# **Efficient Training of RBF Networks Via the BYY Automated Model Selection Learning Algorithms**

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Abstract.

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#### 1 Introduction

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## 2 BYY-AMS Adaptive Gradient Learning Algorithm

and a second of an ilong the second of second of second and and a second of  $y \in Y \subset R^m \quad \text{and } \quad x \in X$  $p, x_{\leftarrow} y_{\ell} = p, x_{\ell} p, y, x_{\ell-\ell-\ell} q, x_{\leftarrow} y_{\ell} = q, x, y_{\ell} q, y_{\ell-\ell-\ell}$ and and the property of the property of the contract of the co property you any prosent as a contraction morning and  $y \in Y = \sum_{i=1}^{N} \cdots \sum_{t=1}^{N} |C_{t}|^{N}$ production of the second contract of the second contract of

 $p, y, x \in p, x \in q, x, y \in q, y \in q$ 

$$H_{i}(p)_{i}(q) = \int p_{i}(y)_{i}(x) p_{i}(x) p_{i}(x) q_{i}(y) q_{i}(y) dxdy - \int_{1}^{\infty} z_{q} z_{q}$$

ma Zqui all palanta -

$$\alpha_j \geq \cdots = \sum_{j=1}^K \alpha_j = \cdots = \cdots = 1 \cdots =$$

 $p_{t}(x) = \frac{1}{N} \sum_{t=1}^{N} \delta_{t}(x - x_{t}) - \frac{1}{$ 

$$p_{\ell} y = j_{\perp} x_{\ell} = p_{\ell} j_{\perp} x_{\ell} = \frac{\alpha_{j} q_{\ell} x_{\perp} \theta_{j'}}{q_{\ell} x_{\perp} \Theta_{K'}}$$

 $U_{j}, x_{i} = \alpha_{j}q_{i} x_{i} m_{j} \Sigma_{j}$   $j = \dots K_{i} J_{i} \Theta_{K}$ 

$$J_{\cdot} \Theta_{K'} = \frac{1}{N} \sum_{t=1}^{N} J_{t \cdot} \Theta_{K'} - J_{t \cdot} \Theta_{K'} = \sum_{j=1}^{K} \frac{U_{j \cdot} x_{t'}}{\sum_{i=1}^{K} U_{i \cdot} x_{t'}} - U_{j \cdot} x_{t'} - \sum_{j=1}^{K} \frac{U_{j \cdot} x_{t'}}{\sum_{i=1}^{K} U_{i \cdot} x_{t'}} - \sum_{j=1}^{K} \frac{U_{j \cdot} x_{t'}}{\sum_{j=1}^{K} U_{j \cdot} x_{t'}} - \sum_{j=1}^{K} \frac{U_{j \cdot} x_{t'}}{\sum_{j=1}^$$

Therefore the second of the second  $J,\Theta_K$  and second  $eta_j$  is  $m_j$  . If  $B_j$  is the second of the second of

$$\frac{\partial J_{t'} \Theta_{K'}}{\partial \beta_{i}} = \frac{1}{q_{i} x_{t'} \Theta_{K'}} \sum_{i=1}^{K} \lambda_{i'} t_{i'} \delta_{ij} - \alpha_{j'} U_{i'} x_{t'}$$

$$\frac{\partial J_{t}, \Theta_{K'}}{\partial m_{j}} = p_{i} j_{i} x_{t'} \lambda_{j}, t \in \Sigma_{j}^{-}, x_{t} - m_{j'} \in$$

$$vec \frac{\partial J_{t'} \Theta_{K'}}{\partial B_{j}} = \frac{\partial_{x} B_{j} B_{j'}^{T}}{\partial B_{j}} vec \frac{\partial J_{t'} \Theta_{K'}}{\partial \Sigma_{j}}$$

where  $\delta_{ij}$  . We can be defined vec A to the vector i and i and i

$$\lambda_{i}, t_{\ell} = \sum_{l=1}^{K} p_{i} l_{i} x_{l}^{\ell} - \delta_{il}^{\ell} |_{i} \alpha_{l} q_{i} x_{l} \cdot m_{l} \sum_{l} \sum_{l} \epsilon_{l}$$

