

Coursework 2 – Report

a) dataset structure, network configuration

For dataset structure:

1) Without applying PCA

[illegible]

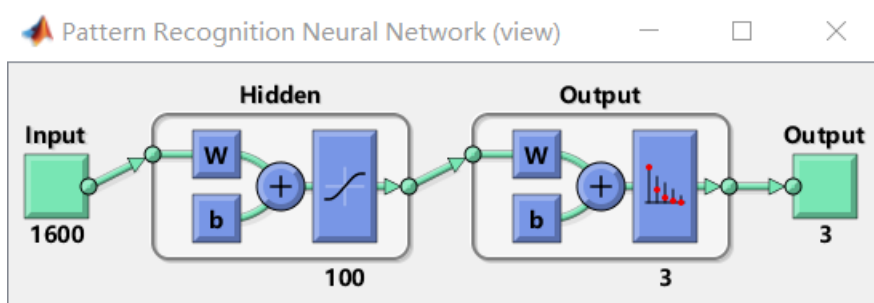
2) Applying PCA

[illegible]

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	1	2	3	4	5	6	7	8	9
1	1	1	1	1	1	1	1	1	1
2	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									

For network configuration



b) Example

Setting:

Size of image	Hidden layers number	Number of neurons in each layer	Accuracy (%)
40 * 40	1	100	55.8

Result:

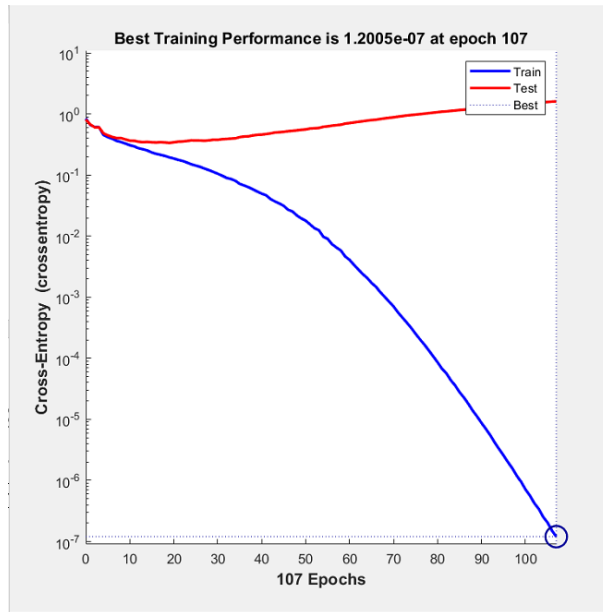
Confusion Matrix				
Output Class	1	2	3	
	116 19.3%	95 15.8%	25 4.2%	49.2% 50.8%
	68 11.3%	88 14.7%	30 5.0%	47.3% 52.7%
	16 2.7%	31 5.2%	131 21.8%	73.6% 26.4%
				55.8% 44.2%
				Target Class

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Raw: the raw represents the test examples that are used for the current testing.

Col: the col represents the guesing result produce by NN model. The last col is the ratio of accuracy of NN guesing of a class.

Other: the number above is the number of current class (NN guess - examples). The last raw is the ratio of accuracy of NN guesing of the example that given by test group.



The graph illustrates that the performance of NN model is unsatisfied. This may because large size images contain more pixels about the irrelevant information. The management of images can be improved.

c) Comparison

1) In terms of number of neurons (nodes of each layer)

Without applying PCA:

Size of image	Hidden layers number	Number of neurons in each layer	Accuracy (%)
200 * 200	1	25	53.2
		100	52
		200	54.3
100 * 100		25	50.5
		100	53.7
		200	52.5
40 * 40		500	54
		25	49.7
		100	55.8
		200	55

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		500	54.2
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Conclusion:

It seems that the number of neurons in each hidden layer have limited effect on the performance of NN model. However, it can be illustrated that when the size of the image is $100 * 100$ or $200 * 200$, there are higher performance of the group which has number of neurons more than 100 in each hidden layer than those has 25 neurons in each hidden layer. Eliminating the error of date, the conclusion is that the neurons in each hidden layer affects the performance of NN when it has too limited number.

applying PCA:

Size of image	Hidden layers number	Number of neurons in each layer	Accuracy (%)
200 * 200	1	25	matlab couldn't calculate 40000 * 40000 array
		100	
		200	
100 * 100		25	42
		100	39.3
		200	38.7
		500	41.3
40 * 40		25	43.7
		100	42
		200	37.7
		500	39

Conclusion:

Eliminating the error of date, the performance of NN model raise when there is less number of neurons in each hidden layer after applying PCA

2) In terms of hidden layers number

Without applying PCA:

Size of image	Hidden layers number	Number of neurons in each layer	Accuracy (%)
200 * 200	1	100	52
	2		52.7
	3		54.5
100 * 100	1	100	53.7
	2		54.3
	3		49
40 * 40	1	100	55.8
	2		54
	3		55

Conclusion:

It seems that the number of hidden layer have limited effect on the performance of NN model. However, it can be illustrated that when the size of the image is $200 * 200$, the performance of

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NN model raises by the hidden layer number. Eliminating the error of date, the conclusion is that the performance of NN model raises by the hidden layer number when training object has abundant details to recognize.

Applying PCA:

Size of image	Hidden layers number	Number of neurons in each layer	Accuracy (%)
200 * 200	1	100	matlab couldn't calculate 40000 * 40000 array
	2		
	3		
100 * 100	1	100	39.3
	2		37.5
	3		40.7
40 * 40	1	100	37.2
	2		42
	3		38.7

Conclusion:

Eliminating the error of date, the NN model have similar performance with different number of hidden layers.

3) In terms of size of image:

Form the tables above we can illustrate that there is higher performance of small-size images than large-size image. This may because large size images contain more pixels about the irrelevant information.

4) Conclusion in terms of size of PCA:

The data shows that the performance of NN model without applying PCA is better than those applying PCA. This may because PCA reduce the dimension of input X which loses information of the image greatly. This process affects the training.