Formulation of A Single Unified Law -- In The Scientific Theory For A Change -- As A Measure For Variations of Observation Data In Empirical Data

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Abstract- *The paper has two parts in the Analysis section. In the first part, there is the formulation of a single law based on the six generalized laws as is given in the scientific theory for a change {Ref.1}. The second part of the Analysis gives an entirely new law. There is the summation as a single unified law. A measure is thus determined for the extent of variations of observation data in empirical data.*

Keywords- Certainty, Uncertainty, Entropy, Reliability, Information

DEFINITIONS

The certainty is given as: [c = exp(p. ln(p))], which is known as the power function, with the base and exponent as (p), where (p) is the probability.

The uncertainty is a complement of the certainty, as: [u = 1 – c], such that the sum is unity.

The root function, as is the logarithmic transformation, gives the entropy function, written as: [s = exp.((1/x). ln(x))], where (x) is the system reliability. It may be noted that, for any variable (x), such as a random variable, which may be a root function in the logarithmic transformation gives the same result as a power function with the exponent as an inverse of the base variable.

The other entropy function is given by the variable (x) as the unreliability; and their respective complements result in two pairs, forming the upper and lower bound each, for the reliability and unreliability functions; the average entropy function, thereby resulting from the upper and the lower bounds, give rise to the new reliability and unreliability functions, respectively.

I. INTRODUCTION

There is a need to inquire into the connection that there is, between the real outcomes of an event and the logical association between the event and the result. It is about two connections, the first is between the several outcomes that is the real outcomes and the one called event and the second is between the events and the result; where there must be more that one event, such as an event to be or not to be is also to be considered. The events are defined by hypothesis, as for instance one is called the null and the other is called the alternate, where the truth requires a validation for each.

The question that arises is, if a connection exists between one of the many outcomes and a result, so defined by the rules of logic, then is there a similar connection between one of the many in-determinates and a single solution that is fully determinable, at each point in space and time, by the same logic.

For the distributions of data that follow the normal and the usual trend, the patterns are very much alike, such as a correlation may be found to exist among these and where some isolated data are left aside, that will not be of a concern. The search goes on for an exact determination, of a single variable and a scalar constant, at the present moment and at the next instant of time.

Mathematical Review

The logical connection, as given by a function of a single variable, also known as an independent variable, is a functional relationship with the other that is the dependent variable; where the proportionality, owing to the functional relationship, gives rise to an inequality, that which becomes comparable.

The probability is a real number, in the finite interval of zero to one, that is given as a dimensionless number; and the probability is commensurable with the information, which is dimensionless as well; where these are as inseparable entities.

The mathematical expression for the probability in information content is given in juxtaposition or adjacency, as is associative in binary operations; alike a scalar multiplication in a vector space; which is also to be viewed as a linear transform.

The strength of a linear relationship, which is calculated from a given data set, is a mapping between two vector spaces; also written as a linear coefficient; that is a constant for a finite element so defined.

The probability in information provide the basis, which span the complete space. The arbitrary constant facilitates tracking, as is the dimensional analysis of physical quantities; where linear algebra is used in computations.

II. ANALYSIS

PART-I

(i) The Six Generalized Laws

Referring to the six generalized laws, Ref.{3}, {1}&{2}, which are mathematically expressed, for the average uncertainty | du |, average certainty | dc |, as is expressed in terms of respective magnitude ; the entropy difference (ds) is between the upper bound (s1) and lower bound (s2), where (s1 > s2) ; the distance (dx) taken from the origin at zero and the point of entanglement (q) on the domain.

(L1) : Max | du | = 0.3 ; Max | ds | = 0.5 .
(L2) : (1 – dp) = 2 | du | ; or | dc – du | = 2 | du | .
(L3) : Max (1 – dp) = 0.5 ; Max | dc – du | = 0.5 .
(L4) : | du | = 0.58 (ds) .
(L5) : ds $\leq$ dx for linear systems ; and ds $\geq$ dx for non-linear systems .
(L6) : [s1 = 3.(s2)] ; for 0 $\leq$ dx $\leq$ q ; and [s1 = (s2 + 2) / 3] ; for q $\geq$ dx $\geq$ 1 . [1]

(i)

Analysis reveals, that the first law specifies only the maximum values for the partial measures of average uncertainty| du | and the entropy difference (ds).

The second law defines the complement of the range or probability, (1-dp), which is the difference function arising from the average certainty | dc | and the average uncertainty | du|.

The third law gives only the limiting value, as a constraint, for the difference function | dc – du |.
The fourth law gives a relation of the average uncertainty | du | with the entropy difference (ds).

