Theoretical Model for Causal One Step Forecasting Of Any Time Series Type Sequence {Version 2}

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***Abstract*- In this research investigation, the author has detailed the Theoretical Model for Causal One Step Forecasting of Any Time Series Type Sequence.**

INTRODUCTION

A lot of literature is available in the domain of One Step Forecasting. The reader can refer to the types of Forecasting dealt in the subject of Time Series Analysis Forecasting.

THEORY (AUTHOR'S MODEL FOR CAUSAL ONE STEP FORECASTING OF ANY TIME SERIES TYPE FORECASTING)

Given any time series sequence of the kind $S_1 = \left\{ {}^1y_1, {}^1y_2, {}^1y_3, ..., {}^1y_{n-1}, {}^1y_n \right\}$, we first find the values of Exhaustive Similarities ${}^2es_{i \to (i+1) \to (i+2)}$ & Exhasutive Dissimilarities ${}^2eds_{i \to (i+1) \to (i+2)}$ which give as Future Average ${}^1y_{(i+2)}$ when we use ${}^1y_{(i)}$ and ${}^1y_{(i+1)}$

Using the technique of finding the Future Average using the scheme laid out by Bagadi, R.C. [1]. Note that, i can take positive integer values such that $n \le (i+2)$. For a sequence of n numbers, we will then have $(n-2)$ number of Exhaustive Similarities and Exhaustive Dissimilarities.

We now consider the thusly found $(n-2)$ number of Exhaustive Similarities, found in order of the given sequence) as a new Time Series Type Sequence and find again the $(n-4)$ in number Exhaustive Similarities. We keep repeating this procedure pyramidally upwards till we are left with only one Final Exhaustive Similarity Value. We now consider k Step Evolution (using the method detailed by Bagadi, R.C. [2]) Of this Final Exhaustive Similarity Value. We now use this value to find the future average of the last two values of the line of values just below the peak line (or rather one value line) of the pyramid. We keep repeating this procedure going pyramidally downward so that we can finally forecast the Exhaustive Similarity part component of the Future Average ${}^1y_{n+1}$.

Similarly, we repeat this procedure to forecast the Exhaustive Dissimilarity part component of the Future Average ${}^1y_{n+1}$. We now add these two components to get the Forecasted Future Value ${}^1y_{n+1}$

An important note here, is to understand that every system has a unique k value or some limited neighbourhood spectrum of k.

Example:

For any given time series of the kind $S_1 = \left\{ {}^1y_1, {}^1y_2, {}^1y_3, {}^1y_4, {}^1y_5 \right\}$, we first find the Exhaustive Similarity ${}^2es_{1 \to 2 \to 3}$ and Exhaustive Dissimilarity ${}^2eds_{1 \to 2 \to 3}$. Also, we find the Exhaustive Similarity ${}^2es_{2 \to 3 \to 4}$ and Exhaustive Dissimilarity ${}^2eds_{2 \to 3 \to 4}$. Finally, we calculate the Exhaustive Similarity ${}^2es_{3 \to 4 \to 5}$ and Exhaustive Dissimilarity ${}^2eds_{3 \to 4 \to 5}$. Our new time Series Sequence of the Exhaustive Similarities in order of the sequence is now $S_{2s} = \left\{ {}^2es_{1 \to 2 \to 3}, \ {}^2es_{2 \to 3 \to 4}, {}^2es_{3 \to 4 \to 5} \right\}$. And, the new time Series Sequence of the Exhaustive Dissimilarities in order of the sequence is now

$S_{2ds} = \left\{ {}^2eds_{1\to2\to3},\ {}^2eds_{2\to3\to4}, {}^2eds_{3\to4\to5} \right\}$.

