

In this, we will extend the code of `pca_all` and add a neural network after `pca` which will do the job of predicting.

We take the best value of `k` found there, `k = 100`

Creating the train and test file

```
addpath("lib/")

accuracy = 0;
k = 100;
load YaleB_32x32.mat
%accuracy = 0;
num_of_passes = 0;
%for iter=0:10
    [data_size,image_size] = size(fea);
    image_size = sqrt(image_size);
    test_index = randi(data_size,1,100);
    train_index = 1:data_size;
    train_index(test_index) = [];

    train_face = fea(train_index,:);
    train_label = gnd(train_index,:);
    test_face = fea(test_index,:);
    test_label = gnd(test_index,:);
    train_size = size(train_index,2);
    test_size = size(test_index,2);
```

Mean

```
train_mean = mean(train_face,2);
train_face = train_face - train_mean;
```

Eigen-faces

```
[eigen_faces,eigen_value,~] = svd(train_face'*train_face);
eigen_faces = normc(train_face*eigen_faces);
eigen_faces = eigen_faces(:,4:k+3);
eigen_value = diag(eigen_value);
eigen_value = eigen_value(4:k+3)';
```

Projection

```
train_weights = eigen_faces' * train_face;
```

Training the model

```
nnOptions = {'lambda', 0.001, 'maxIter', 100000, 'hiddenLayers', [1000 500 250 100]};
model = learnNN(train_weights',train_label,nnOptions);
```

Iteration	1	Cost: 1.494286e+01
Iteration	2	Cost: 4.118754e+00
Iteration	3	Cost: 3.407379e+00
Iteration	4	Cost: 2.547319e+00
Iteration	5	Cost: 1.856541e+00
Iteration	6	Cost: 1.360609e+00
Iteration	7	Cost: 1.011927e+00
Iteration	8	Cost: 6.823752e-01
Iteration	9	Cost: 4.841397e-01
Iteration	10	Cost: 3.436052e-01
Iteration	11	Cost: 2.302344e-01
Iteration	12	Cost: 1.848640e-01
Iteration	13	Cost: 1.201293e-01
Iteration	14	Cost: 9.249776e-02
Iteration	15	Cost: 5.961896e-02
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Iteration	17	Cost: 3.216384e-02
Iteration	18	Cost: 2.879928e-02
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Iteration	20	Cost: 1.500259e-02
Iteration	21	Cost: 1.370602e-02
Iteration	22	Cost: 1.240971e-02
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Iteration	25	Cost: 1.046780e-02
Iteration	26	Cost: 9.590311e-03
Iteration	27	Cost: 9.198199e-03
Iteration	28	Cost: 9.078531e-03
Iteration	29	Cost: 8.498748e-03
Iteration	30	Cost: 8.181376e-03
Iteration	31	Cost: 8.069983e-03
Iteration	32	Cost: 7.728634e-03
Iteration	33	Cost: 7.308884e-03
Iteration	34	Cost: 7.046265e-03
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Iteration	36	Cost: 6.249418e-03
Iteration	37	Cost: 6.030227e-03
Iteration	38	Cost: 5.975648e-03
Iteration	39	Cost: 5.903679e-03
Iteration	40	Cost: 5.838426e-03
Iteration	41	Cost: 5.761328e-03
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Iteration	44	Cost: 5.432714e-03
Iteration	45	Cost: 5.320013e-03
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Iteration	53	Cost: 4.458917e-03
Iteration	54	Cost: 4.159027e-03
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Iteration	56	Cost: 4.081877e-03
Iteration	57	Cost: 4.045974e-03
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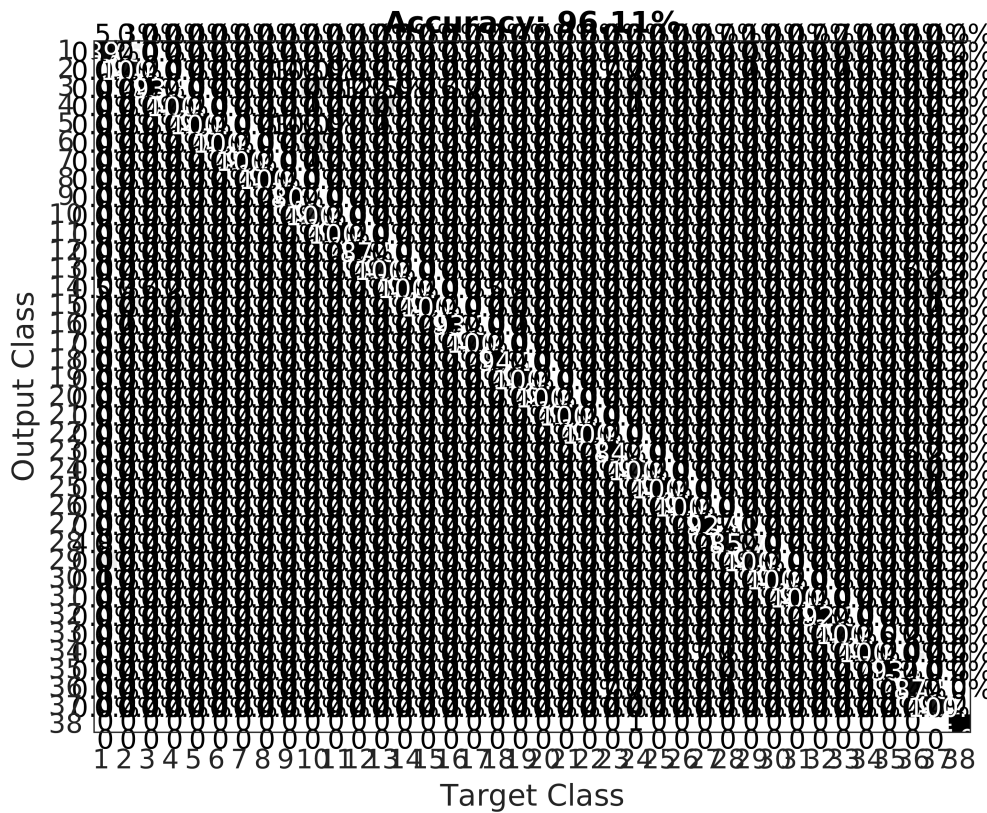
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Iteration	453	Cost: 5.364663e-05
Iteration	454	Cost: 5.347576e-05

