

Artificial Neural Networks

Homework #2 RBF

Breast Cancer classification

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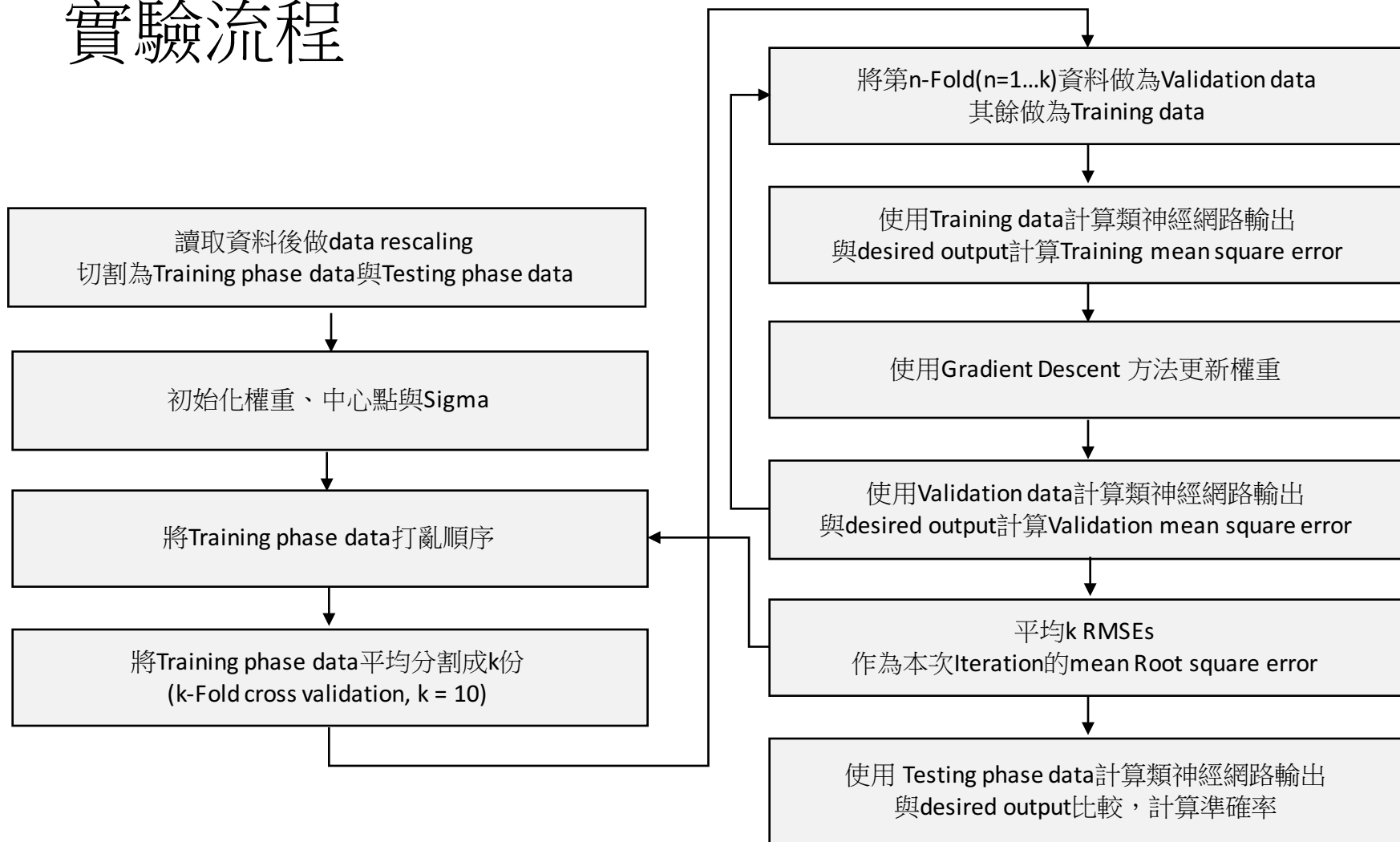
實驗目的

- 設計 RBF Network ，對乳癌資料庫做學習，根據Clump Thickness, Uniformity of Cell Size, Uniformity of Cell Shape, Marginal Adhesion, Single Epithelial Cell Size, Bare Nuclei, Bland Chromatin, Normal Nucleoli 與 Mitoses 九個參數，判斷患者罹患良性或惡性腫瘤。

