Pattern Recognition Report3
Chapter3

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October 20, 2015

1 Question1

In my program of this question,function u1.m compute question(a),u2.m for question(b) ,u3.m for question(c),u4.m for question(d).

1.1 (a)

According to the maximum likelihood estimation on the Gaussian distribution,we can get :

$$\hat{\mu} = \frac{1}{N}\sigma_{k=1}Nx_k \tag{1}$$

$$\hat{\Sigma} = \frac{1}{N}\Sigma_{k=1}^{N}(x_k - \hat{\mu})(x_k - \hat{\mu})^T \tag{2}$$

In terms of (1) and (2),we could compute the value of the parameters by the program . The results are as follows:

feature	$\hat{\mu}$	$\hat{\sigma}^2$
x_1	-0.0709	0.9062
x_2	-0.6047	4.2007
x_3	-0.9110	4.5419

1.2 (b)

Similar with (1) and (2),we can get the results as follows:

$$\mu_{12} = (-0.0709, -0.6047)^T \quad \Sigma_{12} = \begin{matrix} 0.9062 & 0.5678 \\ 0.5678 & 4.2007 \end{matrix}$$

$$\mu_{23} = (-0.6047, -0.9110)^T \quad \Sigma_{23} = \begin{matrix} 4.2007 & 0.7337 \\ 0.7337 & 44.5419 \end{matrix}$$

$$\mu_{13} = (-0.0709, -0.9110)^T \quad \Sigma_{13} = \begin{matrix} 0.9062 & 0.3941 \\ 0.3941 & 4.5419 \end{matrix}$$

1.3 (c)

According to (1) and (2),we get the results as follows:

$$\mu = (-0.0709, -0.6047, -0.9110)^T$$

$$\Sigma = \begin{matrix} 0.9062 & 0.5678 & -0.9110 \\ 0.5678 & 4.2007 & 0.7337 \\ 0.3941 & 0.7337 & 4.5419 \end{matrix}$$

1.4 (d)

The results computed by the program :

$$\mu = (-0.1126, 0.4299, 0.0037)^T$$

$$\Sigma = \begin{matrix} 0.0539 & 0 & 0 \\ 0 & 0.0460 & 0 \\ 0 & 0 & 0.0073 \end{matrix}$$

1.5 (e)

The value of μ_i computed by the first three algorithms are the same. In terms of that the estimate of μ is not affected by other dimensional data.So we have the same results .

Similar ,the forth method's results are the same .

1.6 (f)

According to the forms of (2).The results are the same.

2 Question2

In my program ,work3.m calculate the results.And the function $p(x_1, x_2, x_3, h)$ calculate the probability of the point (x_1, x_2, x_3) in three distribution,and decision which class it is.

2.1 (a)

When $h = 1$The results are:

point	class
$(0.5, 1.0, 0.0)^T$	ω_2
$(0.31, 1.51, -0.50)^T$	ω_2
$(-0.3, 0.44, -0.1)^T$	ω_2

2.2 (b)

When $h = 0.1$,the result are same with (a):

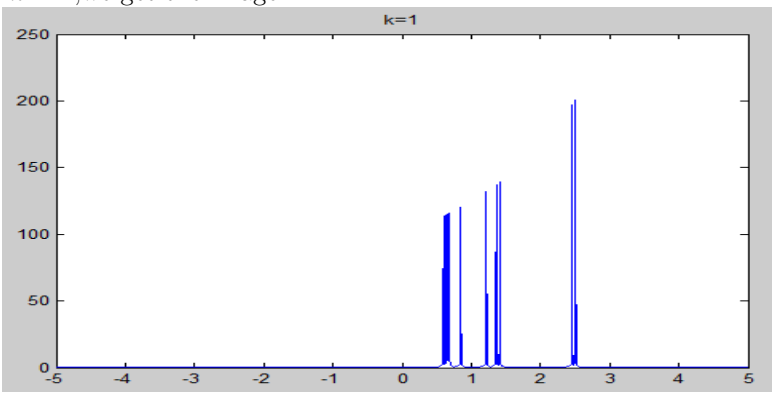
point	class
$(0.5, 1.0, 0.0)^T$	ω_2
$(0.31, 1.51, -0.50)^T$	ω_2
$(-0.3, 0.44, -0.1)^T$	ω_2

3 Question3

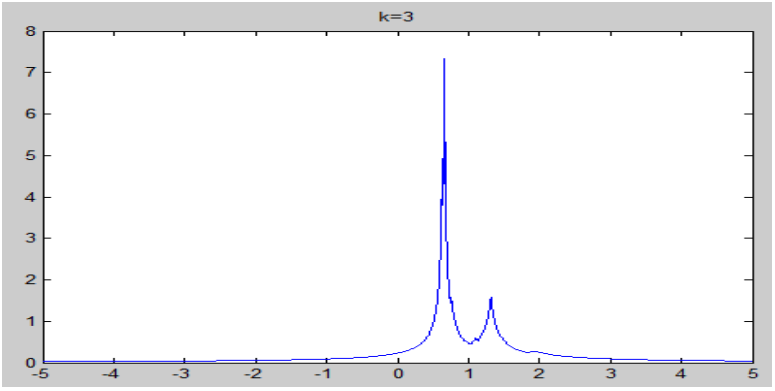
In my program ,function $v1.m$ calculate the one-dimensional density estimation of the n samples. function $v2.m$ calculate the two-dimensional density estimation of the n samples.function $v3.m$ calculate the probability of the point (x_1, x_2, x_3)