Iteration	455	Cost: 5.324008e-05
Iteration	456	Cost: 5.315033e-05
Iteration	457	Cost: 5.311825e-05
Iteration	458	Cost: 5.300099e-05
Iteration	459	Cost: 5.291774e-05
Iteration	460	Cost: 5.285541e-05
Iteration	461	Cost: 5.260234e-05
Iteration	462	Cost: 5.249797e-05
Iteration	463	Cost: 5.238306e-05
Iteration	464	Cost: 5.227121e-05
Iteration	465	Cost: 5.214338e-05
Iteration	466	Cost: 5.208469e-05
Iteration	467	Cost: 5.207795e-05
Iteration	468	Cost: 5.194758e-05
Iteration	469	Cost: 5.186535e-05
Iteration	470	Cost: 5.176775e-05
Iteration	471	Cost: 5.171678e-05
Iteration	472	Cost: 5.167914e-05
Iteration	473	Cost: 5.136694e-05
Iteration	474	Cost: 5.116287e-05
Iteration	475	Cost: 5.063679e-05
Iteration	476	Cost: 5.038376e-05
Iteration	477	Cost: 5.020057e-05
Iteration	478	Cost: 4.988511e-05
Iteration	479	Cost: 4.890185e-05
Iteration	480	Cost: 4.826329e-05
Iteration	481	Cost: 4.787431e-05
Iteration	482	Cost: 4.650428e-05
Iteration	483	Cost: 4.602240e-05
Iteration	484	Cost: 4.590146e-05
Iteration	485	Cost: 4.582184e-05
Iteration	486	Cost: 4.573743e-05
Iteration	487	Cost: 4.556474e-05
Iteration	488	Cost: 4.535616e-05
Iteration	489	Cost: 4.514415e-05
Iteration	490	Cost: 4.498369e-05
Iteration	491	Cost: 4.492329e-05
Iteration	492	Cost: 4.471322e-05
Iteration	493	Cost: 4.459682e-05
Iteration	494	Cost: 4.445836e-05
Iteration	495	Cost: 4.430872e-05
Iteration	496	Cost: 4.414689e-05
Iteration	497	Cost: 4.408527e-05
Iteration	498	Cost: 4.404853e-05
Iteration	499	Cost: 4.395945e-05
Iteration	500	Cost: 4.375600e-05

Required CPU Time: 637.970000

```
figure(1); cla(gca);
plotConfMat(model.confusion_valid);
```



Testing the model

```
test_weights = eigen_faces'*(test_face - train_mean);
for i = 1:test_size
    pred = predictNN(test_weights(:,i)',model);
    if pred == test_label(i)
        accuracy=accuracy+1;
    end
end
%end
disp(accuracy);
```

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```
% nnOptions = {'lambda', 0.01, 'maxIter', 10000, 'hiddenLayers', [1000 500 200 75],
```