

# 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:*

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

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

when the Time Series Data is of the kind

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

*Method 2:*

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

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

when the Time Series Data is of the kind

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

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

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

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

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

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

upto

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

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

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

## References

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