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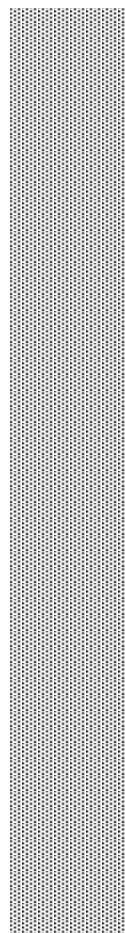
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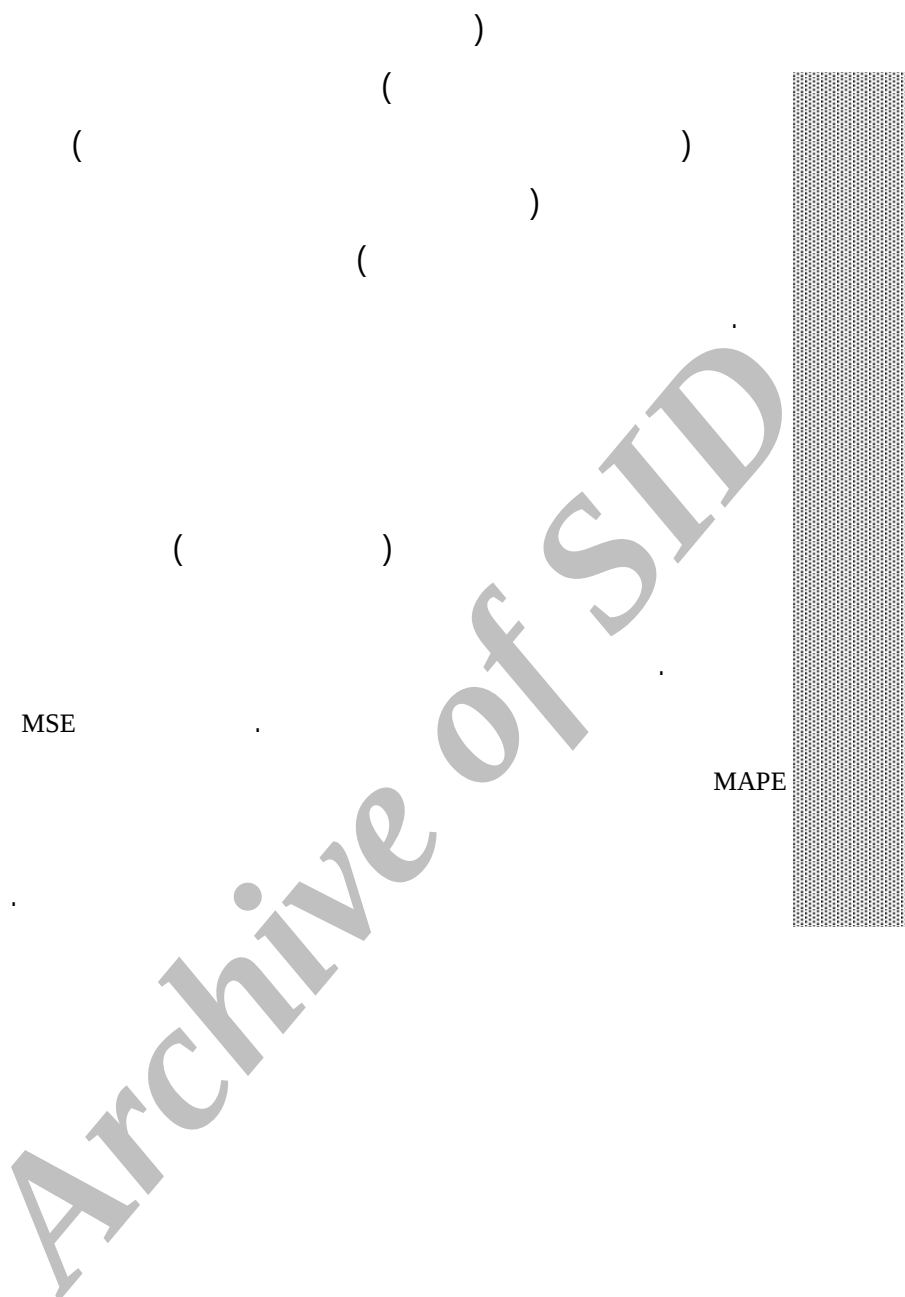
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۱. Artificial Neural Network(A.N.N)
۲. Fuzzy Algorithm
۳. Econometric
۴. Exponential Smoothing
۵. Genetic Algorithm

