```
In [3]: runfile('/Users/noemi/Documents/Uni/Astrostatistics/working/lec13.py', wdir='/Users/noemi/Documents/Uni/Astrostatistics/working')

Import data:
(1797, 8, 8)

Reduced dimensions:
(1797, 2)

Validation set:
pred true
8    8
1    1
9    9
5    5
9    9
7    7
1    6    <--
4    4
8    8
8    8
4    4
9    9
6    6
8    8
2    2
7    7
9    9
8    8
5    5
1    1
6    6
9    9
4    8    <--
8    8
0    0
4    4
5    5
3    3
7    7
3    3
3    3
7    7
0    0
4    4
1    1
3    3
5    5
0    0
5    5
1    1
1    1
9    9
2    2
4    4
0    0
8    8
6    6
1    1
3    3
3    3
3    3
2    2
7    7
9    9
6    6
```

```
1    1
0    0
8    8
6    8
8    3
3    5
5    2
2    7
9    9
2    3
2    2
2    7
1    2
2    2
1    1
6    1
1    6
5    1
9    5
2    9
3    2
7    3
9    7
9    9
3    9
0    3
4    0
3    4
8    3
9    8
2    9
3    2
1    3
5    1
7    5
6    7
2    6
6    2
8    6
7    8
0    3
5    7
0    0
6    5
1    0
1    6
6    1
9    1
9    6
1    9
1    1    <--
4    4    <--
9    5
1    9
2    1
4    2
1    4
6    1
     6
```

```
2    2
2    2
3    2
9    3
9    9
5    5
6    6
9    9
3    3
1    1
3    3
4    2
6    4
8    6
7    8
5    7
9    5
0    9
9    0
7    7
3    9
0    7
6    3
3    0
9    6
8    3
8    9
3    8
6    8
7    3
0    6
9    7
0    0
9    9
2    0
8    9
1    2
7    8
3    1
4    7
2    3
3    4
1    2
5    3
9    1
6    5
1    8    <--
8    8
5    6    <--
6    6
3    3
5    5
6    6
7    7
3    3
4    4
4    4
6    6
8    8
6    1    <--
```

```
1   1
5   8   <--
6   6
5   9
9   5
9   9
0   9
5   0
0   5
4   0
4   8
2   4
9   2
3   9
7   3
4   7
4   4
3   4
0   3
1   0
8   1
8   8
5   8
1   5
9   1
6   9
5   6
1   5
4   1
2   4
1   2
7   1
2   7
4   2
5   4
2   5
5   2
4   5
4   4
1   4
1   1
6   6
9   9
2   3
5   9
7   ?
6   ?
9   6
3   ?
9   9
3   2
3   ?
6
9
9
2
5
1
7
```
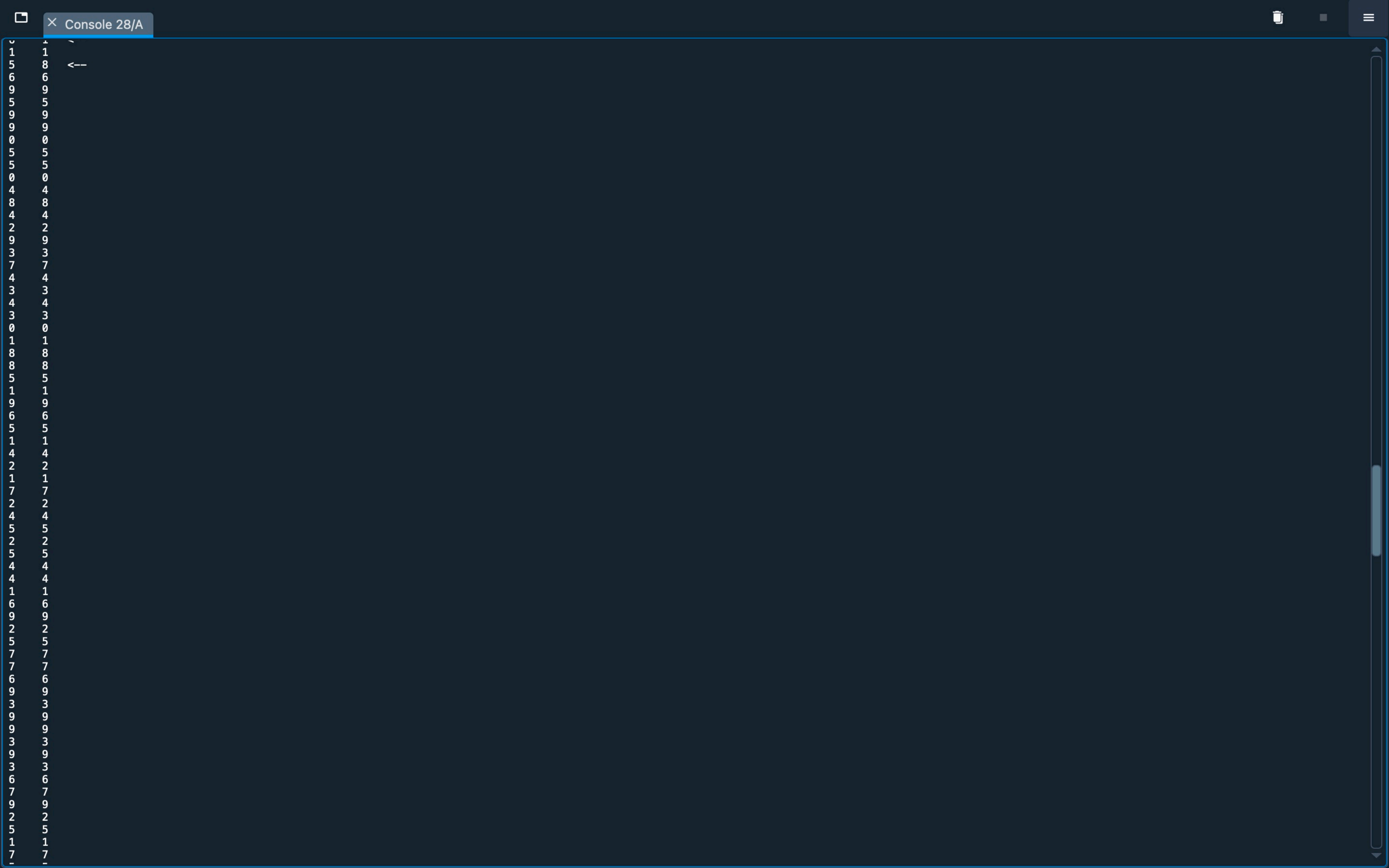
```
2    2
5    5
1    1
7    7
5    5
1    8    <--
8    8
9    3    <--
7    7
3    3
9    9
8    8
2    2
3    3
0    3
0    0
7    7
5    5
1    1
8    8
8    6
6    1
1    9
9    9
9    0
0    7
7    2
2    4
4    0
0    9
2    2
4    4
2    2
6    6
9    9
7    7
2    2
7    7
1    1
8    8
8    8
1    1
5    5
5    5
3    3
5    5
5    5
0    0
5    5
9    9
3    3
0    0
4    4
8    8
2    2
0    0
8    8
7    7
3    3
9    9
7    7
0
```

```
9    9
7    7
0    0
0    0
3    3
3    2
2    6
6    3
4    4
2    2
2    3
3    0
9    9
8    9    <--
5    5
7    7
5    5
0    0
8    8
6    6
6    6
1    1
6    6
2    2
8    8
9    9
7    7
6    6
8    8
3    3
0    0
6    6
6    6
0    0
7    7
9    7    <--
7    7
8    8
4    4
1    1
2    2
2    2
8    8
0    4    <--
5    5
8    8
4    4
1    1
```

