The result is shown in the figure, both AIC and MDL show that M = 4.

test1.m | test2.m | test3.m | AIC.m | MDL.m | CW4.m

```
%% Initialization
clc;
clear;
close all;
load 'Ex04_Array_Signal_Snapshots'
%% Main
array = [-2 0 0; -1 sqrt(3) 0; 1 sqrt(3) 0; 2 0 0; 1 -sqrt(3) 0; -1 -sqrt(3) 0];
L_a = length(array);
L = 1000;
signal = x;
signal_cov= signal * signal' / length(signal(1, :));
[Eig_vector, Eig_value] = eig(signal_cov);
snapshots = randn(1,L) + 1i * randn(1,L);
for k = 1:L
    signal_sample(:,(k-1) * L_a + 1:k * L_a) = Eig_vector * sqrt(Eig_value) * snapshots(k);
end
signal_sample_cov = (signal_sample * signal_sample') / L;

sourceNo_AIC = AIC(L, signal_sample_cov)
sourceNo_MDL = MDL(L, signal_sample_cov)
```

命令行窗口

```
sourceNo_AIC =

     4


sourceNo_MDL =

     4
```

AIC and MDL algorithm are formulated based on the lecture slide.

$$\underline{AIC} = \left[AIC(0),\ AIC(1)\ \ldots,\ AIC(k),\ \ldots,\ AIC(N-1)\right]^T$$

$$= -2L\left(\ln\begin{bmatrix}\prod_{\ell=1}^{N} d_\ell \\ \prod_{\ell=2}^{N} d_\ell \\ \vdots \\ \prod_{\ell=N-2}^{N} d_\ell \\ \prod_{\ell=N-1}^{N} d_\ell \\ d_N\end{bmatrix} + \begin{bmatrix}N \\ N-1 \\ \vdots \\ 3 \\ 2 \\ 1\end{bmatrix} \odot \left(\ln\begin{bmatrix}N \\ N-1 \\ \vdots \\ 3 \\ 2 \\ 1\end{bmatrix} - \ln\begin{bmatrix}\sum_{\ell=1}^{N} d_\ell \\ \sum_{\ell=2}^{N} d_\ell \\ \vdots \\ \sum_{\ell=N-2}^{N} d_\ell \\ \sum_{\ell=N-1}^{N} d_\ell \\ d_N\end{bmatrix}\right)\right)$$

$$+2\begin{bmatrix}0 \\ 1 \\ \vdots \\ N-3 \\ N-2 \\ N-1\end{bmatrix} \odot \begin{bmatrix}2N \\ 2N-1 \\ \vdots \\ N+3 \\ N+2 \\ N+1\end{bmatrix};\ \text{an } (N \times 1) \text{ real vector} \qquad (52)$$

$$\underline{MDL} = \left[MDL(0),\ MDL(1)\ \ldots,\ MDL(k),\ \ldots,\ MDL(N-1)\right]^T$$

$$= -L\left(\ln\begin{bmatrix}\prod_{\ell=1}^{N} d_\ell \\ \prod_{\ell=2}^{N} d_\ell \\ \vdots \\ \prod_{\ell=N-2}^{N} d_\ell \\ \prod_{\ell=N-1}^{N} d_\ell \\ d_N\end{bmatrix} + \begin{bmatrix}N \\ N-1 \\ \vdots \\ 3 \\ 2 \\ 1\end{bmatrix} \odot \left(\ln\begin{bmatrix}N \\ N-1 \\ \vdots \\ 3 \\ 2 \\ 1\end{bmatrix} - \ln\begin{bmatrix}\sum_{\ell=1}^{N} d_\ell \\ \sum_{\ell=2}^{N} d_\ell \\ \vdots \\ \sum_{\ell=N-2}^{N} d_\ell \\ \sum_{\ell=N-1}^{N} d_\ell \\ d_N\end{bmatrix}\right)\right)$$

$$+\frac{1}{2}\begin{bmatrix}0 \\ 1 \\ \vdots \\ N-3 \\ N-2 \\ N-1\end{bmatrix} \odot \begin{bmatrix}2N \\ 2N-1 \\ \vdots \\ N+3 \\ N+2 \\ N+1\end{bmatrix} \ln L;\quad \text{an } (N \times 1) \text{ real vector} \qquad (53)$$