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۱. Delphi
۲. Time independent technological Comparison
۳. Curve estimation
۴. Relevance Tree
۵. Morphology Research

۶. ()

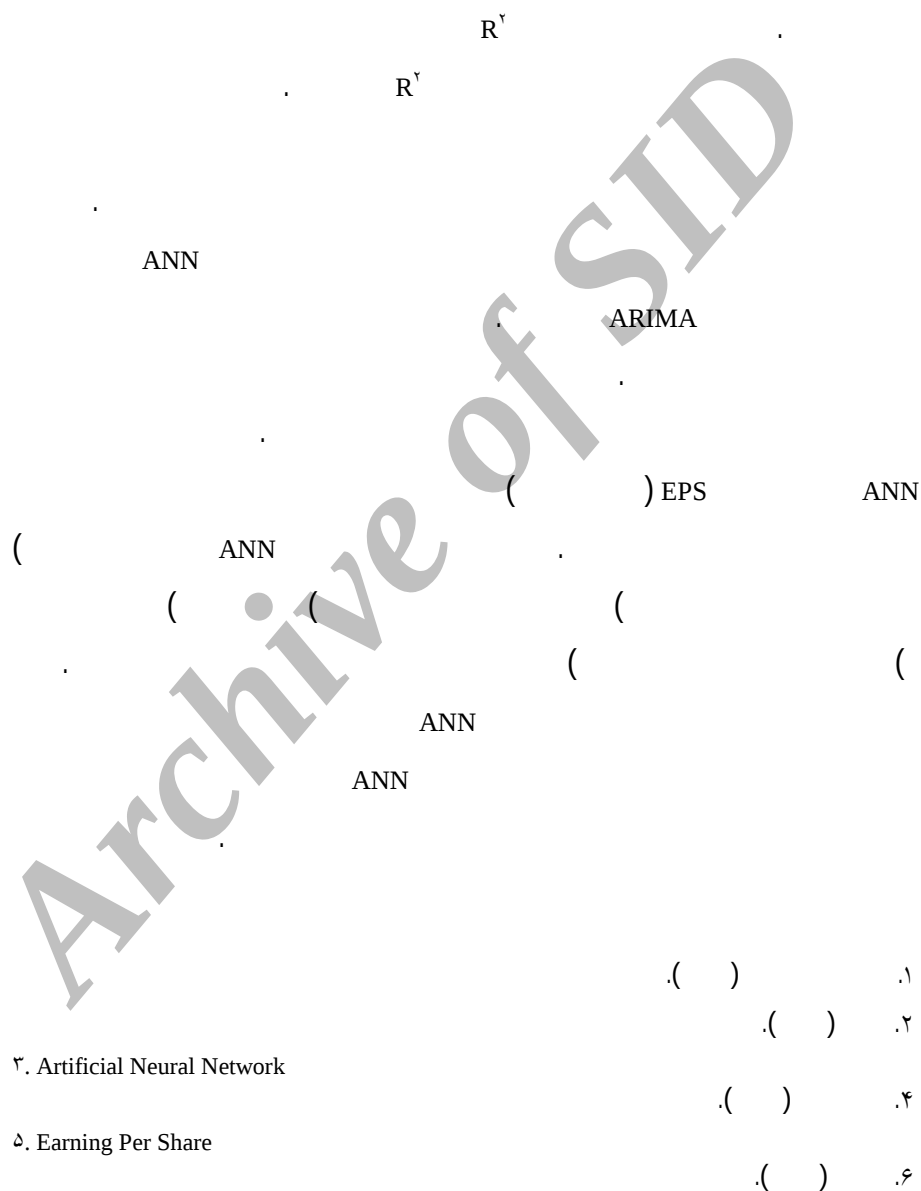
۷. Chaos Theory
۸. Expert System
۹. Genetic Algorithm

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۱. Fuzzy logic
۲. Irreducible Degree of Freedom
۳. Dynamic Model
۴. Spectrum analysis
۵. Deterministic Chaos
۶. Random Process



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ARIMA ANN

۳. Farber and Lapedes

۴. Sharda and Patil

۶. Stern

۷. Connor Marcus

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- ۲. Bates and Granger
- ۳. Newbold
- ۴. Morris
- ۵. Makradiks and Winkler
- ۶. Aston
- ۷. Clemen and Winkler
- ۸. Agno
- ۹. Wilton
- ۱۰. Silk and Urbun
- ۱۱. Bop

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Neural-Coefficient Smooth Transition

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۵. Bop

(RMSE) (MSE)