$$\frac{\partial J_{t}, \Theta_{K'}}{\partial \Sigma_{j}} = \frac{1}{I} p_{i} j_{i} x_{t'} \lambda_{j'} t \in \Sigma_{j}^{-}, x_{t} - m_{j'}, x_{t} - m_{j'}^{T} \Sigma_{j}^{-} - \Sigma_{j}^{-} = 1$$

$$\frac{\partial_{r} BB^{T}_{r}}{\partial B} = I_{d \times d} \otimes B_{d \times d}^{T} + E_{d \times d} \cdot B_{d \times d}^{T} \otimes I_{d \times d}$$

$$E_{d_1 \times d_1} = \frac{\partial B^T}{\partial B} = \Gamma_{ij'} = \begin{pmatrix} \Gamma_{..} & \cdots & \Gamma_{.d} \\ \vdots & \ddots & \vdots \\ \Gamma_{d.} & \cdots & \Gamma_{dd} \end{pmatrix}_{d_1 \times d_1}$$

$$vec \ \frac{\partial J_{i} \Theta_{K'}}{\partial B_{j}} = \frac{1}{i} p_{i} j_{i} x_{t'} \lambda_{j} t_{i} I_{d \times d} \otimes B_{d \times d}^{T} + E_{d \times d} \bullet B_{d \times d}^{T} \otimes I_{d \times d'}$$

$$\times vec \ \Sigma_{j}^{-} , x_{t} - m_{j'} x_{t} - m_{j'}^{T} \Sigma_{j}^{-} - \Sigma_{j}^{-} - \dots$$

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$$\Delta \beta_{j} = \frac{\eta}{q_{i} x_{t} \cdot \Theta_{k'}} \sum_{i=1}^{K} \lambda_{i} t_{i} \delta_{ij} - \alpha_{j'} U_{i} x_{t'}$$

$$\Delta m_{j} = \eta p_{i} j_{i} x_{t'} \lambda_{j'} t_{i} \Sigma_{j}^{-}, x_{t} - m_{j'} L$$

$$\begin{split} \Delta vecB_{j} &= \frac{\eta}{l} p_{,} \ j_{,} \ x_{t'} \lambda_{j}, \ t_{'}, \ I_{d\times d} \otimes B_{d\times d}^{T} + E_{d_{t}\times d_{t}} \bullet B_{d\times d}^{T} \otimes I_{d\times d'} \\ &\times vec \ \Sigma_{j}^{-}, \ x_{t} - m_{j'}, \ x_{t} - m_{j'}^{-} \Sigma_{j}^{-} - \Sigma_{j}^{-} \end{split}$$

of the state of t

$$\hat{\eta}_{n} \rightarrow \infty$$
 $\eta_{n} n_{\ell} = \sum_{n=1}^{\infty} \eta_{n} n_{\ell} = \infty$ 

The conjugation of the conjugation of the  $\eta$  in  $\eta$  in  $\eta$  in  $\eta$  in  $\eta$  in  $\eta$  in  $\eta$ .

 $\mathbf{T}_{n}$   $\mathbf{Y}_{n}$   $\mathbf{Y}_{n}$ 

## 3 Training of the RBF Network

tertain promit ifteen = 1 and the second of the second of

$$y_{j}, x_{i} = \sum_{j=1}^{n} w_{ij} \phi_{i}, x_{i-1}$$

 $i^{th}$  rates the second state  $j^{th}$  . The second state  $i^{th}$  rates the second state  $i^{th}$  rates the second state  $i^{th}$  rates the second state  $i^{th}$ 

$$\phi_{j}, x_{\ell} = \phi_{j}, x_{\ell} - m_{j}, \ell = \sum_{j} -\frac{x_{j} - m_{j}}{\sigma_{j}} \ell L$$

