THEORETICAL MODEL FOR AN APPROXIMATE ONE STEP FORECASTING SCHEME

Bagadi, Ramesh Chandra
Fellow, Institution Of Engineers, India F124-1135
Home Address: MIG-905, Mithilapuri Colony, VUDA Layout, Madhurawada,
Visakhapatnam, Andhra Pradesh State, India
Email: rameshcbagadi@uwalumni.com
Tel: 91-9440032711

ABSTRACT

In this research investigation, the authors present a detailed scheme of a theoretical model for an approximate one step forecasting scheme. Firstly, the authors coin notions of Similarity and Dissimilarity. The authors then coin a notion of causal one step forecast for any given sequence. Parallely, the authors define concepts of Higher Order Sequence of Primes and RL Normalization Scheme based on which alternate better formulae for one step forecast for any given sequence are derived.

Key words: Forecasting, Prime Numbers.

1. INTRODUCTION

In the field of Forecasting, Time Series Forecasting [1], [2], [3] is one of the major technologies that is currently used for forecasting purposes. In this research manuscript the authors present a scheme of one step forecasting that is different from Time Series method of forecasting.

2. AUTHORS PROPOSED CONCEPTS

2.1. Novel Inner Product

Firstly, we consider two vectors

$$\vec{A} = \sum_{i=1}^{n} a_i \hat{e}_i \qquad (1)$$

and $$\vec{B} = \sum_{i=1}^{n} b_i \hat{e}_i \qquad (2)$$

We propose an Inner Product Of the kind detailed as below.

$$\vec{A} \cdot \vec{B} = \sum_{i=1}^{n} \left\{ b_i^2 F_1 + a_i^2 F_2 \right\} \qquad (3)$$

$$\begin{aligned} &where\ F_1 = 1, F_2 = 0\ when\ a_i > b_i \\ &and\ F_2 = 1, F_1 = 0\ when\ a_i < b_i \end{aligned} \qquad (4), (5)$$

2.2. Novel Notions of Similarity & Dissimilarity

Firstly, we define the definitions of Similarity and Dissimilarity using author's as follows:

Given any two real numbers a and b, their Similarity is given by

$$Similarity(a,b) = \begin{matrix} a^2 \ if \ a < b \\ b^2 \ if \ b < a \end{matrix} \tag{6}$$

Also, the Similarity Coefficient is given by

$$SimilarityCoefficient(a,b) = \begin{matrix} \left(\frac{a^2}{ab}\right) if \ a < b \\ \left(\frac{b^2}{ab}\right) if \ b < a \end{matrix} \tag{7}$$

and their Dissimilarity is given by

$$Dissimilarity(a,b) = \begin{matrix} ab - a^2 \ if \ a < b \\ ab - b^2 \ if \ b < a \end{matrix} \tag{8}$$

$$DissimilarityCoefficient(a,b) = \begin{matrix} \left(\frac{ab - a^2}{ab}\right) if \ a < b \\ \left(\frac{ab - b^2}{ab}\right) if \ b < a \end{matrix} \tag{9}$$

Therefore, the Dissimilarity for two Vectors

$\overline{A} = \sum_{i=1}^{n} a_i \hat{e}_i$ and $\overline{B} = \sum_{i=1}^{n} b_i \hat{e}_i$ is

$$\vec{A} \cdot \vec{B} = \sum_{i=1}^{n} \left\{ \left(a_i b_i - b_i^2\right) F_i + \left(a_i b_i - a_i^2\right) G_i \right\} \tag{10}$$

where $F_i = 1$ and $G_i = 0$ if $b_i < a_i$ and (11)

$F_i = 0$ and $G_i = 1$ if $b_i > a_i$ (12)

2.3. Proof for the Formula of Euclidean Inner Product as a Measure of Similarity of Two Same Sized Vectors

The colloquial definition of Inner Product mentioned in the previous section motivates us now to propose a Proof for the formula of *Euclidean Inner Product* computed as shown below:

If

$a_i < b_i$

$$\vec{A} \cdot \vec{B}_{FirstTerm} = \sum_{i=1}^{n} \left\{ a_i^2 \right\}$$

Which is the area gotten by squaring the lower dimension

Then, the left over area is given by

$$\left(\sum_{i=1}^{n} \left\{ \left(b_i - a_i\right) a_i \right\} \right)$$

Case 1

If $\left(b_i - a_i\right) < a_i$

$$\vec{A}\cdot\vec{B}_{SecondTerm} = \sum_{i=1}^{n}\left\{(b_i - a_i)^2\right\}$$

