Bagadi, R. (2017). One Step Forecasting Model. {Advanced Model} (Version 2). ISSN 1751-3030.
PHILICA.COM Article number 1005.
http://www.philica.com/display_article.php?article_id=1005

One Step Forecasting Model {Advanced Model}

ISSN 1751-3030

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Abstract

In this research investigation, the author has presented an Advanced Forecasting Model.

Theory

Given,

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

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

Now, $y_{k+1}, y_{k+2}, \ldots\ldots, y_{n-1}, y_n$ can be arranged among themselves (within their position bounds) in $(n-k)!$ ways and $y_1, y_2, y_3, \ldots.. y_k$ can be arranged among themselves (within their position bounds) in $k!$ ways. Hence, the Vector $Y_{\{(k+1)\mapsto n\},\{1\mapsto k\}}$ can be arranged in $\{(n-k)! \times k!\}$ number of ways.

$${}^{j}Y_{\{(k+1)\mapsto n\},\{1\mapsto k\}} = j^{th}\ arrangement\ of\ elements\ of\ Y_{\{(k+1)\mapsto n\},\{1\mapsto k\}}\ among\ the \{(n-k)! \times k!\} arrangements$$

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

$${}^{j}\hat{Y}_{1,(n-k)} = \frac{{}^{j}Y_{\{(k+1)\mapsto n\},\{1\mapsto k\}}}{\left\{\sum_{i=1}^{n} y_i^2\right\}^{1/2}}$$

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

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Model

$$y_{n+1} = \sum_{k=0}^{n-1} \left(\breve{\breve{\alpha}}_{n-k}\right)\left(y_{n-k}\right)$$

Case 1:

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

Case 2:

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

Computation of $\breve{\alpha}_{n-k}$

Case 1:

$$\breve{\alpha}_{n-k} = \sum_{j=1}^{\{(n-k)!\times k!\}} \left\{\frac{{}^{j}\alpha_{n-k}}{\sum_{j=1}^{\{(n-k)!\times k!\}} {}^{j}\alpha_{n-k}}\right\} {}^{j}\alpha_{n-k} \quad \text{Self-Weighted Mean}$$

Case 2:

$$\breve{\alpha}_{n-k} = \sum_{j=1}^{\{(n-k)!\times k!\}} \left\{\frac{{}^{j}\alpha_{n-k}}{\left\{\sum_{j=1}^{\{(n-k)!\times k!\}} \left\{{}^{j}\alpha_{n-k}\right\}^{2}\right\}^{1/2}}\right\} {}^{j}\alpha_{n-k} \qquad \text{Normalized Weight}$$

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Computation of $\breve{\breve{\alpha}}_{n-k}$

Case 1:

$$\breve{\breve{\alpha}}_{n-k} = \left\{ \frac{\breve{\alpha}_{n-k}}{\sum_{k=0}^{n-1} \breve{\alpha}_{n-k}} \right\}$$

Case 2:

$$\breve{\breve{\alpha}}_{n-k} = \frac{\breve{\alpha}_{n-k}}{\left\{ \sum_{k=0}^{n-1} \left\{ \breve{\alpha}_{n-k} \right\}^2 \right\}^{1/2}}$$

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