 $m_{j} \cdot \sigma_{j} \cdot \sigma_{j$ 

$$y_{i} x_{i} = \sum_{j=1}^{n} \lambda_{j} \phi_{j}, x_{i} = \sum_{j=1}^{n} \lambda_{j}, \dots, -\frac{x - m_{j}}{\sigma_{j}} \phi_{j}$$

 $T_{i,l} = \sum_{j=1}^{l} \sum_{i=1}^{l} \sum_{j=1}^{l} \sum_{j=1}^{l} \sum_{j=1}^{l} \sum_{i=1}^{l} \sum_{j=1}^{l} \sum_{j=1$ 

$$E = \sum_{i=1}^{N} y_{i} - f_{i} x_{i'} = \sum_{i=1}^{N} y_{i} - \sum_{j=1}^{n} \lambda_{j} \phi_{j}, x_{i'}$$

$$= \sum_{i=1}^{N} y_{i} - \sum_{j=1}^{n} \lambda_{j}, \dots, -\frac{\|x_{i} - m_{j}\|}{\sigma_{j}}$$

and a so proper who received the second of t

$$\begin{cases} \Delta \lambda_{j} = \eta_{\lambda} \sum_{i=1}^{N} y_{i} - \sum_{l=1}^{n} \lambda_{l} \phi_{l}, x_{i'} \phi_{j}, x_{i'} \\ \Delta m_{j} = \eta_{m} \sum_{i=1}^{N} y_{i} - \sum_{l=1}^{n} \lambda_{l} \phi_{l}, x_{i'} \phi_{j}, x_{i'}, x_{i} - m_{j'} \lambda_{j} \sigma_{j} \\ \Delta \sigma_{j} = \eta_{\sigma} \sum_{i=1}^{N} y_{i} - \sum_{l=1}^{n} \lambda_{l} \phi_{l}, x_{l'} \phi_{j}, x_{i'}, x_{i} - m_{j'}^{T}, x_{i} - m_{j'} \lambda_{j} \sigma_{j} \end{cases}$$

 $\lambda_{j}$ ,  $\eta_{m}$ ,  $\eta_{\sigma}$ ,  $\sigma$  is a possible of the constant j -  $\lambda_{j}$ ,  $m_{j}$ ,  $\sigma_{j}$  is a constant j -

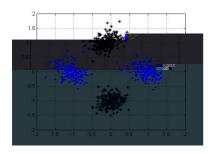
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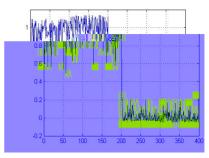
$$\sigma_{j} = \frac{1}{N_{j}} \sum_{x_{t} \in C_{j}} \left( x_{t} - m_{j} \right)^{T} \left( x_{t} - m_{j} \right)$$

## 4 Experiment Results

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## 4.1 On the Noisy XOR Problem





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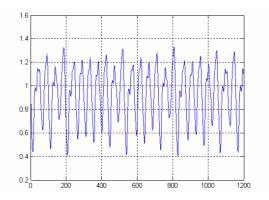
#### 4.2 On the Mackey-Glass Time Series Prediction

to the commence of the second of the second

$$x_{i} t + y = y - b \epsilon x_{i} t \epsilon + \frac{ax_{i} t - \tau \epsilon}{1 + x_{i} t - \tau \epsilon},$$

 $a = \frac{1}{2}b = \frac{1}{2}(T = \frac{1}{2} - \frac{1}{2}) + \frac{1}{2}(x, t - \frac{1}{2}x, t - \frac{1}{2}$ 

The properties of the second production of the



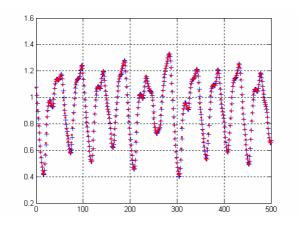


Fig. 4. The observation of a series of the section of the section

#### 5 Conclusions

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#### References

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- Happing and and happing the lapton of the and and the and the land of the la  $\sum_{i=1}^{n} \frac{1}{(n-1)^n} \sum_{i=1}^{n} \frac{1$ 

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