Accuracy of training digits:
1.0

Accuracy of test digits:
0.9638888888888889

Confusion matrix of training digits:
```
[[149   0   0   0   0   0   0   0   0   0]
 [  0 147   0   0   0   0   0   0   0   0]
 [  0   0 139   0   0   0   0   0   0   0]
 [  0   0   0 141   0   0   0   0   0   0]
 [  0   0   0   0 153   0   0   0   0   0]
```

```
5    5
0    0
8    8
6    6
6    6
1    1
6    6
2    2
8    8
9    9
7    7
6    6
8    8
3    3
0    0
6    6
6    6
0    0
7    7
9    7      <--
7    7
8    8
4    4
1    1
2    2
2    2
2    2
8    8
0    4      <--
5    5
8    8
4    4
1    1


Accuracy of training digits:
1.0

Accuracy of test digits:
0.9638888888888889

Confusion matrix of training digits:
[[149   0   0   0   0   0   0   0   0   0]
 [  0 147   0   0   0   0   0   0   0   0]
 [  0   0 139   0   0   0   0   0   0   0]
 [  0   0   0 141   0   0   0   0   0   0]
 [  0   0   0   0 153   0   0   0   0   0]
 [  0   0   0   0   0 149   0   0   0   0]
 [  0   0   0   0   0   0 146   0   0   0]
 [  0   0   0   0   0   0   0 144   0   0]
 [  0   0   0   0   0   0   0   0 136   0]
 [  0   0   0   0   0   0   0   0   0 133]]

Confusion matrix of test digits:
[[29  0  0  0  0  0  0  0  0  0]
 [ 0 34  0  0  0  0  1  0  0  0]
 [ 0  0 38  0  0  0  0  0  0  0]
 [ 0  0  0 41  0  0  0  0  0  1]
 [ 1  1  0  0 26  0  0  0  0  0]
 [ 0  0  0  0  1 32  0  0  0  0]
 [ 0  1  0  0  0  1 33  0  0  0]
 [ 0  0  0  0  0  0  0 34  0  1]
 [ 0  2  0  0  1  1  0 34  0]
 [ 0  0  0  0  0  0  0  0  1 46]]

In [4]:
```