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用 BP 神经网络进行股票预测

1、目的：掌握 **BP** 神经网络算法及其 **Matlab** 环境下编程实现

2、题目：用 **BP** 神经网络对附表 **3.1** 的训练数据，预测附表 **3.2** 中数据的收盘价

3、设计过程：用“**5－7－1**”**BP** 神经网络进行训练和预测

4、**Matlab** 源程序如下：

```
P=[
   12.49    12.49    12.21    12.22    13607255    167520944;
   12.22    12.72    12.18    12.66    29082744    363202560;
   12.58    12.74    12.45    12.46    22802103    286893924;
   12.42    12.56    12.26    12.3     15584448    193329056;
   12.26    12.68    12.26    12.67    19746980    246494080;
   12.82    12.97    12.55    12.78    27583354    351219296;
   12.77    13.42    12.66    13.36    43462230    570755526;
   13.01    13.37    13.01    13.19    31144350    410931872;
   13.16    13.59    13.14    13.43    23668448    316467424;
   13.49    13.5     13.12    13.19    19269676    255614928;
   13.19    13.72    13.02    13.6     36358424    487460544;
   13.6     13.73    13.51    13.62    23845804    324467584;
   13.62    13.71    12.95    12.99    22462342    299506784;
   12.99    13.12    12.75    12.89    20363860    263010736;
   12.7     12.83    12.2     12.53    17330308    217278656;
   12.4     12.57    12.31    12.41    7140875     88986592;
   12.49    12.55    12       12.04    10509253    128913712;
   12.09    12.25    11.97    12.01    7511755     90902304;
   12.02    12.18    11.96    12.15    7514297     90803536;
   12.1     12.32    12.03    12.14    7283098     88802800;
   12.1     12.15    11.58    11.71    11352825    133326640;
   11.73    11.92    11.57    11.59    7573305     89033640;
   11.67    11.9     11.21    11.89    10277141    119762592;
   11.76    11.89    11.61    11.73    11368580    133410400;
   11.44    12.65    11.36    12.11    35556024    430798464;
   12.09    12.29    11.67    11.93    13918940    166163120;
   11.93    12.02    11.75    11.87    10202644    121107256;
   12       12.02    11.79    11.9     8337176     98893768;
   11.9     11.96    11.82    11.89    6640187     78795592;
   11.91    11.95    11.84    11.93    6213950     73982808;
   11.9     12.2     11.85    11.98    10342758    124693128;
```

```
 11.98    12.02    11.71    11.96    6952637     82441696;
 11.85    12.2     11.81    12.19    9931446     119920744;
 12.19    12.49    12.15    12.41    16455316    203530048;
12.38    12.55    12.27    12.34    11542922    143000448;
 12.34    12.77    12.32    12.66    17138950    216009424;
 12.67    12.71    12.42    12.59    14056620    176113952;
12.6     12.63    12.45    12.62    11645531    146168336;
 12.6     12.97    12.22    12.28    21390096    270573504;
 12.28    12.64    12.24    12.44    14494819    180426080;
 12.47    12.52    12.3     12.37    10144725    125570008;
 12.3     12.35    12.05    12.26    9879639     120649136;
 12.25    12.36    12       12.04    9657725     117189536;
 12.1     12.16    11.87    11.96    7706144     92401216;
 12       12.04    11.78    11.79    8360817     99209584;
 11.78    11.87    11.29    11.45    19292420    221751744;
 11.49    11.54    11.3     11.53    7994094     91515968;
 11.55    11.78    11.48    11.77    12833044    149231184;
 11.76    11.83    11.66    11.72    8246960     96896400;
 11.76    11.85    11.64    11.81    6818095     80201072;
 11.8     11.91    11.75    11.87    6776051     80297552;
 11.85    11.89    11.62    11.78    7782495     91447728;
 11.82    11.83    11.66    11.69    6816861     79911968;
 11.69    11.69    11.45    11.46    7720525     88956312;
 11.47    11.69    11.45    11.63    5151524     59730096;
 11.69    11.89    11.69    11.8     13983169    165247696;
 11.8     11.88    11.76    11.83    11766064    138909840
]';
for i=1:5
    P(i,:)=(p(i,:)-min(p(i,:)))/(max(p(i,:))-min(p(i,:)));
end
```

