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MLP

ARIMA

(BP)



Ang, and Tang, )

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_{p-1} x_{p-1} + \varepsilon$$

$\beta_0, \beta_1, \dots, \beta_{p-1}$

$x_1, x_2, \dots, x_{p-1}$

:(1975

( )

$y$

$\varepsilon$ .

$\sigma^2$

$\varepsilon_i$  (1  $\times$   $p$ )  $\beta$





$z_t$  : (ARMA) -  
 ARMA(p,q)      q      p  
 :  
 ARMA(p,q) :  $z_t = \sum_{j=1}^p \phi_j z_{t-j} - \sum_{j=0}^q \theta_j \varepsilon_{t-j}$        $\theta_0 = -1$       ( )  
 .       $\varepsilon_t, \varepsilon_{t-1}, \dots$   
 : (ARIMA) -  
 ARMA  
 d .  
 . ARIMA(p,d,q)  
 (      )  
 )  
 (      ) ARIMA(P,D,Q)<sub>w</sub>  
 ARIMA      (      )  
 .  
 - -  
 CI  
 CI



(ASCE, 2000)

Lachtermacher and )

(Jain, et al., 1999)

(Thirumalaiah and Deo, 1998)

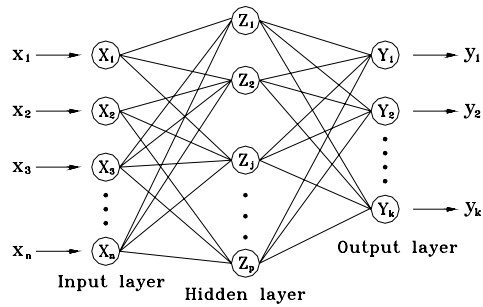
(Fuller, 1994)

(Coulibaly, et al., 2000, 2001)

(Jain, Indurthy, 2003)

( )

(Haykin)



: ( )

$w_i$   
(net)

$$\vec{X} = (x_1, x_2, \dots, x_n)$$





- :

- (R)

- (RMSE)

(e)

y

( )

...,X<sub>2</sub>,X<sub>1</sub>

$$Q_{pre}(t) = f\{Q_{obs}(t-i), P_{obs}(t-i), S_{obs}(t-i), T_{obs}(t-i)\} \quad i=1, 2, \dots \quad ( )$$



$$T_{obs}(t-i) \quad S_{obs}(t-i) \quad P_{obs}(t-i) \quad Q_{obs}(t-i) \quad ( \quad ) \quad : Q_{pre}(t)$$

$i$

(ANOVA)

(ARIMA ARMA , AR)

AICC ( )

ARIMA(2,0,0)

ARIMA(1,0,0)

ARIMA(1,0,0)x(2,0,0)<sub>12</sub>

(MFNN)

(MLP)

(BP)

$\eta$

$\alpha$



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∴

- .  $(Q(t-1), P(t-1), S(t-1), T(t-1))$  -
- .  $(Q(t-2), Q(t-1), P(t-2), \dots)$  -
- .  $(Q(t-3), Q(t-2), Q(t-1), \dots)$  -

:()

						RMSE	(R)		(e)		
412						/	/	/	/	/	Sig
4112						/	/	/	/	/	tanh
4116						/	/	/	/	/	sig
4121						/	/	/	/	/	tanh
4124						/	/	/	/	/	tanh
4126						/	/	/	/	/	sig
814						/	/	/	/	/	sig
8110						/	/	/	/	/	tanh
8113						/	/	/	/	/	sig
8119						/	/	/	/	/	tanh
1213						/	/	/	/	/	sig
12110						/	/	/	/	/	tanh

$(Q_{pre}(t))$

(RMSE)

(R)

(e)



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8I19 4I12

.(e<sub>ave</sub>)

e<sub>ave</sub>

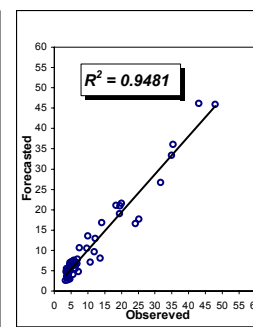
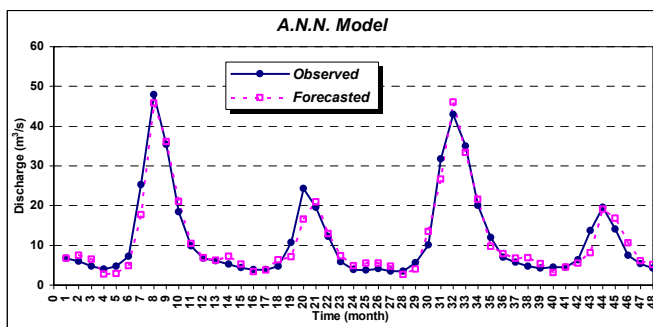
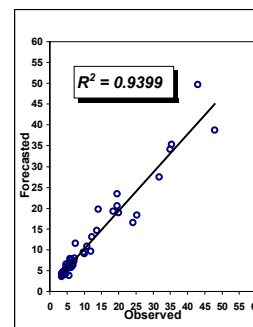
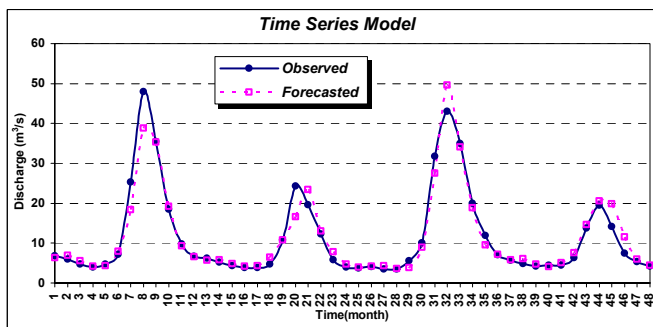
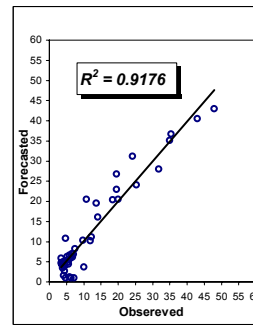
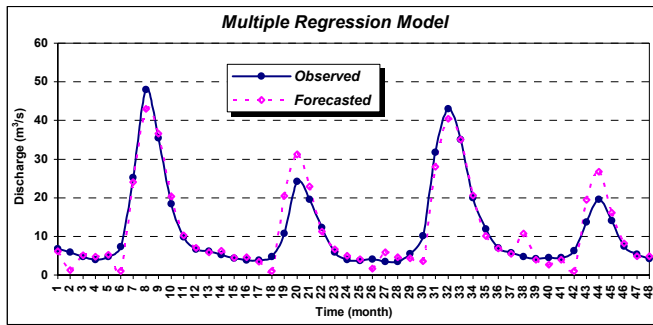
12I3

4I12

4I12

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