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One Step Forecasting Model {Simple Model} Version 6

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Abstract

In this research investigation, the author has presented two models of One Step Forecasting.

Theory

Given,

$$Y_n = \{y_1, y_2, y_3, \ldots\ldots, y_{n-1}, y_n\}$$

$$Y_{\{(k+1)\mapsto n\},\{1\mapsto k\}} = \left\{ \overbrace{y_{k+1}, y_{k+2}, \ldots\ldots, y_{n-1}, y_n}^{\{(k+1)\mapsto n\}}, \overbrace{y_1, y_2, y_3, \ldots\ldots y_k}^{\{1\mapsto k\}} \right\}$$

$$\hat{Y}_{\{(k+1)\mapsto n\},\{1\mapsto k\}} = \frac{\left\{ \overbrace{y_{k+1}, y_{k+2}, \ldots\ldots, y_{n-1}, y_n}^{\{(k+1)\mapsto n\}}, \overbrace{y_1, y_2, y_3, \ldots\ldots y_k}^{\{1\mapsto k\}} \right\}}{\left\{ \sum_{i=1}^{n} y_i^2 \right\}^{1/2}}$$

$$\hat{Y}_n = \frac{\{y_1, y_2, y_3, \ldots\ldots, y_{n-1}, y_n\}}{\left\{ \sum_{i=1}^{n} y_i^2 \right\}^{1/2}}$$

$$Co\sin eSimilarity\left(\hat{Y}_n, \hat{Y}_{\{(k+1)\mapsto n\},\{1\mapsto k\}}\right) = Dot\Pr oduct\left(\hat{Y}_n, \hat{Y}_{\{(k+1)\mapsto n\},\{1\mapsto k\}}\right)$$

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Model 1

$$y_{n+1} = \sum_{k=0}^{n-1} (\alpha_{n-k})(y_{n-k})$$

Case 1:

For finding α_{n-k}

$$\alpha_{n-k} = \frac{Co\sin eSimilarity\left(\hat{Y}_n , \hat{Y}_{\{(k+1)\mapsto n\},\{1\mapsto k\}}\right)}{\left\{\sum_{k=0}^{n-1} \left\{Co\sin eSimilarity\left(\hat{Y}_n , \hat{Y}_{\{(k+1)\mapsto n\},\{1\mapsto k\}}\right)\right\}^2\right\}^{1/2}}$$

Case 2:

For finding α_{n-k}

$$\alpha_{n-k} = \frac{Co\sin eSimilarity\left(\hat{Y}_n , \hat{Y}_{\{(k+1)\mapsto n\},\{1\mapsto k\}}\right)}{\sum_{k=0}^{n-1} \left\{Co\sin eSimilarity\left(\hat{Y}_n , \hat{Y}_{\{(k+1)\mapsto n\},\{1\mapsto k\}}\right)\right\}}$$

Model 2

Case 1:

For finding y_{n+1}

$$y_{n+1} = \sum_{k=0}^{n-1} (\alpha_{n-k})(y_{k+1})$$

Case 2:

For finding y_{n+1}

$$y_{n+1} = \sum_{k=0}^{n-1} (\alpha_{n-k})(y_{n-k})$$

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$$Y_{\{n\mapsto((k+1))\},\{1\mapsto k\}} = \left\{ \overbrace{y_n, y_{n-1}, \ldots\ldots, y_{k+2}, y_{k+1}}^{\{n\mapsto((k+1))\},\{1\mapsto k\}}, \overbrace{y_1, y_2, y_3, \ldots\ldots y_k}^{\{1\mapsto k\}} \right\}$$

$$\hat{Y}_{\{n\mapsto((k+1))\},\{1\mapsto k\}} = \frac{\left\{ \overbrace{y_n, y_{n-1}, \ldots\ldots, y_{k+2}, y_{k+1}}^{\{n\mapsto((k+1))\},\{1\mapsto k\}}, \overbrace{y_1, y_2, y_3, \ldots\ldots y_k}^{\{1\mapsto k\}} \right\}}{\left\{ \sum_{i=1}^{n} y_i^2 \right\}^{1/2}}$$

Case 1:

For finding α_{n-k}

$$\alpha_{n-k} = \frac{Co\sin eSimilarity\left(\hat{Y}_n, \hat{Y}_{\{n\mapsto((k+1))\},\{1\mapsto k\}}\right)}{\left\{ \sum_{k=0}^{n-1} \left\{ Co\sin eSimilarity\left(\hat{Y}_n, \hat{Y}_{\{n\mapsto((k+1))\},\{1\mapsto k\}}\right)\right\}^2 \right\}^{1/2}}$$

Case 2:

For finding α_{n-k}

$$\alpha_{n-k} = \frac{Co\sin eSimilarity\left(\hat{Y}_n, \hat{Y}_{\{n\mapsto((k+1))\},\{1\mapsto k\}}\right)}{\sum_{k=0}^{n-1} \left\{ Co\sin eSimilarity\left(\hat{Y}_n, \hat{Y}_{\{n\mapsto((k+1))\},\{1\mapsto k\}}\right)\right\}}$$

Results

Model 1

For Model 1 (Case 1: For finding α_{n-k}), when the first 8 Primes Numbers, i.e., $Y_n = \{2,3,5,7,11,13,17,19\}$ were taken to predict the next Number, a result of 22.8606 was found. The next Prime Number being 23, the Error % was (23-22.8606)

$$Error\ \% = \left\{ \frac{(23 - 22.8606)}{23} \right\} \times 100 = 0.606087\%$$

Model 2

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For Model 2 (Case 1: For finding α_{n-k}) and (Case 1: For finding y_{n+1}), when the first 8 Primes Numbers, i.e., $Y_n = \{2,3,5,7,11,13,17,19\}$ were taken to predict the next Number, a result of 23.8 was found. The next Prime Number being 23, the Error % was (23-23.8)

$$Error\ \% = \left\{ \frac{(23-23.8)}{23} \right\} \times 100 = 3.8247\%$$

References

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