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WinNN, MaTLAB, Eviews,

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SPSS, Stategraph

- ۱. Marin E. Bond
- ۲. Hartly Commission Model
- ۳. George Kouris and Colin Robinson
- ۴. Hunington
- ۵. Vately
- ۶. Rusher
- ۷. Pindik

1. Exponential Smoothing Methods
2. Simple Brown

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MSE R

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$$\therefore y = b_0 + b_1 t \Rightarrow y = - \frac{1}{T} + \frac{1}{T} T$$

$$\therefore y = b_0 + b_1 \ln t \Rightarrow y = - \frac{1}{\ln t} + \frac{1}{\ln t} \ln t$$

$$\therefore y = b_0 + b_1 t + b_2 t^2 \Rightarrow y = - \frac{1}{t} + \frac{1}{t} t - \frac{1}{t^2} t^2$$

$$\therefore y = b_0 \cdot b_1^t \Rightarrow y = \frac{1}{(1/b_1)^t}$$

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ARIMA

۱. Cubic
۲. Power T
۳. Compound T
۴. S-Curve T
۵. Logistic T
۶. Growth T
۷. Exponential trend
۸. Autoregressive-Integrated Moving Average
۹. Normalized
۱۰. Stationary
۱۱. Kolomogrov- Sminogrov
۱۲. Autocorrelation and Partial Correlation

:

$$Y_t = \phi_1 y_{t-1} + \theta \xi_{t-1} \Rightarrow \phi_1 y_{t-1} + \theta \xi_{t-1}$$

$$q = p = \text{ARIMA} (\quad)$$

d =

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$$1) \text{LnOD}_t = - \quad / \quad - \quad / \quad \text{Ln PR}_t + \quad / \quad \text{Ln GDP} - \quad / \quad \text{LnOE}_t$$

$$(\text{D.W} = \quad / \quad , (\text{P-V} = \quad) , R = \quad / \quad , \quad R = \quad / \quad)$$

$$2) \text{LnOD}_t = \quad / \quad - \quad / \quad \text{LnPR}_t + \quad / \quad \text{LnGDP}_t - \quad / \quad \text{LnOE}_t + \quad / \quad \text{Ln VAI}$$

F

$$(\text{D.W} = \quad / \quad , (\text{P-V} = \quad) , R = \quad / \quad , \quad R = \quad / \quad)$$

$$3) \text{LnOD}_t = - \quad / \quad - \quad / \quad \text{LnPR}_t + \quad / \quad \text{LnGDP} - \quad / \quad \text{LnOE}_t$$

t F

$$(\text{D.W} = \quad / \quad , (\text{P-V} = \quad) , R = \quad / \quad , \quad R = \quad / \quad)$$

$$4) \text{LnOD}_t = - \quad / \quad - \quad / \quad \text{Ln PR}_t + \quad / \quad \text{Ln GDP} - \quad / \quad \text{Ln OE} + \quad / \quad \text{Ln VAI} + \xi_t + \quad / \quad \xi_{t-1}$$

$$(R = \quad / \quad , (\quad) R = \quad / \quad , \text{D.W} = \quad , \text{P-V} = \quad)$$

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t

: OD_t

t

: PR_t

$$(\text{OECD})_t \quad \text{GDP}_t$$

$$t \quad \text{OE}_t$$

$$(\text{OECD}) \quad \text{VAI}$$

$$t$$

$$/ \quad R \quad R \quad \alpha = \%$$

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$$(\text{B.P})()$$

$$(\Delta * \Delta * \Delta)$$

$$()$$

$$\left(f_n = \frac{1}{1 + e^{-cn}} \right)$$

$$()$$

$$:$$

$$:$$

$$X_i :$$

$$1. \text{ P-Value}$$

$$2. \text{ Back- Propagation (B.P)}$$

$$3. \text{ Sigmoid}$$

$$4. \text{ Pureline}$$

$X_i :$

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$X_i : \text{ARIMA} (\quad)$

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$$\begin{aligned} (i=1, \dots, n) \quad & x_i, x_i, \dots, x_i, x_i, x_i, \dots, x_i \\ (i=1, \dots, n) \quad & Y_i \end{aligned}$$

F=

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t	t	B	
	/	/	X_i
	/	/	X_i
	/	/	X_i
	- /	- /	X_i

$$F= \quad D.w = / \quad R = / \quad (\quad) R = /$$

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$$Y = \frac{1}{n} \sum_{i=1}^n x_i + \frac{1}{n} \sum_{i=1}^n x_i + \frac{1}{n} \sum_{i=1}^n x_i + \frac{1}{n} \sum_{i=1}^n x_i$$

xij

Y

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t	t	B	
	- /	-	
	- /	- /	X _i
	- /	- /	X _i
	/	/	X _i
	/	/	X _i
	/	/	X _i
	- /	- /	X _i