Now, the Left over area is given by

$$\left(\sum_{i=1}^{n}\{[(a_i - (b_i - a_i))](b_i - a_i)\}\right)$$

Case 2

If $a_i < (b_i - a_i)$

$$\vec{A}\cdot\vec{B} = \sum_{i=1}^{n}\left\{(a_i)^2\right\}$$

Now, the Left over area is given by

$$\left(\sum_{i=1}^{n}\{[((b_i - a_i) - a_i)](a_i)\}\right)$$

Case 1-1

If

$$(a_i - (b_i - a_i)) < (b_i - a_i)$$

$$\vec{A}\cdot\vec{B}_{ThirdTerm} = \sum_{i=1}^{n}\left\{(a_i - (b_i - a_i))^2\right\}$$

Now the left over area is given by

$$\left(\sum_{i=1}^{n}\{(b_i - a_i) - (a_i - (b_i - a_i))\}(a_i - (b_i - a_i))\right)$$

Case 1-2

If

$$((b_i - a_i) - a_i) < (a_i - (b_i - a_i))$$

$$\vec{A}\cdot\vec{B}_{ThirdTerm} = \sum_{i=1}^{n}\left\{((b_i - a_i) - a_i)^2\right\}$$

Now the left over area is given by

$$\left(\sum_{i=1}^{n}\{(a_i - (b_i - a_i)) - ((b_i - a_i) - a_i)\}((b_i - a_i) - a_i)\right)$$

Case 2-1

If

$$((b_i - a_i) - a_i) < a_i$$

$$\vec{A}\cdot\vec{B}_{ThirdTerm} = \sum_{i=1}^{n}\left\{((b_i - a_i) - a_i)^2\right\}$$

Now the left over area is given by

$$\left(\sum_{i=1}^{n} \{a_i - ((b_i - a_i) - a_i)\}((b_i - a_i) - a_i) \right)$$

Case 2-2

If

$$a_i < ((b_i - a_i) - a_i)$$

$$\vec{A} \cdot \vec{B}_{ThirdTerm} = \sum_{i=1}^{n} \{a_i{}^2\}$$

Now the left over area is given by

$$\left(\sum_{i=1}^{n} \{((b_i - a_i) - a_i) - a_i\}(a_i) \right)$$

Case 1-1-1

If

$$\{(b_i - a_i) - (a_i - (b_i - a_i))\} < (a_i - (b_i - a_i))$$

$$\vec{A} \cdot \vec{B}_{FourthTerm} = ...$$

Case 1-1-2

Case 1-2-1

If

$$\{(a_i - (b_i - a_i)) - ((b_i - a_i) - a_i)\} < ((b_i - a_i) - a_i) \ \vec{A} \cdot \vec{B}_{FourthTerm} = ...$$

Case 1-2-2

Case 2-1-1

If

$$\{a_i - ((b_i - a_i) - a_i)\} < ((b_i - a_i) - a_i)$$

$$\vec{A} \cdot \vec{B}_{FourthTerm} = ...$$

Case 2-1-2

Case 2-2-1

If

$$\{((b_i - a_i) - a_i) - a_i\} < (a_i)$$

$$\vec{A} \cdot \vec{B}_{FourthTerm} = ...$$

Case 2-2-2

Therefore, we can write the net Holistic Inner Product for the explicitly computed first case (along a certain branch) as

$$\vec{A}\cdot\vec{B} = \sum_{i=1}^{n}\left\{a_i^2\right\} + \sum_{i=1}^{n}\left\{(b_i - a_i)^2\right\} + \sum_{i=1}^{n}\left\{(a_i - (b_i - a_i))^2\right\} + ...$$

In this fashion, we can compute the net *Holistic Inner Product* along the appropriate branch as dictated by the numerical values of

a_i

and

b_i

We can note that this infinite sum is also equal to

$$\vec{A}\cdot\vec{B} = \sum_{i=1}^{n}\left\{a_i\, b_i\right\} \tag{13}$$

Therefore, forms the *Proof* of

$$\vec{A}\cdot\vec{B} = \sum_{i=1}^{n}\left\{a_i\, b_i\right\}$$

2.4. Euclidean Inner Product of Two N Dimensional Matrices A and B

In this research section, the Euclidean Inner Product of two N-Dimensional Matrices A and B is slated by the author.

