

---

```
% Add new features with convnet

N=60000;
M=10000;

% Initialize some filters
sharper1 = [0 -1 0;-1 5 -1; 0 -1 0];%81
sharper2 = [1,1,1;1,-9,1; 1,1,1];%79 or with -7
edge1 = [1 0 -1;0 0 0;-1 0 1];
edge2=[
    0,  0, -1,  0,  0;
    0,  0, -1,  0,  0;
    0,  0,  2,  0,  0;
    0,  0,  0,  0,  0;
    0,  0,  0,  0,  0;
];%68
edge3=[
    0,  0, -1,  0,  0;
    0,  0, -1,  0,  0;
    0,  0,  4,  0,  0;
    0,  0, -1,  0,  0;
    0,  0, -1,  0,  0;
];%80
edge4=[
    -1,  0,  0,  0,  0;
    0, -2,  0,  0,  0;
    0,  0,  6,  0,  0;
    0,  0,  0, -2,  0;
    0,  0,  0,  0, -1;
];%78.9
mean_f = [1 1 1; 1 1 1; 1 1 1]./9;
emboss = [-1 -1 0;-1 0 1;0 1 1];
random1 = 3*(rand(5,5)-0.5);
random2 = 3*(rand(5,5)-0.5);
random3 = 3*(rand(5,5)-0.5);
random4 = 3*(rand(5,5)-0.5);
id = 1;

% Select the filter to use in the convnet
filters = {sharper1,edge3,edge4};
% filters = {id};
%filters = {random1, random2, random3};

% Select the number of layers and the ratio used to reduce the image
size
% in the pooling layer
nb_layers = 2;
ratio = 0.6;

% Extract the features
[ M_new_data_train ,layer] =
    h2_extract_feature(M_data_train,filters,nb_layers,ratio);
```

---

---

```

[ M_new_data_test ,layer1] =
h2_extract_feature(M_data_test,filters,nb_layers,ratio);

% Train the classifier
[M_new_means, M_new_variances] =
f1_train_naive_bayes_classifier( M_new_data_train, M_labels_train );

% Test the predictions on the test data for the MNIST dataset
[M_labels_prediction, M_confusion_matrix, M_accuracy] =
f2_predict_naive_bayes_classifier( M_new_means, M_new_variances,
M_new_data_test, M_labels_test, 0.084);

% Display the confusion matrix and the accuracy
M_confusion_matrix
M_accuracy

% Display the confusion matrix through an image
figure();
colormap hot;
image(M_confusion_matrix*2);
title('confusion matrix - naive bayes classifier - MNIST with convnet
features')

clearvars random1 random2 random3 random4 emboss mean_f id filters edge1 edge2 edge3

M_confusion_matrix =

    NaN     0     1     2     3     4     5     6     7     8     9
     0    90     0     0     2     0     1     4     1     2     0
     1     0    69     1     6     0     1     8     4    10     1
     2     7     0    53    12     0     0    16     2     9     0
     3     2     1     2    82     0     0     3     5     4     1
     4     3     1     1     2    54     1    13     8     9     9
     5    10     0     0    22     1    32     7     5    21     2
     6     2     0     0     1     0     1    94     0     1     0
     7     0     1     1     2     0     0     1    89     3     2
     8     3     1     1    13     1     2     5     5    68     1
     9     2     1     0     4     4     0     1    24     8    54

M_accuracy =

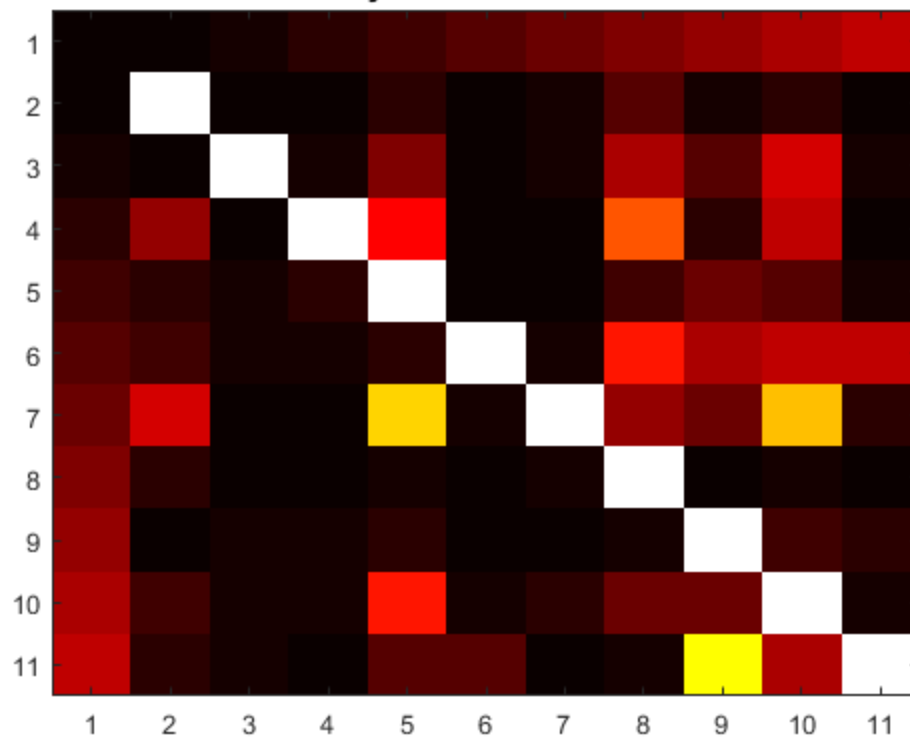
    0.6882

```

---

---

**confusion matrix - naive bayes classifier - MNIST with convnet features**



*Published with MATLAB® R2015b*