D.w = /

R = /

R = /

F=

GAPE MAPE RMSE

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$$۱. RMSE = \sqrt{\frac{\sum_{t=1}^n (y_t - \hat{y}_t)^2}{n}}$$

$$۲. MAPE = \frac{\sum_{t=1}^n |(y_t - \hat{y}_t) / y_t|}{n}$$

$$۳. GAPE = \text{GeometricMean} \frac{(y_t - \hat{y}_t)}{y_t}$$

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(MSE)

GAPE	MAPE	RMSE	
/	/	/	-
/	/	/	ANN -
/	/	/	-
/	/	/	-
/	/	/	(x_i) -
/	/	/	(x_i) -
/	/	/	(x_i) -
/	/	/	(x_i) -
/	/	/	-
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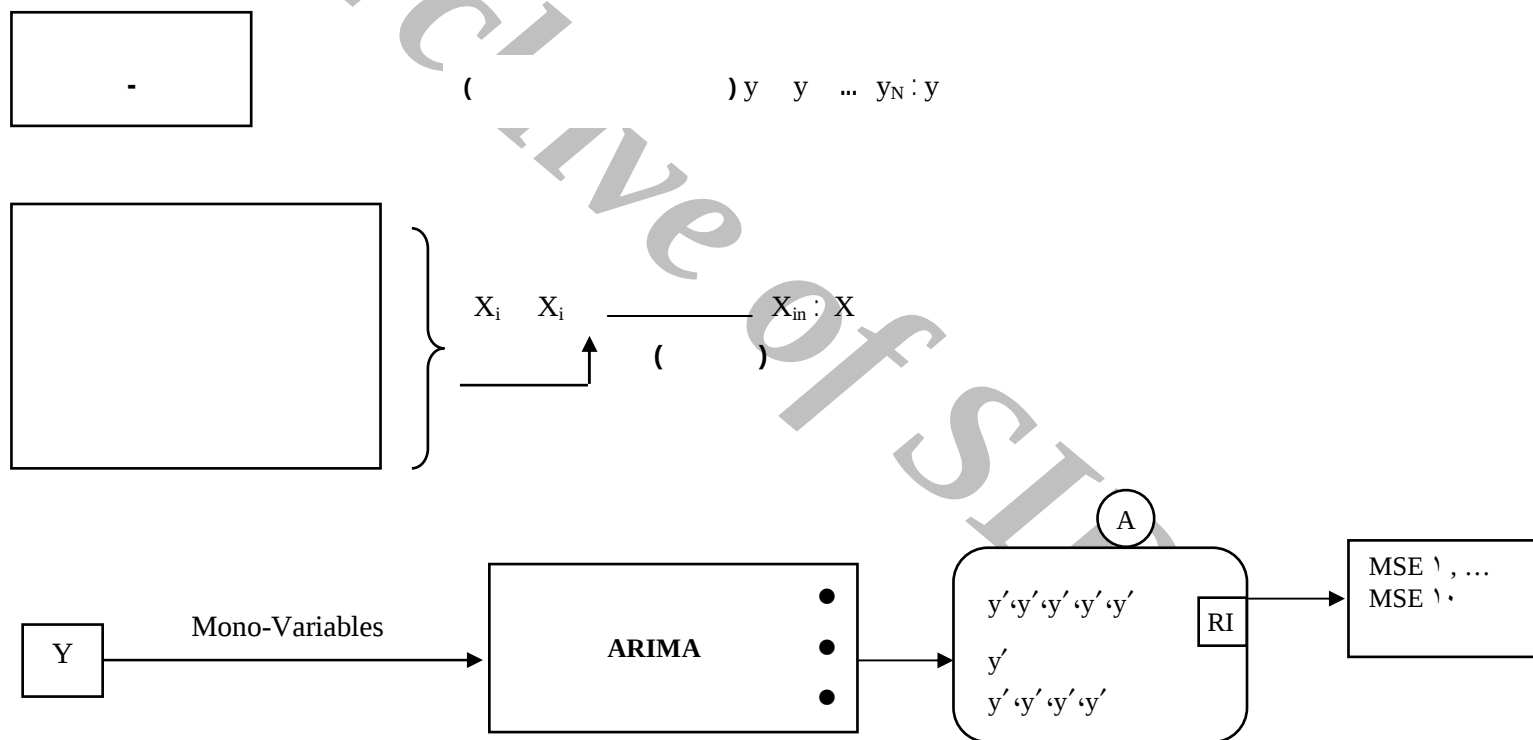
EViews MATLAB