實驗方法

1. 讀入資料
2. 將九項輸入參數Rescale 到 0.01~0.99之間，輸出參數為二維，各表示良性腫瘤與惡性腫瘤
3. 將所有資料分割成Training phase data與Testing phase data
4. 初始化權重 (-0.4~0.4 uniform)
5. 從Training data中隨機選取資料點當作center
6. 將初始sigma設定為 $1/\# \text{ of neurons}$
7. 將Training phase data平均分割成k份 (k-Fold CS, $k = 10$)
8. 計算類神經網路輸出與錯誤
9. 計算Training Square Error
10. 根據Error使用Gradient Descent 方法更新權重、Center與Sigma
11. 計算Validation Square Error
12. 計算RMSE
13. 使用Testing phase data計算神經網路準確率

實驗流程



程式操作介面

S1010329-RBF

Hidden L1 neurons	<input type="text" value="6"/>	Initial learning rate	<input type="text" value="0.5"/>
Learning Rate shift	<input type="text" value="500"/>	k-fold k	<input type="text" value="10"/>
Minimum learning Rate	<input type="text" value="0.001"/>	Iteration times	<input type="text" value="1500"/>
Testing Data Ratio	<input type="text" value="0.5"/>	Terminal Ratio	<input type="text" value="0.1"/>

