

```

clear
load a1digits.mat

% Conditional Gaussian Classifiers
C = size(digits_train,3); %class K
Size = size(digits_train,2); %matrix M
P = size(digits_train,1); %D features

Centre = mean(digits_train,2);
uki = repmat(Centre,1,Size,1);
sigmasqr = sum(sum(sum((digits_train - uki).^2))) / (P .* Size .* C);
sigma = sqrt(sigmasqr);

figure
for i = 1:C
    subplot(5,2,i)
    imagesc(reshape(Centre(:,1,i),8,8));
    axis equal;
    axis off;
    colormap gray;
    title(['\sigma = ',num2str(sigma)])
end

```



```
%% Naive Bayes Classifiers
```

```
b = digits_train;
```

```
b(b >= 0.5)=1;
```

```
b(b < 0.5) = 0;
```

```
n = sum(b,2) / Size;
```

```
nre = reshape(n,P,C);
```

```
figure
```

```
for i = 1:C
```

```
    subplot(3,4,i)
```

```
    imagesc(reshape(nre(:,i),8,8)');
```

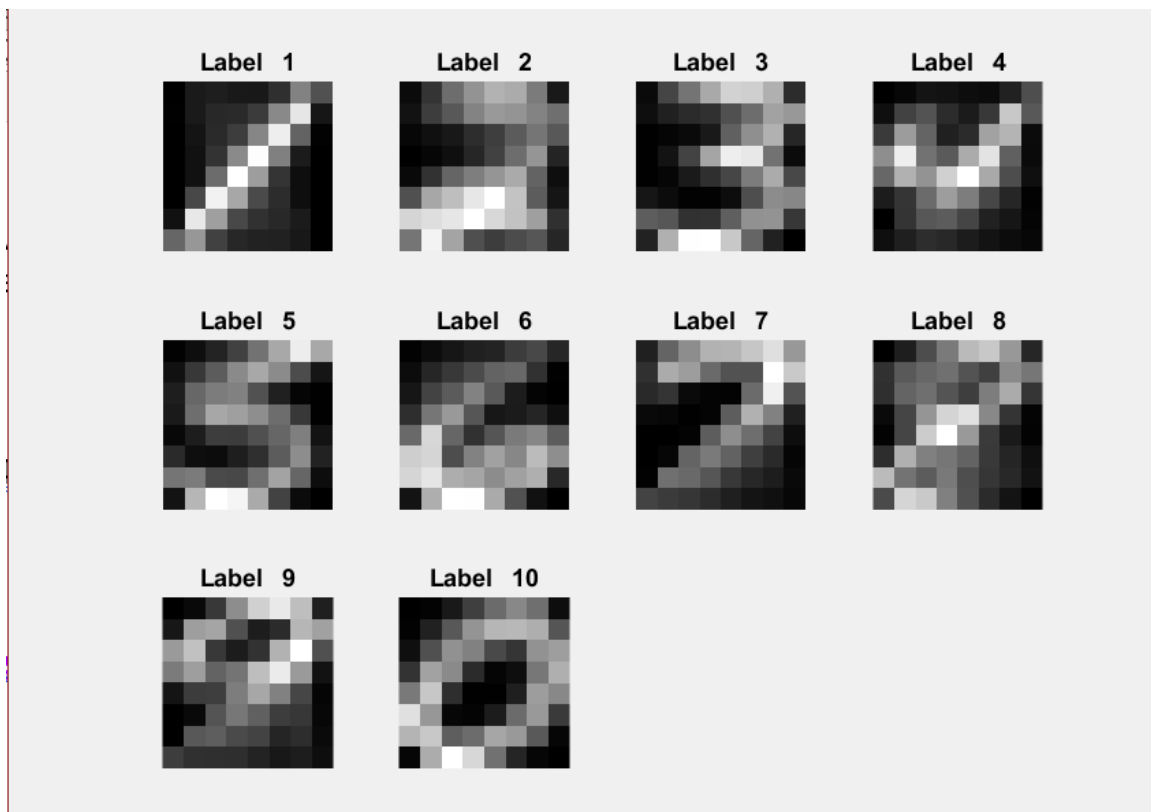
```
    axis equal;
```

```
    axis off;
```

```
    colormap gray;
```

```
    title(['Label ',num2str(i)]);
```

```
end
```



### %%Conditional Gaussian Classifiers

```

alpha = 0.1;
pCk = alpha;
class = 10;
data = 400;
pixel = 64;

for z = 1:class
    for j = 1:data
        for i = 1:class
            exponent = exp(-1/(2*sigma)*sum((digits_test(:,j,z) - Centre(:,1,i)).^2,1));
            pxC(i) = (2*pi*sigma)^(-P/2).* exponent;
        end
        px = 1/400;
        pCx = pxC * pCk./ px;
        [~,label(j)] = max(pCx);
    end

    error(z) = 400-sum(label == z);
    ErrorR(z) = sum(label == z) / data;
end
OverallRate = sum(error)/4000 * 100;

fprintf(' ');
for i = 1:C
    fprintf(' %d',i);
end
fprintf('\nGuass Classifier error:');

```

	1	2	3	4	5	6	7	8	9	10	
Guass Classifier error:	69	81	63	61	68	44	63	109	110	53	
Guass Classifier error(%):	82.75	79.75	84.25	84.75	83.00	89.00	84.25	72.75	72.50	86.75	
OverallRate =	18.02										

### %% Naive Bayes Classifiers

```

for z = 1:class
    for j = 1:data
        for i = 1:class
            bi = digits_test(:,j,z);
            bi(bi>=0.5)=1;
            bi(bi<0.5) = 0;
            ni = nre(:,i);
            pbcn(i) = 1;
            for x = 1:pixel
                if bi(x) ==1

```

```

        pbcn(i) = pbcn(i) * ni(x);
    else
        pbcn(i) = pbcn(i) * (1-ni(x));
    end
end
end
end
pCkb = pbcn./sum(pbcn);
[~,l(j)] = max(pCkb);
end
%%error and ErrorR
errorB(z) = 400-sum(l == z);
accB(z) = sum(l == z)/ data;
end

```

```

NOveralRate = sum(errorB)/4000 * 100;

```

```

fprintf(' ');
for i = 1:C
    fprintf(' %d',i);
end

```

```

fprintf('\nBayes Classifier error:');

```

```

for i = 1:C
    fprintf(' %d',errorB(i));
end

```

```

fprintf('\nBayes Classifier error(%%):');

```

```

for i = 1:C
    fprintf(' %.2f',accB(i)*100);
end

```

```

fprintf('\n\n OverallRate = ')
fprintf(' %.2f',NOveralRate)

```

```

fprintf('\n')

```

	1	2	3	4	5	6	7	8	9	10	
Bayes Classifier error:	87	106	85	85	115	59	91	120	126	55	
Bayes Classifier error(%):	78.25	73.50	78.75	78.75	71.25	85.25	77.25	70.00	68.50	86.25	

```

OverallRate = 23.23
>>

```