Using S_{2s} as a Time Series Type Sequence, we now calculate $S_{3s} = \left\{ {}^3es_{1\to2\to3} \right\}$ and using S_{2ds} as a Time Series Type Sequence, we now calculate $S_{3ds} = \left\{ {}^3eds_{1\to2\to3} \right\}$. We now consider k step Evolution of ${}^3es_{1\to2\to3}$ and ${}^3eds_{1\to2\to3}$ Individually and write them as $E^k\left({}^3es_{1\to2\to3}\right)$ and $E^k\left({}^3eds_{1\to2\to3}\right)$ respectively. We now use $E^k\left({}^3es_{1\to2\to3}\right)$ and ${}^2es_{2\to3\to4}, {}^2es_{3\to4\to5}$ to find the Future Average ${}^2es_{4\to5\to6}$. Similarly, using $E^k\left({}^3eds_{1\to2\to3}\right)$ and ${}^2eds_{2\to3\to4}, {}^2eds_{3\to4\to5}$ we find ${}^2eds_{4\to5\to6}$. We now use ${}^1y_4, {}^1y_5$ and ${}^2es_{4\to5\to6}$ to find the Future Average Similarity Component of the Future Average ${}^1y_{(n+1)}$, say ${}^1sy_{(n+1)}$. Similarly, we use ${}^1y_4, {}^1y_5$ and ${}^2eds_{4\to5\to6}$ to find out the Dissimilarity Component of the Future Average ${}^1y_{(n+1)}$, ${}^1dsy_{(n+1)}$. Finally, we add ${}^1sy_{(n+1)}$ and ${}^1dsy_{(n+1)}$ to get ${}^1y_{(n+1)}$, i.e., ${}^1y_{(n+1)} = {}^1sy_{(n+1)} + {}^1dsy_{(n+1)}$. We note that all works well when we have an odd number of terms in the Time Series Type Sequence to begin with. However, if we have an even number of terms in the Time Series Type Sequence, then we can follow the method given in this example.

Example:

For any given time series of the kind $S_1 = \left\{ {}^1y_1, {}^1y_2, {}^1y_3, {}^1y_4 \right\}$, we first find the Exhaustive Similarity ${}^2es_{1\to2\to3}$ and Exhaustive Dissimilarity ${}^2eds_{1\to2\to3}$. Also, we find the Exhaustive Similarity ${}^2es_{2\to3\to4}$ and Exhaustive Dissimilarity ${}^2eds_{2\to3\to4}$. Our new time Series Sequence of the Exhaustive Similarities in order of the sequence is now $S_{2s} = \left\{ {}^2es_{1\to2\to3},\ {}^2es_{2\to3\to4} \right\}$. And, the new time Series Sequence of the Exhaustive Dissimilarities in order of the sequence is now $S_{2ds} = \left\{ {}^2eds_{1\to2\to3},\ {}^2eds_{2\to3\to4} \right\}$. Using S_{2s} as a Time Series Type Sequence, we now calculate $S_{3s} = \left\{ {}^3es_{1\to2\to3} \right\}$ by simply using the relation ${}^3es_{1\to2\to3} = \left(\frac{{}^2es_{2\to3\to4}}{{}^2es_{1\to2\to3}} \right)$ and using S_{2ds} as a Time Series Type Sequence, we now calculate $S_{3ds} = \left\{ {}^3eds_{1\to2\to3} \right\}$ by simply using the relation ${}^3es_{1\to2\to3} = \left(\frac{{}^2es_{2\to3\to4}}{{}^2es_{1\to2\to3}} \right)$. We now consider k step Evolution of ${}^3es_{1\to2\to3}$ and ${}^3eds_{1\to2\to3}$ individually and write them as $E^k\left({}^3es_{1\to2\to3}\right)$ and $E^k\left({}^3eds_{1\to2\to3}\right)$ respectively. We now use $E^k\left({}^3es_{1\to2\to3}\right)$ and ${}^2es_{1\to2\to3}, {}^2es_{2\to3\to4}$ to find the Future Average ${}^2es_{3\to4\to5}$. Similarly, using $E^k\left({}^3eds_{1\to2\to3}\right)$ and ${}^2eds_{1\to2\to3}, {}^2eds_{2\to3\to4}$ we find ${}^2eds_{3\to4\to5}$. We now use ${}^1y_3, {}^1y_4$ and ${}^2es_{3\to4\to5}$ to find the Future Average Similarity Component of the Future Average ${}^1y_{(n+1)}$, say ${}^1sy_{(n+1)}$. Similarly, we use ${}^1y_3, {}^1y_4$ and ${}^2eds_{3\to4\to5}$ to find out the Dissimilarity Component of the Future Average ${}^1y_{(n+1)}$, ${}^1dsy_{(n+1)}$. Finally, we add ${}^1sy_{(n+1)}$ and ${}^1dsy_{(n+1)}$ to get ${}^1y_{(n+1)}$, i.e., ${}^1y_{(n+1)} = {}^1sy_{(n+1)} + {}^1dsy_{(n+1)}$.

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