☒ Rescale

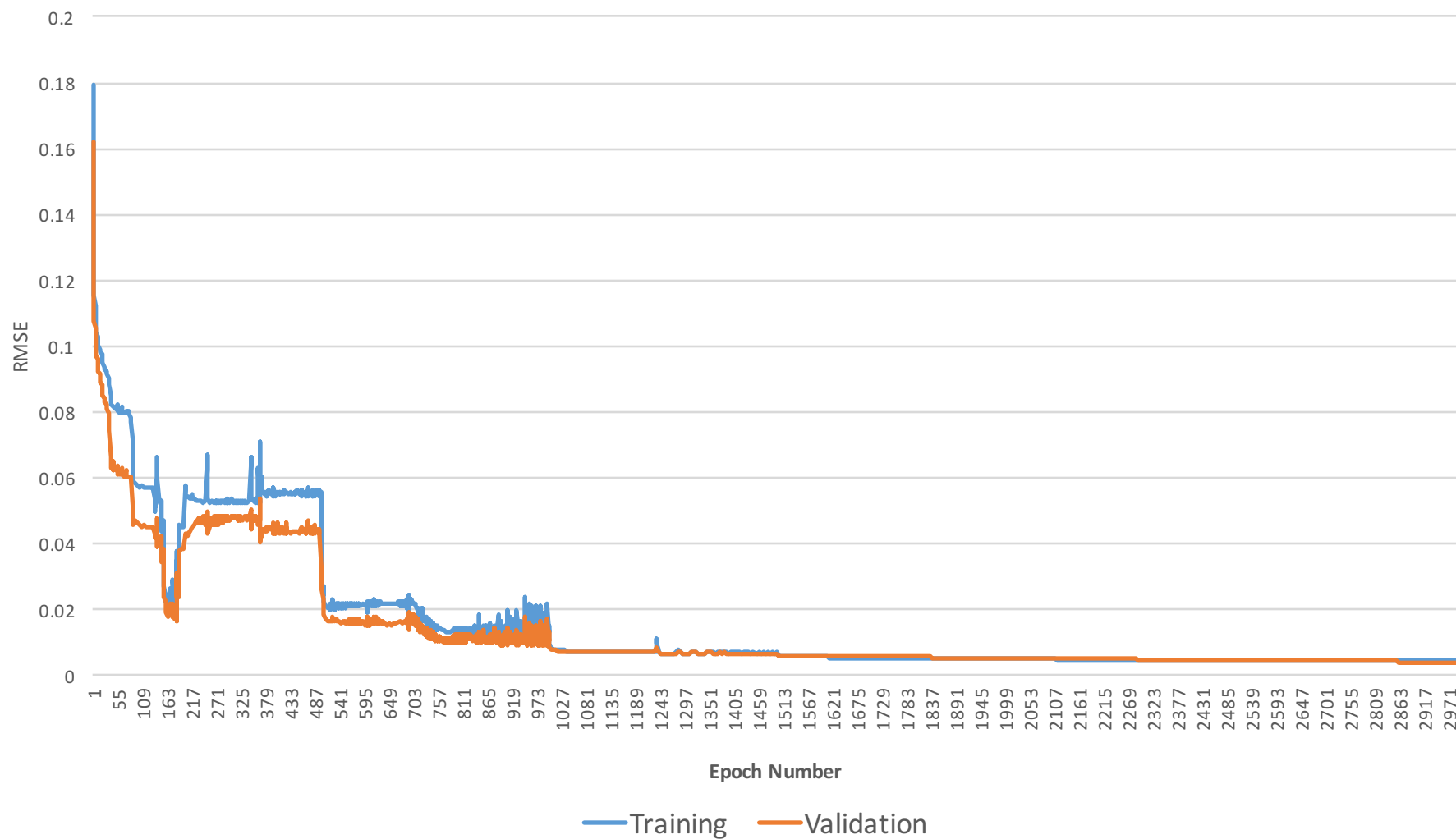
Learning rate adjust

9999/9999 00:00:00:000

實驗參數

- 一層隱藏層與一層輸出層
 - Number of neurons :
 - Hidden layer:60
 - Output layer:2
- Learning rate adjusting
 - Search then converge
 - slope = 0.5
 - $\tau=500$
 - initial learning rate = 0.5
- cross validation
 - K-fold, k = 10
- Iteration times
 - K = 3000

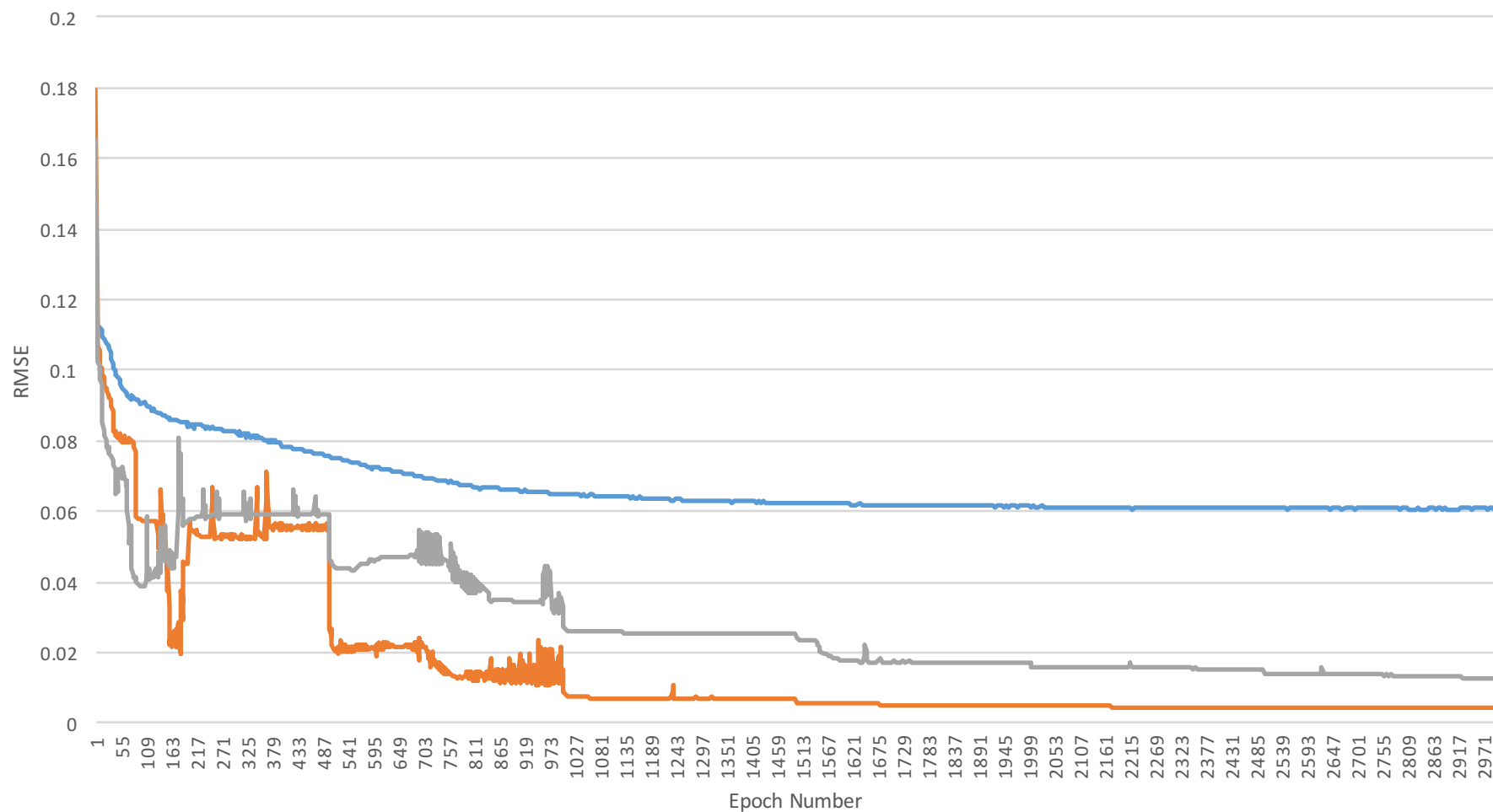
實驗結果



實驗結果 (準確率:96.18%)

