



\*

-  
-  
-  
( // // // )

%

- - - :

[ ]

[ ] Box,Jenkins

[ ]

)

(...

ANN  
ANN

LMS

$$() \quad .[ ]$$

$$()$$

$$.[ ]$$

$$X_P = x_0, x_1, \dots, x_{n-1}$$

$$T_P = t_0, t_1, \dots, t_{m-1} \quad .[ ]$$

m n

$$y_{P_j} = f \left[ \sum_{i=0}^{n-1} w_i x_i \right] \quad ()$$

$$O_{P_j} = f(net) = Sig(net) = \frac{1}{1+e^{-net}} \quad ()$$

$$0 < f(net) < 1$$

$$w_{ij}(t+1) = w_{ij}(t) + \eta \delta_{P_j} O_{P_j} \quad ()$$

$$i \quad w_{ij}(t)$$

$$\delta_{P_j} \quad \eta \quad t \quad j$$

$$j \quad p$$

$$: \quad net$$

$$f'(net) = f(net)(1-f(net)) = O_{P_j}(1-O_{P_j}) \quad ()$$

$$\delta_{P_j} = O_{P_j}(1-O_{P_j})(t_{P_j} - O_{P_j}) \quad ()$$

$$\delta_{P_j} = O_{P_j}(1-O_{P_j}) \sum_k \delta_{P_k} w_{jk} \quad ()$$

MinMax

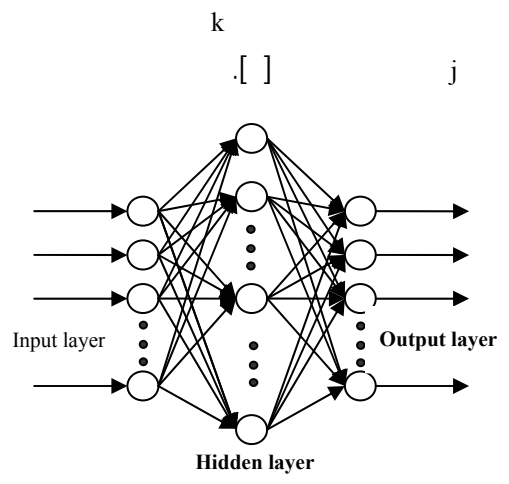
( )

[ ]

$$P_n = \frac{P - P_{\min}}{P_{\max} - P_{\min}}$$

( )

$P_n$   $P$   $P_{\max}$   $P_{\min}$



$$P = P_n(P_{\max} - P_{\min}) + P_{\min}$$

( )

[ , ]

$$MRE(\%) = \frac{1}{N} \sum_{i=1}^N \frac{|Forecast_i - Actual_i|}{Actual_i} \times 100$$

( )

$$MSE = \frac{1}{N} \sum_{i=1}^N (Actual_i - Forecast_i)^2$$

( )

%

%

%

)

(

[ ]

(

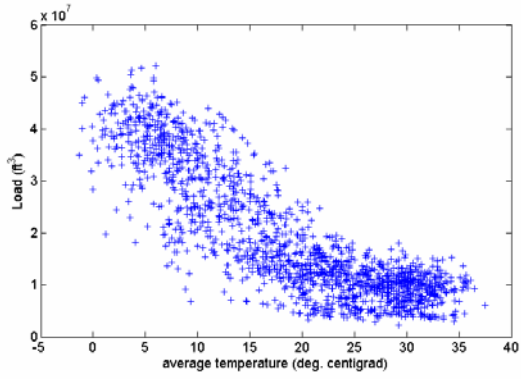
)

[ ]

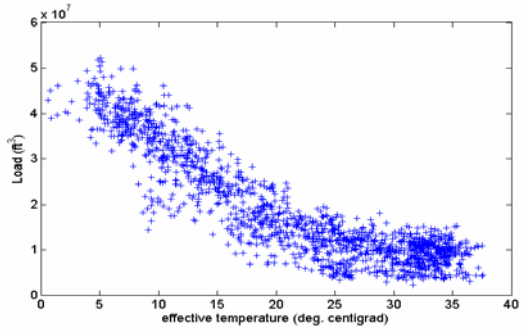
{ - - - }

{ - - - }

/



:



:

:[ ]

$$T_{eff_i} = 0.8 \times T_{eff_{i-1}} + 0.05 \times T_{min_i} + 0.15 \times T_{max_i} \quad ( )$$

$$T_{eff_{i-1}} \quad T_{eff_i} \quad T_{min_i} \quad T_{max_i}$$

( )