One can note that, one can find the Euclidean Inner Product of two N-Dimensional Matrices A and B using the following definition

$$A\cdot B = \sum_{i_1}\sum_{i_2}\cdots\cdots\sum_{i_{n-1}}\sum_{i_n} A_{i_1 i_2 i_3 .....i_n}\, B_{i_1 i_2 i_3 .....i_n} \tag{14}$$

where $A_{i_1 i_2 i_3 .....i_n}$ and $B_{i_1 i_2 i_3 .....i_n}$ are the elements of the two N-Dimensional Matrices A and B.

2.5. Causal One Step Future Average Model Based on Similarity & Dissimilarity –Method 1

Given any time series or non-time series sequence of the kind

$$S = \left\{y_1, y_2, y_3, ..., y_{n-1}, y_n\right\} \tag{15}$$

We can now write y_{n+1} as

$$y_{(n+1)} = y_{(n+1)S} + y_{(n+1)DS} \tag{16}$$

where

$$y_{(n+1)S} = \frac{\sum_{i=1}^{n} y_i \sum_{j=1}^{i}\left\{SimilarityCoefficient\left(y_i, y_j\right)\right\}}{\sum_{i=1}^{n}\sum_{j=1}^{i}\left\{SimilarityCoefficient\left(y_i, y_j\right)\right\}} \tag{17}$$

and

$$y_{(n+1)DS} = \frac{\sum_{i=1}^{n} y_i \sum_{j=1}^{i} \left\{ DissimilarityCoefficient\left(y_i, y_j\right)\right\}}{\sum_{i=1}^{n}\sum_{j=1}^{i} \left\{ DissimilarityCoefficient\left(y_i, y_j\right)\right\}} \quad (18)$$

This scheme can also be used to Predict Primes starting from 2, 3, 5, 7, 11, ….

2.6. Theory of Higher Order Sequence of Primes

Since, the dawn of civilization, human kind has been leaning on the Sequence of Primes to devise Evolution Schemes akin to the behavior of the Distribution of Primes, in an attempt to mimic natural phenomenon and be able to forecast useful aspects of science of the aforementioned phenomenon. Many western and as well as oriental Mathematicians and Physicists have understood the importance of Prime Numbers (in the ambit of Quantum Groups, Hopf Algebras, Differentiable Quantum Manifolds, etc.,) in understanding subatomic processes such as Symmetry Breaking, Standard Model Explanation, etc. In this section, the author advocates a novel concept of Higher Order Sequence Of Primes.

A Positive Integer Number is considered as a Prime Number in a Certain Higher Order (Positive Integer ≥ 2) Space, say R, if it is factorizable into a Product of (R-1) factors wherein the factors are (R-1) number of Distinct Non-Reducible Positive Integer Numbers (Primes of 2^{nd} Order Space).

Example 1

The general Primes that we usually refer to can be called as Primes of 2^{nd} Order Space.

Example 2

First Few Elements of Sequence's Of Higher Order Space Primes	R^{th} Order Space
{2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, …}	R=2
{6 (3x2), 10 (5x2), 14 (7x2), 15 (5x3), 21 (7x3), 22 (11x2), 26 (13x2), 33 (11x3), 34 (17x2), 35 (7x5), 38 (19x2), 39, (13x3), 45 (9x5), ... }	R=3
{30 (5x3x2), 42 (7x3x2), 70 (7x5x2), 84 (7x4x3), 102 (17x3x2), 105 (17x3x2), 110 (11x5x2), 114 (19x3x2), 130 (13x5x2), ...}	R=4
{210 (7x5x3x2), 275 (11x5x3x2), 482 (11x7x3x2), 770 (11x7x5x2), 1155 (11x7x5x3), …}	R=5

We can note that the Primes of any Integral (Positive Integer ≥ 2) Order Space (say R) can be arranged in an increasing order and their position in this order denotes their Higher Order Space Prime Metric Basis Position Number.