t=[	12.89	11.87	12.44
12.66	12.53	11.9	12.37
12.46	12.41	11.89	12.26
12.3	12.04	11.93	12.04
12.67	12.01	11.98	11.96
12.78	12.15	11.96	11.79
13.36	12.14	12.19	11.45
13.19	11.71	12.41	11.53
13.43	11.59	12.34	11.77
13.19	11.89	12.66	11.72
13.6	11.73	12.59	11.81
13.62	12.11	12.62	11.87
12.99	11.93	12.28	11.78

```
11.69 | 11.63 | 11.83 | ];
11.46 | 11.8  | 11.82 |
for i=1:57
    T(1,i)=(t(1,i)-min(t))/(max(t)-min(t));
end
threshold=[0 1;0 1;0 1;0 1;0 1];
net=newff(threshold,[7,1],{'tansig','logsig'},'trainlm');
net=train(net,P,T);
y_test=sim(net,P)'
Y_test=y_test*(max(t)-min(t))+min(t);
Y_test
            P_test=[
                11.75 11.85 11.7  11.82 18916234 223018080
                11.84 11.97 11.79 11.96 25926092 307388896
                11.97 11.98 11.83 11.93 17332436 206247184
                11.9  11.9  11.75 11.8  16090465 190226112
                11.76 11.99 11.75 11.9  25872632 307294816
                11.89 11.93 11.77 11.84 22329792 264373664
                11.86 11.89 11.64 11.67 19268084 226253664
                11.71 11.88 11.58 11.83 22292468 262448816
                11.83 12    11.8  11.99 33137402 394032864
                11.94 11.94 11.6  11.74 19153084 226116128
                11.74 11.77 11.54 11.6  12339411 143391136
                11.55 11.55 10.91 10.94 19457130 218281936
                10.97 11.09 10.74 10.91 11189915 121600920
                10.94 11.08 10.82 11    12121000 132738072
                11    11    10.76 10.83 13177050 142735072
                10.81 10.91 10.56 10.67 10931088 117223056
                11.84 11.86 11.66 11.71 8286360  97152416
                ];
for i=1:5
    P_test(i,:)=(p_test(i,:)-min(p_test(i,:)))/(max(p_test(i,:))-min(p_test(i,:)));
end
format long ;
y=sim(net,P_test)'
Y=y*(max(t)-min(t))+min(t);
Y
figure;
plot(1:57,t,'k*');
title('预测误差（%）');
hold on;
plot(1:57,Y_test,'bo');
title('预测误差（%）');
hold off;
```

W=[	11.9	11.74	10.83
11.82	11.84	11.6	10.67
11.96	11.67	10.94	11.71
11.93	11.83	10.91	];
11.8	11.99	11	

```
figure;
plot(1:17,W,'k*');
title('预测误差（%）');
hold on;
plot(1:17,Y,'bo');
title('预测误差（%）');
hold off;
```