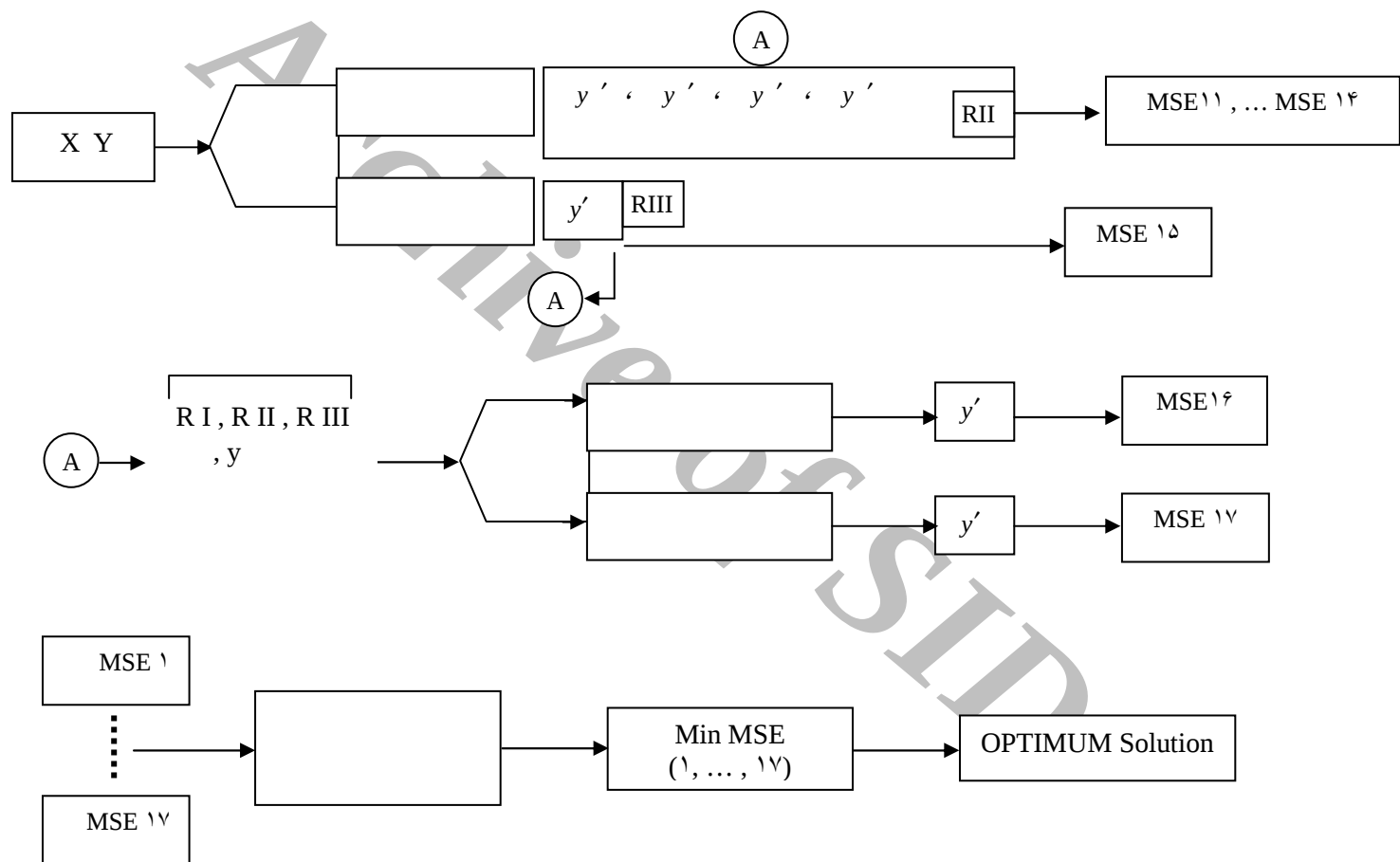
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RMSE

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RMSE

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MPE, GAPE, MAPE

$$F_i = \sum_{i=1}^n W_i x_i$$

$$W_i = \frac{(MSE_i)^{-1}}{\sum_{i=1}^n (MSE_i)^{-1}}$$

- ۱. Mean Absolute percentage error
- ۲. Geometric Absolute percentage error
- ۳. Mean percentage error

MSE

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