( )

( )

.[ ]

)% /

MSE

(

%

%

( )

$$\text{Monthly } T_{eff} = \frac{1}{r} \sum_{i=1}^r T_{eff_i}$$

( )

/

i

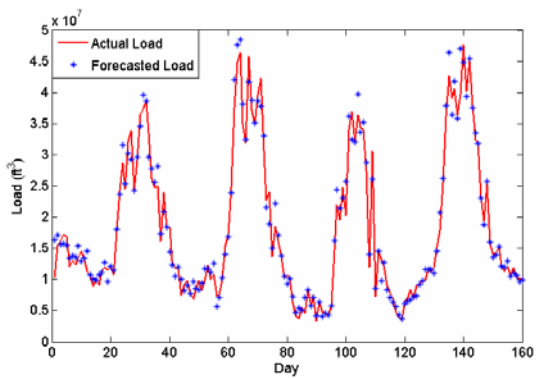
$T_{eff_i}$

( )

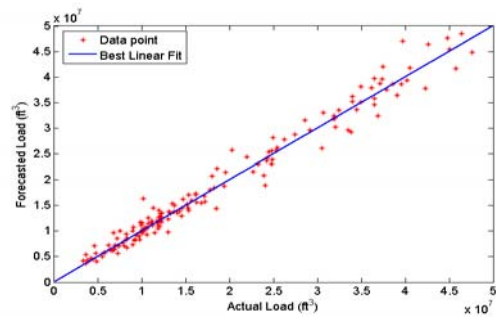
( )

%

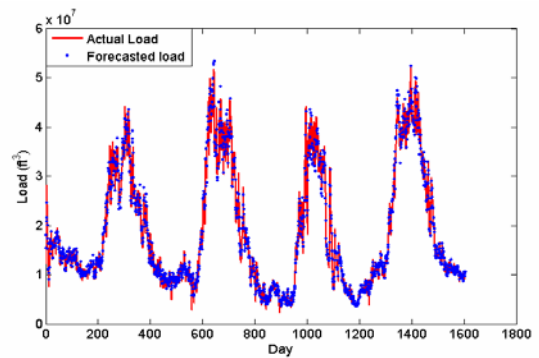
%



{ - - }



.R= /



%

( )

/

MSE

%





- 
- 6 - Zhang, G., Patuwo, B. E. and Hu, M. Y. (1998). "Forecasting with artificial neural networks: The state of the art." *International Journal of Forecasting*, Vol. 14, PP. 35-62.
  - 7 - Beale, R. and Jackson, T. (1998). *Neural Computing: An Introduction*, Institute of Physics Publishing.
  - 8 - Gorr, L. (1993). "Research prospective on neural network forecasting." *International Journal of Forecasting*, Vol. 10, PP. 1-4.
  - 9 - Islamoglu, Y. and Kurt, A. (2004). "Heat transfer analysis using ANNs with experimental data for air flowing in corrugated channels." *International Journal of Heat and Mass Transfer* 47, PP. 1361–1365.
  - 10 - Lamp, P., W.G.P., D. and Logue, E. S. I. (2001). *Implimentation of a Gas Load Forecaster At Williams Gas Pipeline*.
  - 11 - Piggott, J. (2003). *Advantica ltd, Accurate Load Forecasting, you cannot be serious*.
  - 12 - Ashouri, F. (1993). "An expert system for predicting gas demand: A case study." *OMEGA Int. J. of Mgmt Sci.*, Vol. 21, No. 3, PP. 307-317.
  - 13 - *Natural Gas Consumption Data*, National Iranian Gas Company, NIGC.
  - 14 - *Meteorology Data*, Mehrabad Meteorology Station.

- 1 - ANN (Artificial Neural Network)
  - 2 - Back Propagation
  - 3 - Logistic
  - 4 - LMS (Least Mean Square)
  - 5 - Multilayer Perceptron
  - 6 - Multilayer Feedforward Neural Network
  - 7 - Validation Set
  - 8 - Normalization
  - 9 - Unnormalization
  - 10 - MRE (Mean Relative Error)
  - 11 - MSE (Mean Square Error)
  - 12 - Sigmoid Transfer Function
  - 13 - Purline Transfer Function
  - 14 - Training Cycle
  - 15 - Pearson
-