BP 神经网络训练运行结果如图 3－1：

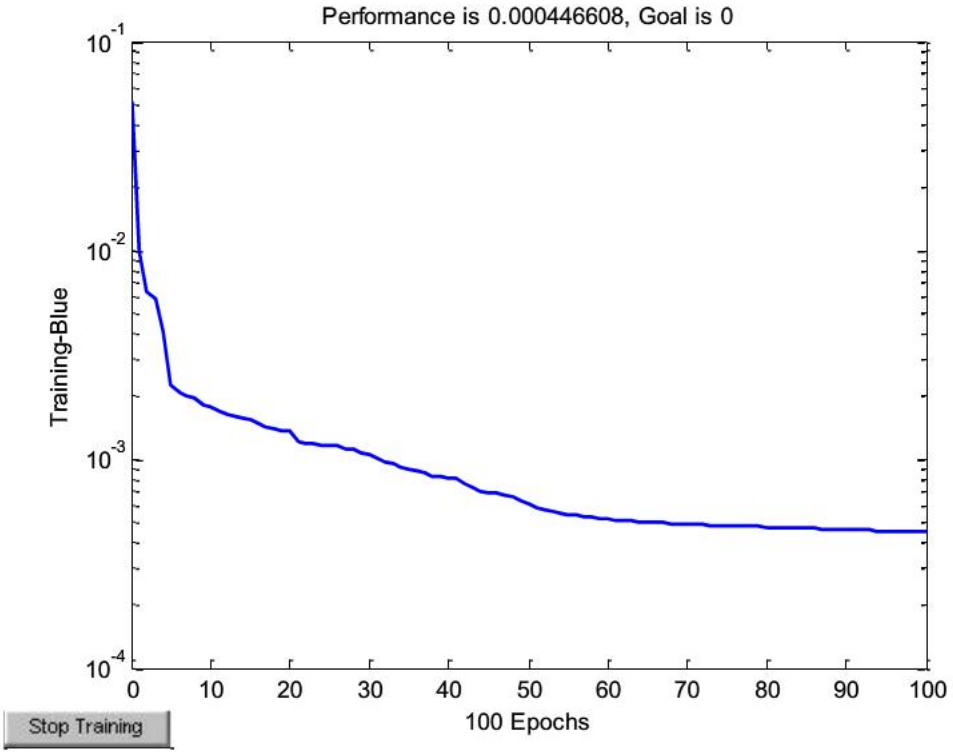

图 3－1　BP 神经网络训练效果

BP 神经网络对训练样本的预测结果与实际结果比较见图 3—2：

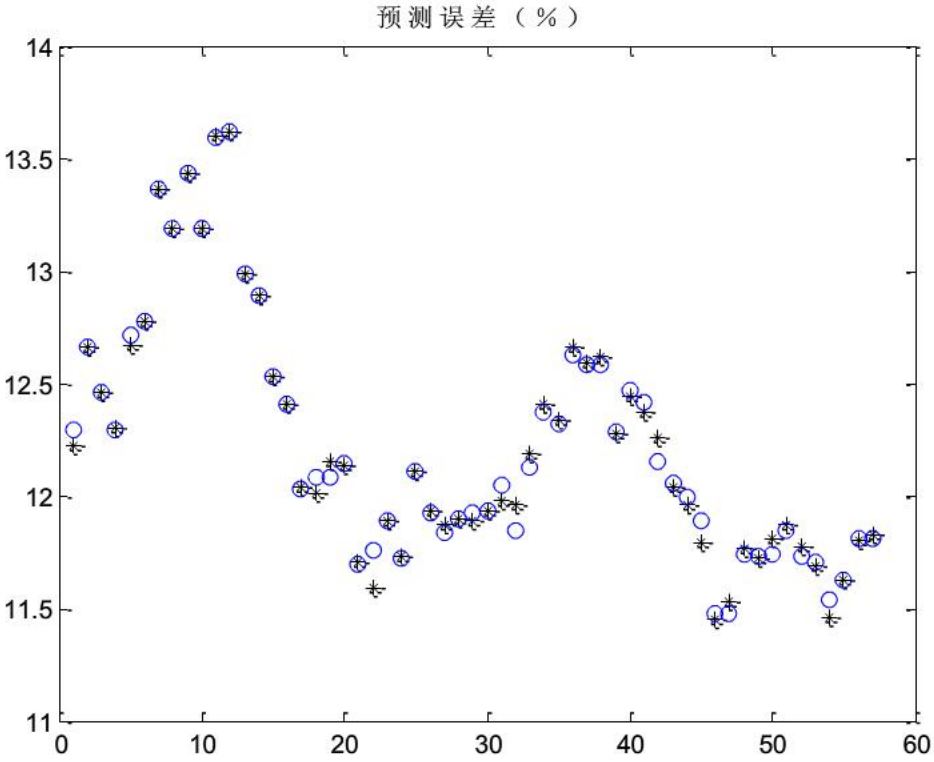

图 3—2　BP 神经网络对训练样本的预测误差　　*代表实际值 **o** 代表预测值

由图 3—2 可以看出，BP 神经网络对训练样本的预测精度很高，从表 3—1 中也可看出精度很高：

表 3—1 训练样本的预测精度

序号	收盘价	预测值	误差
1	12.22	12.29763217	-0.07763217
2	12.66	12.65885601	0.001143986
3	12.46	12.46283617	-0.00283617
4	12.3	12.29513407	0.004865926
5	12.67	12.71289171	-0.04289171
6	12.78	12.77709325	0.00290675
7	13.36	13.35989241	0.000107585
8	13.19	13.19060209	-0.00060209
9	13.43	13.43261436	-0.00261436
10	13.19	13.18914428	0.000855724
11	13.6	13.59195055	0.008049448
12	13.62	13.61994652	5.34764E-05
13	12.99	12.99103834	-0.00103834
14	12.89	12.8936052	-0.0036052
15	12.53	12.52877733	0.001222669

16	12.41	12.40926015	0.000739852
17	12.04	12.03393918	0.006060818
18	12.01	12.07936773	-0.06936773
19	12.15	12.08356782	0.066432176
20	12.14	12.14121235	-0.00121235
21	11.71	11.69643784	0.013562161
22	11.59	11.7566428	-0.1666428
23	11.89	11.89066117	-0.00066117
24	11.73	11.72772523	0.002274773
25	12.11	12.10970771	0.00029229
26	11.93	11.92386849	0.006131506
27	11.87	11.83779827	0.032201727
28	11.9	11.90164011	-0.00164011
29	11.89	11.92387633	-0.03387633
30	11.93	11.93705917	-0.00705917
31	11.98	12.04790222	-0.06790222
32	11.96	11.84282612	0.117173883
33	12.19	12.12454842	0.065451576
34	12.41	12.37059757	0.039402428
35	12.34	12.32257557	0.017424428
36	12.66	12.62448938	0.035510618
37	12.59	12.58647808	0.003521925
38	12.62	12.5833798	0.036620198
39	12.28	12.2819888	-0.0019888
40	12.44	12.47068646	-0.03068646
41	12.37	12.41603301	-0.04603301
42	12.26	12.1536367	0.106363301
43	12.04	12.05996079	-0.01996079
44	11.96	11.99437798	-0.03437798
45	11.79	11.88992702	-0.09992702
46	11.45	11.47496748	-0.02496748
47	11.53	11.48059295	0.049407045
48	11.77	11.7376807	0.032319304
49	11.72	11.73221453	-0.01221453
50	11.81	11.7374465	0.072553498
51	11.87	11.8499229	0.0200771
52	11.78	11.73052918	0.049470818
53	11.69	11.70480346	-0.01480346
54	11.46	11.53879929	-0.07879929
55	11.63	11.62484057	0.005159431
56	11.8	11.81097454	-0.01097454
57	11.83	11.81020274	0.019797259

