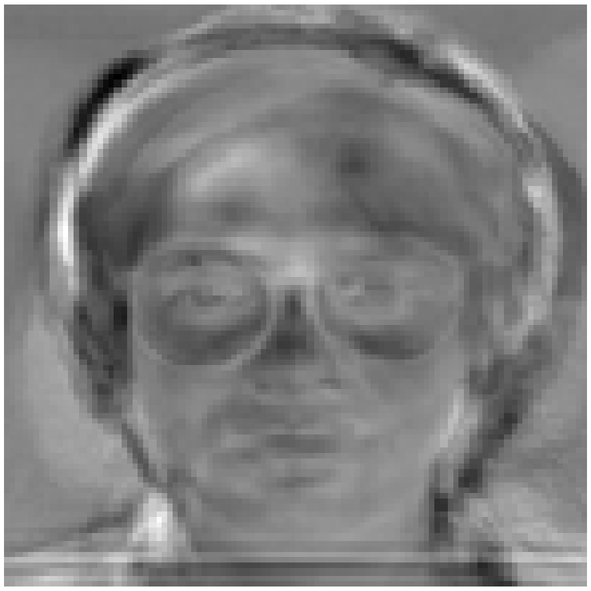
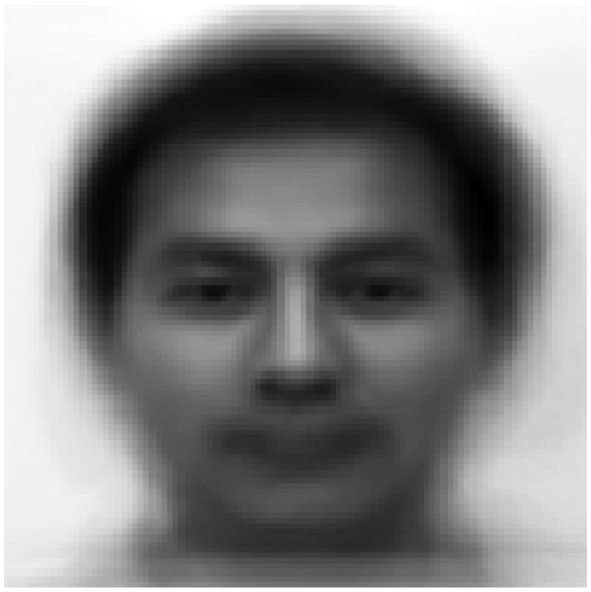
In [64]: cnt = 20
         plt.imshow(eigen_faces[cnt,:,:,0].astype(dtype=np.float), cmap='gray')
         plt.title('%s - %s'%(labels[cnt,0],labels[cnt,1]))
         plt.axis('off')
         plt.show()
```

subject02 - surprised



```
In [65]: plt.imshow(mean_images[:,:,0], cmap='gray')
         plt.title('Mean Images')
         plt.axis('off')
         plt.show()
```

Mean Images



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In [ ]:
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