3.1 (a)

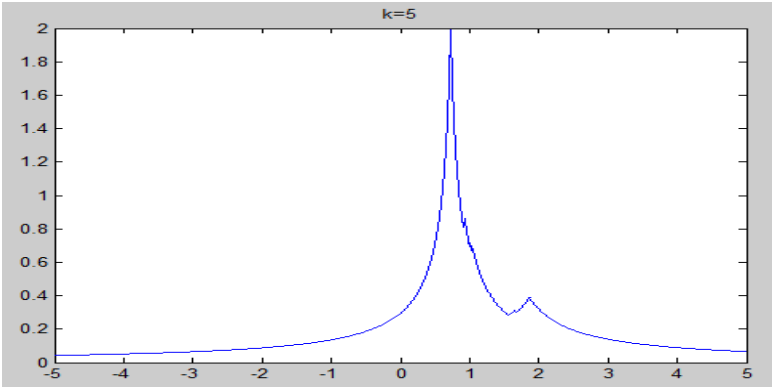
Let $k = 1$,we get the image :



Let $k = 3$, we get that:

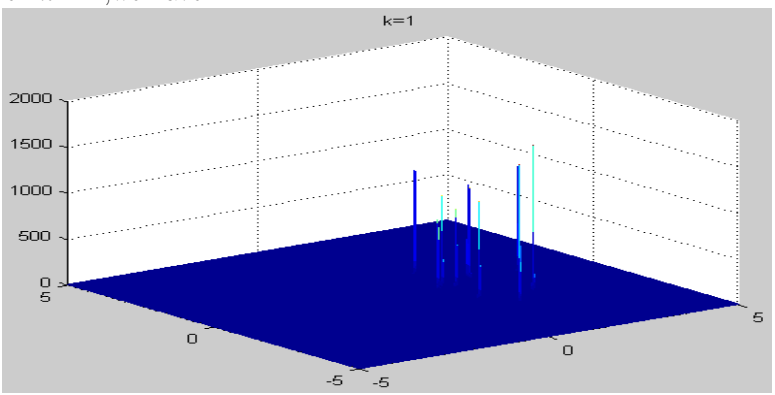


Let $k = 5$,we get that :

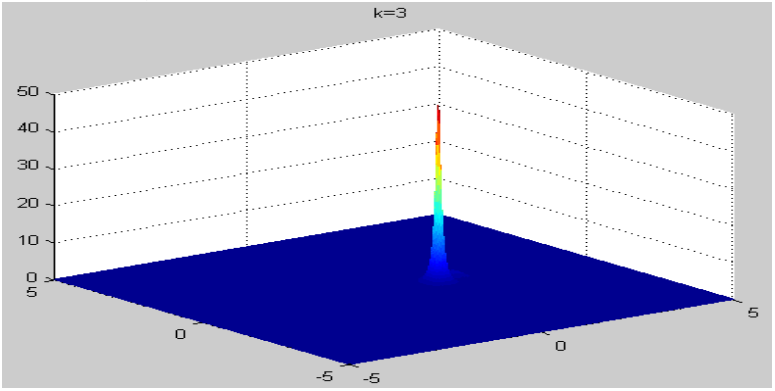


3.2 (b)

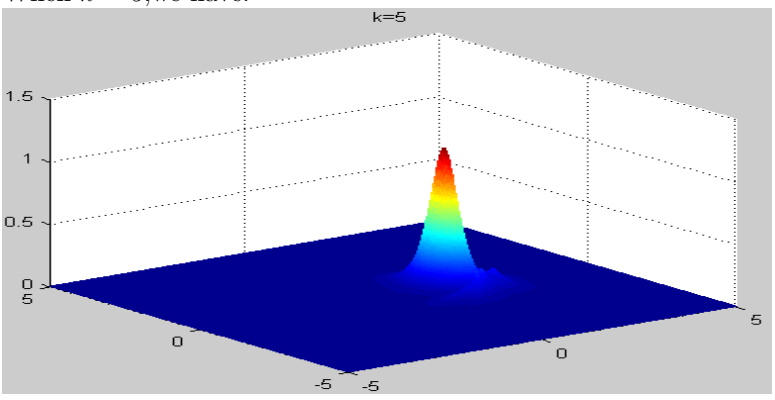
When $k = 1$,we have:



When $k = 3$,we have :



When $k = 5$,we have:



3.3 (c)

Let $k = 3$,we calculate the probability ,the results are follows:

p_{11}	0.0021
p_{21}	0.0553
p_{31}	0.0358
p_{12}	0.0043
p_{22}	9.6478e-04
p_{32}	0.0021
p_{13}	0.0026
p_{23}	0.0869
p_{33}	0.0085