We can generate the Sequence Of Any Integral (Positive Integer ≥ 2) Higher Order Primes in the following fashion:

The First Prime of any R^{th} Order Space Sequence Of Primes can be computed by simply considering consecutively the First (R-1) Number of Primes of 2^{nd} Order Space Sequence Of Primes, starting from the First Prime of 2^{nd} Order Space Sequence Of Primes, i.e., 2 and Forming a Product Term of the Form

$${}^{R}p_1 = \overbrace{\left\{ {}^{2}2_1 \times {}^{2}3_2 \times {}^{2}5_3 \times {}^{2}7_4 \times \ldots\ldots\ldots\ldots \left\{{}^{2}p_{(R-3)}\right\} \times \left\{{}^{2}p_{(R-2)}\right\} \times \left\{{}^{2}p_{(R-1)}\right\}\right\}}^{(R-1)\ Number\ Of\ \Pr oduct\ For\min g\ Factors} \quad (19)$$

which becomes the First Prime of any R^{th} Order (Positive Integer ≥ 2) Space Sequence Of Primes as it cannot be factored in terms of R Number of Unique Factors. We Label this Number as ${}^{R}p_1$

One Step Evolution of any element of Second Order Space Sequence Of Primes is the next consecutive Second Order Space Prime element of the given element of Second Order Space Sequence Of Primes. For Example, One Step Evolution of 2 is 3 and of 31 is 37.

The Second Prime of any R^{th} Order (Positive Integer ≥ 2) Space Sequence Of Primes can be computed in the following fashion.

Firstly, we consider consecutively the First (R-1) Number of Primes of 2^{nd} Order Space Sequence Of Primes, starting from the First Prime of 2^{nd} Order Space Sequence Of Primes, i.e., 2 and forming a Product Term of the form

$$^{R}p_1 = \overbrace{\left\{^2 2_1 \times {}^2 3_2 \times {}^2 5_3 \times {}^2 7_4 \times \ldots\ldots\ldots\ldots \left\{^2 p_{(R-3)}\right\} \times \left\{^2 p_{(R-2)}\right\} \times \left\{^2 p_{(R-1)}\right\}\right\}}^{(R-1)\ Number\ Of\ \Pr oduct\ For\min g\ Factors}$$

which becomes the First Prime of any R^{th} Order (Positive Integer ≥ 2) Space Sequence Of Primes as it cannot be factored in terms of R Number of Unique Factors. We now cause One Step Evolution of that one particular factor among the (R-1) factors such that the Product climb of the value ${}^{R}p_2$ over ${}^{R}p_1$ is minimum as compared to that gotten by performing the same using any other factor among the (R-1) factors.

{One Step Devolution of any element of Second Order Space Sequence Of Primes is the just previous Second Order Space Prime element of the given element of Second Order Space Sequence Of Primes. For Example, One Step Devolution of 3 is 2 and of 37 is 31}.

We find ${}^{R}p_3$ using ${}^{R}p_2$ as detailed in the above paragraph, and similarly, we can find any element of the R^{th} Order Sequence of Primes.

For Example, 210 is the 1^{st} (Higher Order Space Prime Metric Basis Position Number) element of $R=5^{th}$ Order Space Sequence Of Primes.

Similarly, 102 is the 5^{th} (Higher Order Space Prime Metric Basis Position Number) element of $R=4^{th}$ Order Space Sequence Of Primes.

Therefore, any of these Higher Order Space Primes can be represented as follows:

$$^{Higher\ Order\ Space\ Number}(Number)_{\text{Higher Order Space Prime Metric Basis Position Number}}$$

That is,

210 can be written as ${}^{5}210_1$ and 102 can be written as ${}^{4}210_5$.

Each of the rest of the Positive Integers can be classified to belong to it's Unique Parent Sequence Of Higher Non Integral Order Space Primes, at a particular Prime Metric Basis Position Number.

That is, for any Positive Integer, we can use the Method of One Step Evolution successively and can find all the elements greater than it up to a certain limit. Similarly, we can use the Method Of One Step Devolution successively and can find all the elements lower than it but greater than zero. These set of numbers when arranged in an order form a Sequence, namely the Sequence Of Higher (Positive Non Integer Order) Primes, of some particular Positive Non Integer Order.