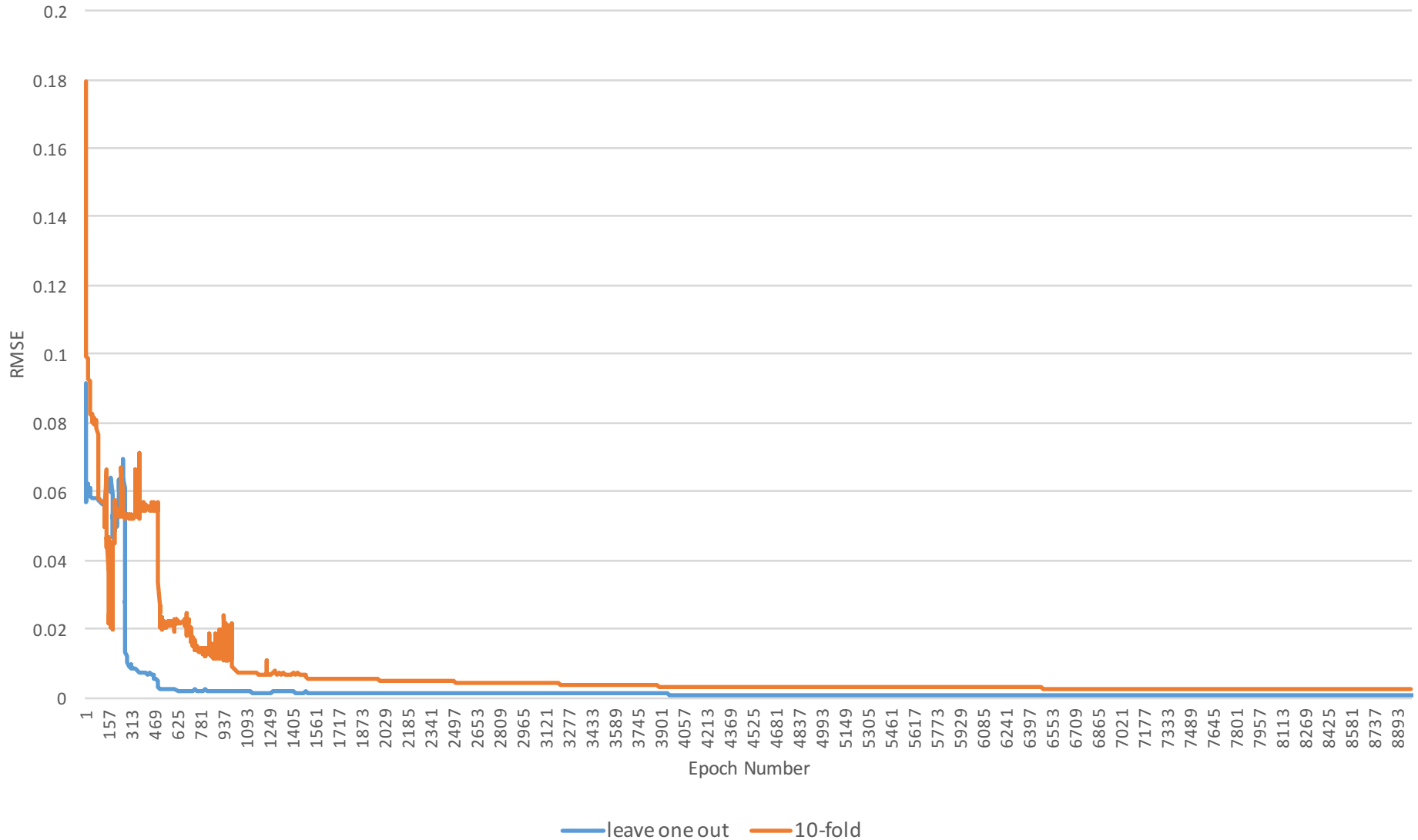
Epoch	Training MSE	Validation MSE
1	0.179320	0.162000
300	0.053162	0.048295
600	0.022287	0.016196
900	0.011524	0.009351
1200	0.006843	0.006868
1500	0.006859	0.006601
1800	0.005270	0.005454
2100	0.004771	0.004896
2400	0.004627	0.004705
2700	0.004316	0.004340
3000	0.004147	0.004034