BP 神经网络对检验训练样本的分类结果与实际分类结果比较见图 3—3：

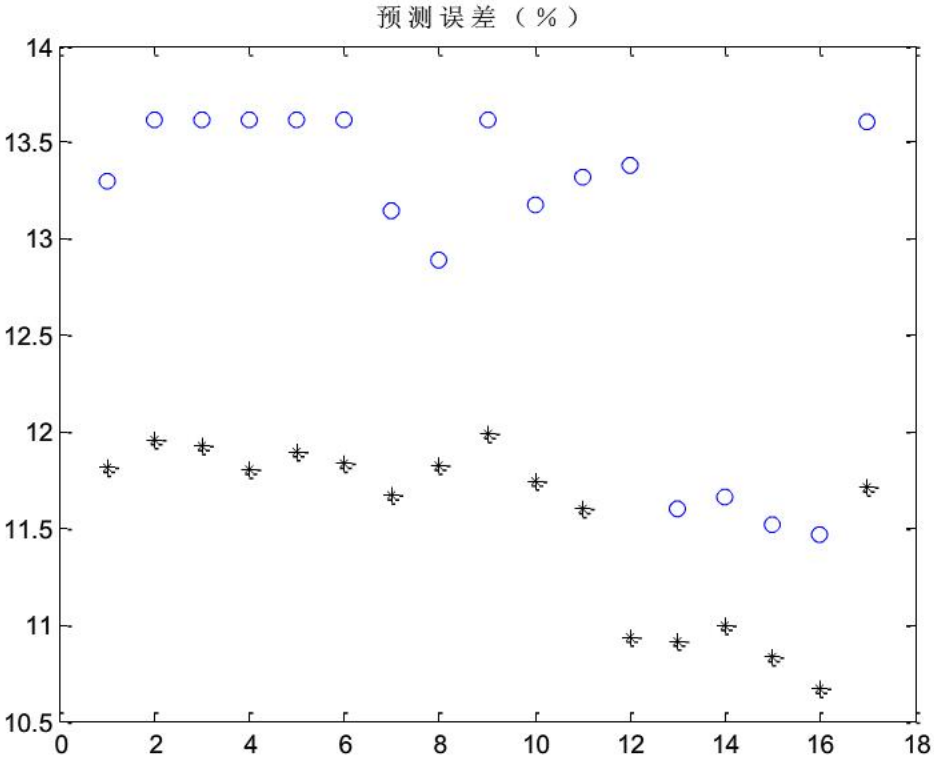

图 3—3　BP 神经网络对检验训练样本的预测误差　*代表实际值 **o** 代表预测值

BP 神经网络对检验训练样本的预测精度如表 3—2：

表 3—2 检验训练样本的预测精度

序号	实际值	预测值	误差	精度（%）
1	11.82	13.30011603	-1.48011603	12.52213221
2	11.96	13.61929544	-1.65929544	13.87370772
3	11.93	13.6199137	-1.6899137	14.16524473
4	11.8	13.61600789	-1.81600789	15.38989735
5	11.9	13.61842072	-1.71842072	14.44051024
6	11.84	13.61677364	-1.77677364	15.00653412
7	11.67	13.15039445	-1.48039445	12.6854709
8	11.83	12.89308868	-1.06308868	8.986379369
9	11.99	13.61986107	-1.62986107	13.59350352
10	11.74	13.17313699	-1.43313699	12.20729976
11	11.6	13.31949608	-1.71949608	14.82324208
12	10.94	13.37636315	-2.43636315	22.27022987
13	10.91	11.59602062	-0.68602062	6.287998309
14	11	11.65833819	-0.65833819	5.984892608
15	10.83	11.52234957	-0.69234957	6.392886148

16	10.67	11.46930105	-0.79930105	7.491106417
17	11.71	13.60921563	-1.89921563	16.21875006

总结：网络预测能力好，但是训练能力差时，预测能力也差，并且一定程度上，随训练能力地提高，预测能力也提高