Recursive Future Average Of A Time Series Data Based On Cosine Similarity-RF

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Technical Note

Abstract

In this research Technical Note the author have presented a Recursive Future Average Of A Time Series Data Based on Cosine Similarity.

Theory

The Recursive Future Average Of A Time Series Data Based on Cosine Similarity can be given by the following methods:

Method 1:

$$y_{n+1} = \frac{\sum_{i=1}^{n} (y_i)\{CS(y_i, y_{n+1})\}}{\left\{\sum_{i=1}^{n} \left(\{CS(y_i, y_{n+1})\}^2\right)\right\}^{1/2}}$$

where $CS(y_i, y_{n+1}) = \left\{\frac{Smaller\ \ of\ \ (y_i, y_{n+1})}{Larger\ \ of\ \ (y_i, y_{n+1})}\right\}$

when the Time Series Data is of the kind

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

Method 2:

$$y_{n+1} = \frac{\sum_{i=1}^{n} (y_i)\{CS(y_i, y_{n+1})\}\{CS(y_i, y_{n+1})\}}{\sum_{i=1}^{n} \{CS(y_i, y_{n+1})\}}$$

where $CS(y_i, y_{n+1}) = \left\{\frac{Smaller\ \ of\ \ (y_i, y_{n+1})}{Larger\ \ of\ \ (y_i, y_{n+1})}\right\}$

when the Time Series Data is of the kind

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

Deriving motivation from this concept, we further extend this formula using [1] as

$$y_{n+1}=\frac{\left\{\begin{array}{l}\sum_{i=1}^{n}(y_i)\{CS(y_i,y_{n+1})\}+\sum_{i=1}^{n}({}^{1}y_i)\{CS({}^{1}y_i,y_{n+1})\}+\sum_{i=1}^{n}({}^{2}y_i)\{CS({}^{2}y_i,y_{n+1})\}+\ldots\ldots+\\ \sum_{i=1}^{n}({}^{r}y_i)\{CS({}^{r}y_i,y_{n+1})\}\end{array}\right\}}{\left\{\begin{array}{l}\sum_{i=1}^{n}\left(\{CS(y_i,y_{n+1})\}^2\right)+\sum_{i=1}^{n}\left(\{CS({}^{1}y_i,y_{n+1})\}^2\right)+\sum_{i=1}^{n}\left(\{CS({}^{2}y_i,y_{n+1})\}^2\right)+\ldots\ldots+\\ \sum_{i=1}^{n}\left(\{CS({}^{r}y_i,y_{n+1})\}^2\right)\end{array}\right\}^{1/2}}$$

where ${}^{1}y_i=\dfrac{\left\{y_i y_{n+1}-\dfrac{(Smaller\ of\ (y_i,y_{n+1}))^2}{y_i y_{n+1}}\right\}}{y_{n+1}}$ and

$${}^{2}y_i=\frac{\left\{{}^{1}y_i y_{n+1}-\dfrac{(Smaller\ of\ ({}^{1}y_i,y_{n+1}))^2}{{}^{1}y_i y_{n+1}}\right\}}{y_{n+1}}$$, ……, i.e., and so on, so forth

$${}^{k}y_i=\frac{\left\{{}^{k-1}y_i y_{n+1}-\dfrac{(Smaller\ of\ ({}^{k-1}y_i,y_{n+1}))^2}{{}^{k-1}y_i y_{n+1}}\right\}}{y_{n+1}}$$

upto

$${}^{r}y_i=\frac{\left\{{}^{r-1}y_i y_{n+1}-\dfrac{(Smaller\ of\ ({}^{r-1}y_i,y_{n+1}))^2}{{}^{r-1}y_i y_{n+1}}\right\}}{y_{n+1}}$$ such that we can write

$$y_{n+1}=\frac{\left\{\sum_{i=1}^{n}(y_i)\{CS(y_i,y_{n+1})\}+\sum_{k=1}^{r}\sum_{i=1}^{n}({}^{k}y_i)\{CS({}^{1}y_i,y_{n+1})\}\right\}}{\left\{\sum_{i=1}^{n}\left(\{CS(y_i,y_{n+1})\}^2\right)+\sum_{k=1}^{r}\sum_{i=1}^{n}\{CS({}^{k}y_i,y_{n+1})\}^2\right\}^{1/2}}$$

where r is a number such that ${}^{r}y_i\rightarrow 0$.

References

1.Bagadi, R. (2016). Proof Of As To Why The Euclidean Inner Product Is A Good Measure Of Similarity Of Two Vectors. *PHILICA.COM Article number 626*.
http://philica.com/display_article.php?article_id=626
2.http://www.philica.com/advancedsearch.php?author=12897
3.http://www.vixra.org/author/ramesh_chandra_bagadi