類神經網路比較

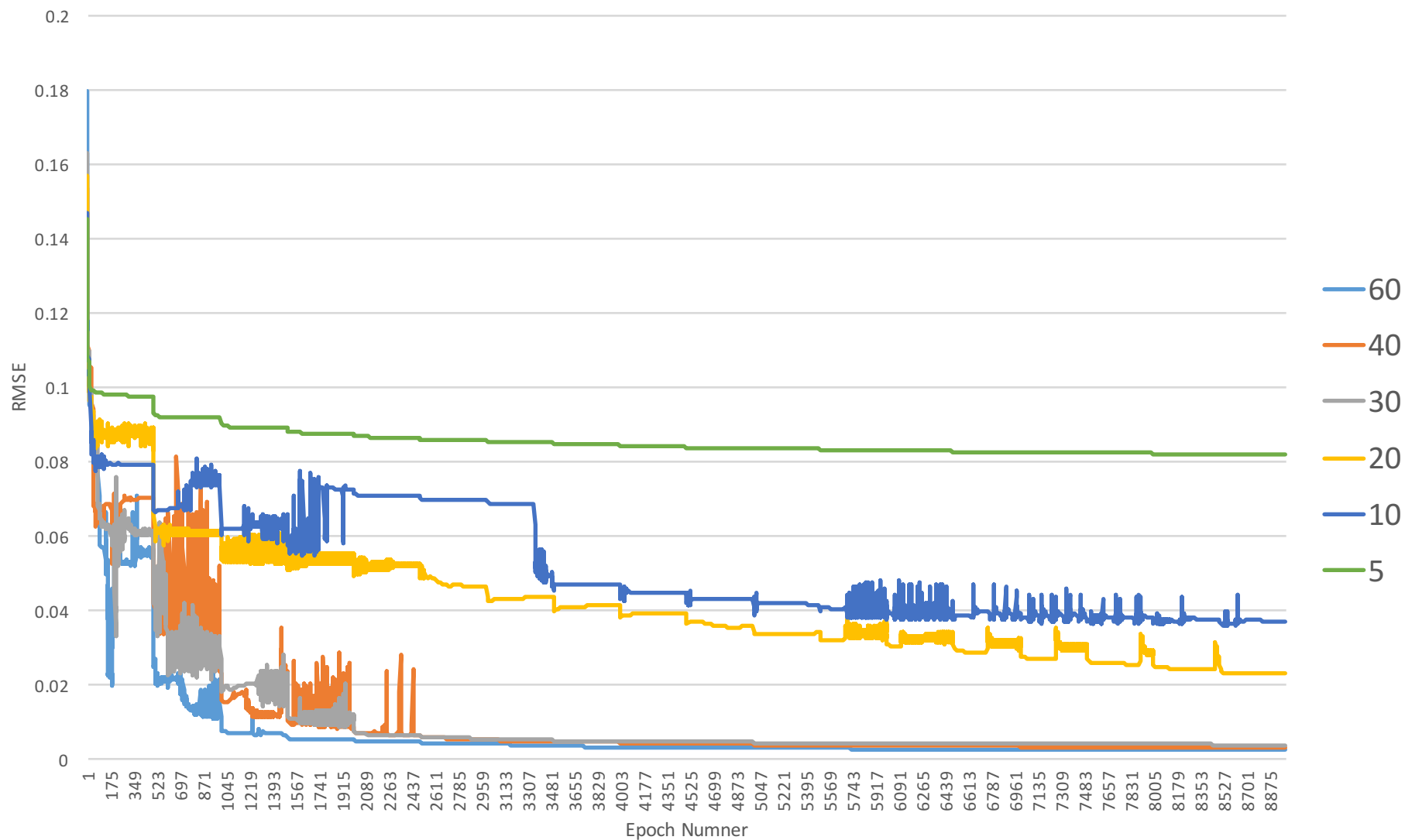


— MLP, (6,8), 97.65% — RBF, 60, 96.18% — RBF, 15, 95.60%

Compare k-fold cross validation



比較神經元數目 (epoch = 9000)



程式碼