2.7. Coarser Representation of Positive Integers other than the Sequence of Primes of Any Higher Order (Positive Integer Greater than or Equal to 2) Space

Considering any number say f, we can write its nearest primes of any Rth Order Space, on either side as ${}^{R}p_k$ and ${}^{2}p_{k+1}$, where ${}^{R}p_k$ is the k^{th} Prime and ${}^{R}p_{k+1}$ is the $(k+1)^{th}$ Prime of the Sequence Of Primes Of the Rth Order (Positive Integer ≥ 2) Space. We can then write

$$f = {}^{R}p_{k+\alpha} \tag{20}$$

$$\text{where } \alpha = \left(\frac{f - {}^{R}p_k}{{}^{R}p_{k+1} - {}^{R}p_k}\right)\left(\frac{{}^{R}p_{\left(f - {}^{R}p_k\right)}}{{}^{R}p_{\left({}^{R}p_{k+1} - {}^{R}p_k\right)}}\right) \text{ with } 0 < \alpha < 1. \tag{21}$$

Then, $(k+\alpha)$ is the Non Integral Prime Basis Position Number of f. In a similar fashion, any Rational Number $\frac{a}{b}$ can be written as $\frac{a}{b} = \frac{{}^{R}p_{k+\alpha}}{{}^{R}p_{l+\beta}}$ (22)

where k, l are some positive integers and $0 < \alpha, \beta < 1$.

2.8. Finer Representation of Any Natural Number in Terms of Primes Basis Position Number of Any Positive Integer Order Sequence of Primes

Considering any Natural Number q, and any Positive Integer Order Number r, we first find two r^{th} Order Sequence Primes that bound r, i.e., ${}^{r}p_{u_1} < q < {}^{r}p_{u_1+1}$ where u_1 is a Positive Integer such that ${}^{r}p_{u_1}$ is the Largest r^{th} Order Sequence Of Primes element that is less than q and p_{u_1+1} is the Smallest r^{th} Order Sequence of Primes element that is greater than q.

Then q can be represented as

$$q = {}^{r}p_v \text{ where } v = u_1 + \left\{\frac{q - {}^{r}p_{u_1}}{{}^{r}p_{u_1+1} - {}^{r}p_{u_1}}\right\} = u_1 + \left(\frac{\delta_{N1}}{\delta_{D1}}\right) \tag{23), (24}$$

However, we can note that this is not the Best Representation for v. Therefore, we multiply $\left(q - {}^{r}p_{u_1}\right)$ by a Smallest Natural Number a_1 such that $a_1\left(q - {}^{r}p_{u_1}\right) \geq {}^{r}p_{u_1+1}$. Therefore, we now also multiply the value $\left({}^{r}p_{u_{1+1}} - {}^{r}p_{u_1}\right)$ by a_1 as well. Now, we inspect the Set of r^{th} Order Primes for an element ${}^{r}p_{u_{N1}}$ such that ${}^{r}p_{u_{N1}}$ is the Largest r^{th} Order Sequence of Prime Element (of Position Number u_{N1}) which is less than $a_1\left(q - {}^{r}p_{u_1}\right)$ and similarly, we inspect the Set of r^{th} Order Primes for an element ${}^{r}p_{u_{D1}}$ such that ${}^{r}p_{u_{D1}}$ is the Largest r^{th} Order Sequence of Prime Element (of Position Number u_{N1}) which is less than $a_1\left({}^{r}p_{u_{1+1}} - {}^{r}p_{u_1}\right)$.

Therefore, we can write

$$\left(\frac{\delta_{N1}}{\delta_{D1}}\right) = \left(\frac{{}^{r}p_{u_{N1}}}{{}^{r}p_{u_{D1}}}\right) + \left(\frac{\delta_{N2}}{\delta_{D2}}\right) \tag{25}$$

We again re-write

$$\left(\frac{\delta_{N2}}{\delta_{D2}}\right) = \left(\frac{{}^{r}p_{u_{N2}}}{{}^{r}p_{u_{D2}}}\right) + \left(\frac{\delta_{N3}}{\delta_{D3}}\right) \tag{26}$$

Using the aforementioned scheme analogously and keep finding the best or accurate possible value by doing as many iterations as necessary for the desired accuracy.

To elaborate further, we write the Residue

$$\left(\frac{\delta_{N1}}{\delta_{D1}}\right)-\left(\frac{{}^{r}p_{u_{N1}}}{{}^{r}p_{u_{D1}}}\right)=\left(\frac{\delta_{N2}}{\delta_{D2}}\right), \tag{27}$$

i.e., as a Fraction whose Numerator and Denominator are both Natural Numbers. We then find ${}^{r}p_{u_{N2}}$ such that it is the Largest element of the r^{th} Order Sequence Of Primes Set and which is Smaller than δ_{N2}. Similarly, we find ${}^{r}p_{u_{D2}}$ such that it is the Largest element of the r^{th} Order Sequence Of Primes Set and which is Smaller than δ_{D2}. We now write the Residue

$$\left(\frac{\delta_{N2}}{\delta_{D2}}\right)-\left(\frac{{}^{r}p_{u_{N2}}}{{}^{r}p_{u_{D2}}}\right)=\left(\frac{\delta_{N3}}{\delta_{D3}}\right) \tag{28}$$

We should note that if δ_{N2} and δ_{D2} are Small Numbers, we can multiply the δ_{N2} and δ_{D2} by some Natural Number a_2 such that they are sufficiently large enough to capture the desired accuracy of our representation. We can note that in the relation $a_1\left(q-{}^{r}p_{u_1}\right)\geq {}^{r}p_{u_1+1}$ already mentioned, we can have a_1 replaced by a Natural Number much larger than a_1 so as to capture the desired accuracy of our representation. We can now re-write

$$\left(\frac{\delta_{N3}}{\delta_{D3}}\right)-\left(\frac{{}^{r}p_{u_{N3}}}{{}^{r}p_{u3}}\right)=\left(\frac{\delta_{N4}}{\delta_{D4}}\right) \tag{29}$$

In this fashion, we can represent any number q in terms of a Non Integral Prime Basis Position Number of r^{th} Order Sequence Of Primes. That is, we can write

$$q={}^{r}p_{v} \tag{30}$$

$$q={}^{r}p_{u_1+\left(\frac{\delta_{N1}}{\delta_{D1}}\right)} \tag{31}$$

And so on, so forth as,

$$q={}^{r}p_{u_1+\sum_{i=1}^{\infty}(\xi_{uNi})} \tag{32}$$

where

$$\xi_{uNi}=\left(\frac{{}^{r}p_{uNi}}{{}^{r}p_{uDi}}\right) \tag{33}$$

2.9. The RL-Norm

For Normalization scheme, when we have to Normalize a Set of Real Numbers, we can use the concept of RL-Norm, i.e., normalization in the z Space where z is the Prime Basis Position Number in L^{th} Order Sequence Of Primes Representation of the Highest Value of the Set Of Real Numbers. For L=2, it reduces to Representation in Standard Sequences Of Primes Basis. That is, we can write the RL-Norm of a Set of Real Numbers

If, x_{1i} and x_{2i} are two n dimensional points, then

$$dist(RL \underset{for \ \ i=1 \ to \ n}{Norm}(x_{1i}, x_{2i})) =$$

$$\left\{\sum_{i=1}^{n}\left\{(x_{1i}-x_{2i})^{\left\{{}^{G}PBPN\left\{\underset{for\,all\,i}{Max}(x_{1i},x_{2i})\right\}\right\}}\right\}\right\}^{\left\{\frac{1}{{}^{G}PBPN\left\{\underset{for\,all\,i}{Max}(x_{1i},x_{2i})\right\}}\right\}} \tag{34}$$

Therefore, any RL-Norm type Normalization simply takes the form

$$RL\ Norm(x_i) = \frac{(x_i)}{\left\{\sum_{i=1}^{n}\left\{(x_i)^{\left\{{}^{G}PBPN\left\{\underset{for\,all\,i}{Max}(x_i)\right\}\right\}}\right\}\right\}^{\left\{\frac{1}{{}^{G}PBPN\left\{\underset{for\,all\,i}{Max}(x_i)\right\}}\right\}}} \tag{35}$$

Here, G_{PBPN} is the Prime Basis Position Number of the greatest value of x_{1i} for the above formula and G_{PBPN} is the Prime Basis Position Number of the greatest value of (x_{1i}, x_{2i}) for the formula above the above formula.

2.10 *Causal One Step Future Average Model Based On Similarity & Dissimilarity Using Lag Sequences In Holisticness*

Given any time series or non-time series sequence of the kind

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

We can now write y_{n+1} as

$$y_{(n+1)} = y_{(n+1)S} + y_{(n+1)DS}$$

where

$$y_{(n+1)S} = \frac{\sum_{i=1}^{n} y_i \sum_{j=1}^{i}\{SimilarityCoefficient(y_i, y_j)\}}{\sum_{i=1}^{n}\sum_{j=1}^{i}\{SimilarityCoefficient(y_i, y_j)\}}$$

and

$$y_{(n+1)DS} = \frac{\sum_{i=1}^{n} y_i \sum_{j=1}^{i} \{DissimilarityCoefficient(y_i, y_j)\}}{\sum_{i=1}^{n} \sum_{j=1}^{i} \{DissimilarityCoefficient(y_i, y_j)\}}$$

Herein, we find all the Lag Sequences (including 0 Lag) of the given Sequence with Lag 1, Lag 2, Lag 3,…, etc upto as many possible lags backwards from the Result Position, i.e., the y_{n+1} term.

For Example, for the sequence

$$S = \{2,3,5,7,11,13,17\}$$

There are 3 lag sequences possible, each gotten by going backwards from the y_{n+1} term.

$$S_0 = \{2,3,5,7,11,13,17\}$$

is the zero lag sequence.

$$S_1 = \{3,7,13\}$$

is the lag 1 sequence.

$$S_2 = \{3,11\}$$

is the lag 2 sequence.

We then find the L2 or RL Norm for each such Lag Sequence. Say if there are possible (M+1) (starting from 0) number of Lag Sequences and ${}_k y_{n+1}$ is the Result (gotten by using Equation number 16) of the Lag Sequence with Lag *k*, and using

$$ {}_k \tilde{y}_{n+1} = \left\{ \frac{{}_k y_{n+1}}{RLNorm\{Lag\ k\ Sequence\}} \right\}, \qquad (36)$$

we find its weight as follows:

$$w_k = \frac{{}_k \tilde{y}_{n+1}}{\sum_{j=0}^{M} {}_j \tilde{y}_{n+1}} \qquad (37)$$

We now write the Holistic True Forecast as

$$y_{n+1\ Holistic} = \sum_{j=0}^{M} w_j \left({}_j y_{n+1} \right)$$

(38)

with

where $z = \left\{ {}^{G}PBPN \left\{ \underset{for\,all\,i}{Max}\left(y_1, y_2, y_3, ..., y_{n-1}, y_n \right) \right\} \right\}$

and

$$RL\,Norm\left(y_1, y_2, y_3, ..., y_{n-1}, y_n \right) = \left\{ y_1^{\,z} + y_2^{z} + y_3^{z} + ... + y_{n-1}^{z} + y_n^{z} \right\}^{\frac{1}{z}}$$

(39)

This scheme can also be used to Predict Primes starting from 2, 3, 5, 7, 11, ….

2.11 Recursive *Causal One Step Future Average Model Based On Similarity & Dissimilarity Using Lag Sequences In Holisticness*

Given any time series or non-time series sequence of the kind

$S = \left\{ y_1, y_2, y_3, ..., y_{n-1}, y_n \right\}$

We can now write y_{n+1} as

$$y_{(n+1)} = y_{(n+1)S} + y_{(n+1)DS}$$

where

$$y_{(n+1)S} = \frac{\sum_{i=1}^{n} y_i \sum_{j=1}^{i} \left\{ SimilarityCoefficient\left(y_i, y_j \right) \right\}}{\sum_{i=1}^{n} \sum_{j=1}^{i} \left\{ SimilarityCoefficient\left(y_i, y_j \right) \right\}}$$

and

$$y_{(n+1)DS} = \frac{\sum_{i=1}^{n} y_i \sum_{j=1}^{i} \left\{ DissimilarityCoefficient\left(y_i, y_j \right) \right\}}{\sum_{i=1}^{n} \sum_{j=1}^{i} \left\{ DissimilarityCoefficient\left(y_i, y_j \right) \right\}}$$

Herein, we find all the Lag Sequences (including 0 Lag) of the given Sequence with Lag 1, Lag 2, Lag 3,…, etc upto as many possible lags backwards from the Result Position, i.e., the y_{n+1} term. Let S_k be such Series with Lag *k*. Let y_{ik} be the i^{th} element of S_k. Let the Cardinality, i.e., the number of elements of S_k be equal to n_k.

We then find the RL Norm for each such Lag Sequence. Say if there are possible (M+1) (starting from 0) number of Lag Sequences for the given Sequence S and $y_{(n+1)k}$ is the Result of the Lag Sequence with Lag k, and using

$$\tilde{y}_{(n_k+1)k} = \left\{ \frac{y_{(n+1)k}}{|y_k|} \right\}, \qquad (40)$$

where $|y_k| = \left\{ y_{1k}^{\;Z_k} + y_{2k}^{Z_k} + y_{3k}^{Z_k} + ... + y_{(n_k-1)k}^{Z_k} + y_{(n_k)k}^{Z_k} \right\}^{\frac{1}{Z_k}}$ (41)

and $z_k = {}^{G}PBPN \left\{ Max \left\{ \left\{ \bigcup_{i=1}^{n_k} y_{ik} \right\} \bigcup y_{(n_k+1)k} \right\} \right\}$ (42)

we find its weight as follows:

$$w_k = \frac{\tilde{y}_{(n_k+1)k}}{\sum_{j=0}^{M} {}_j\tilde{y}_{(n_k+1)k}}$$

We now write the Holistic True Forecast as

$$y_{n+1\ Holistic} = \sum_{j=0}^{M} w_j \left({}_j\, y_{(n_k+1)k} \right)$$

where $y_{(n_k+1)k}$ is the Causal One Step Future Average Of The Sequence S_k

using the Formula in Equation (16).

This scheme can also be used to Predict Primes starting from 2, 3, 5, 7, 11, ….

2.12 Conservative Recursive *Causal One Step Future Average Model Based On Similarity & Dissimilarity Using Lag Sequences In Holisticness*

Given any time series or non-time series sequence of the kind

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

We can now write y_{n+1} as

$$y_{(n+1)} = y_{(n+1)S} + y_{(n+1)DS}$$

where

$$y_{(n+1)S} = \frac{\sum_{i=1}^{n} y_i \sum_{j=1}^{i} \{SimilarityCoefficient(y_i, y_j)\}}{\sum_{i=1}^{n} \sum_{j=1}^{i} \{SimilarityCoefficient(y_i, y_j)\}}$$

and

$$y_{(n+1)DS} = \frac{\sum_{i=1}^{n} y_i \sum_{j=1}^{i} \{DissimilarityCoefficient(y_i, y_j)\}}{\sum_{i=1}^{n} \sum_{j=1}^{i} \{DissimilarityCoefficient(y_i, y_j)\}}$$

Herein, we find all the Lag Sequences (including 0 Lag) of the given Sequence with Lag 1, Lag 2, Lag 3,…, etc upto as many possible lags backwards from the Result Position, i.e., the y_{n+1} term. Let S_k be such Series with Lag *k*. Let y_{ik} be the i^{th} element of S_k. Let the Cardinality, i.e., the number of elements of S_k be equal to n_k.

Say if there are possible (M+1) (starting from 0) number of Lag Sequences for the given Sequence S and $y_{(n+1)k}$ is the Result of the Lag Sequence with Lag *k* , and using

$$\tilde{y}_{(n_k+1)k} = \left\{ \frac{y_{(n+1)k}}{|y_k|} \right\},$$

where $|y_k| = \left\{ y_{1k}^{\ x_k} + y_{2k}^{x_k} + y_{3k}^{x_k} + ... + y_{(n_k-1)k}^{x_k} + y_{(n_k)k}^{x_k} \right\}^{\frac{1}{x_k}}$

with $x_k = Max\left\{ \bigcup_{k=0}^{M} z_k \right\}$ (43)

and $z_k = {}^{G}PBPN\left\{ Max\left\{ \left\{ \bigcup_{i=1}^{n_k} y_{ik} \right\} \bigcup y_{(n_k+1)k} \right\} \right\}$

we find its weight as follows:

$$w_k = \frac{\tilde{y}_{(n_k+1)k}}{\sum_{j=0}^{M} {}_j\tilde{y}_{(n_k+1)k}}$$

We now write the Holistic True Forecast as

$$y_{n+1\ Holistic} = \sum_{j=0}^{M} w_j \left({}_j y_{(n_k+1)k} \right)$$

where $y_{(n_k+1)k}$ is the Causal One Step Future Average Of The Sequence S_k

using the Formula in Equation (16).

This scheme can also be used to Predict Primes starting from 2, 3, 5, 7, 11, ….

2.13 Special Issues

1. One can try 1 as the First Prime. This may give better answer. Else, 2 can be used as the First Prime.

2. If L2 Norm does not give good results then one can resort to the use of Augmented RL Norm.

3. CONCLUSIONS

Examples were hand computed using the Sequence of Primes starting from 2 and the next Prime number was predicted with a good accuracy.

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