The fifth law is regarding the inclination of the entropy difference (ds), which implies that the point intersection, or the so called entanglement, is a movable point, which depends on the position of the equilibrium that is system specific.

And the sixth law is about the values of the upper bound (s1) and the lower bound (s2) of entropy, with respect to the entropy difference (ds) ; and the average entropy (Sav) is determinable.

It is so deduced, starting from the sixth law, that with an information about a point on either bound of entropy, the other bound can be found, and the entropy difference between the two bounds is obtainable.

Next, by the fourth law, the average uncertainty can be calculated, where by the logical complementarity, the average certainty can also be found.

The second and the third law do not have a direct role and the same is true with the first and the fifth law, which are of lesser significance in terms of practical considerations, owing to the universal constants being there in respective places.

(ii) Formulation of A Single Law

The single law, formulated from the six generalized laws, is stated as follows:

Beginning with a single information, of a point located on either bound of entropy, the other bound can be found and the difference is known; that gives the average uncertainty and the average certainty is computed.

PART – II

The Variations of Average Entropy from the Originating Function

It is so observed, that the difference between the average entropy and the originating function, gives yet another partial measure of the probability, where the modulus of the difference is to be taken, due to a change of sign at the intersection. A similar function gets formed by the complementary pairs, where each is of a sinusoidal shape. The maximum value is at 0.1, approximately, which is a constant. And this maximum is placed at about the mid-point on the domain scale, which is between the point of intersection and each of the boundary points.

This measure was not considered of much significance, due to a change in the signage, for which the field boundary was getting exceeded; {Ref.3}.

Nevertheless, this measure has served to form a new law altogether, which is meant to relate the entropy difference with the average entropy that hence, can no longer be left ignored.

The assumption here is that, the entropy difference is at a maximum value of 0.15, such as this line is perfectly matching when projected onto the line of the average entropy.

The assumption is taken into consideration, owing to a sinusoidal form of the average entropy, which tends to move away from linearity with successive recursions that is by the process of augmentation; as contrary to the average uncertainty that approaches more and more towards linearity with successive recursions that is given by the process of compression; {Ref.4}.

(ii)The Seventh Law

The new law, that have emerged from the above discussion, is stated as:

The difference between the average entropy and the originating function, taken in modulus form, is given by the average uncertainty, where the maximum value is assumed to be at 0.15, which is placed at the mid-point of each domain scale, between the intersection and the boundary point, respectively.

This is mathematically written, for the Difference of Average Entropy with the originating function, |del(Sav)| Max. 0.15, approximately; and (dx) is distance from origin at zero:

(L7) : $| del(Sav) | = du$; for ($0 \leq dx \leq 0.25$);
$| del(Sav) | = (0.3 - du)$; for ($0.25 \leq dx \leq 0.50$);
$| del(Sav) | = du$; for ($0.50 \leq dx \leq 0.75$);
$| del(Sav) | = (0.3 – du)$; for ($0.75 \leq dx \leq 1.0$) .

(iii)Formulation of A Single Unified Law

In summation to the laws, it is hence propounded, that: Beginning with a single information, of a point located on either bound of entropy, the other bound is obtained and the difference is known; the average uncertainty is calculated from the entropy difference; and modulus of difference between the average entropy and the originating function is found by the average uncertainty.

(iv)The Logical Conjecture

The laws are thus unified into a single law, for a practical implementation, as might also be found cited in property equivalence in data extensions, that is about data of data, where the values are the same with mostly the same-as construct, while a different-as construct for some may be just as well.

The logical conjecture drawn is such as: the measure for variations of average entropy from the originating function, by a reverse engineering, serves as the measure for variations of observations found to be in almost all empirical data.

III. CONCLUSION

The paper gives the formulation of a single law from the six generalized laws in the scientific theory for a change in general and special form. A measure is determined that gives rise to an entirely new law. The laws are summed to give a single unified law and that is equally alike the extent of variations of observations in almost all empirical data, to be practically implemented, in metadata.

REFERENCES

[1] Maitra M. [2021], “Explanation of A Scientific Theory For A Change- In General And Special Form- By Using Metaphysics.”, International Journal for Science and Advance Research in Technology (IJSART), Vol.7, Issue 12, Dec.21, pp 48-60.

[2] Maitra M. [2021], “In Continuation to Quantum of Time”, Educreation Publications, India;

[3] Maitra M. [2020], “Quantum of Time”, Educreation Publications, India;

[4] Maitra M. [2019], “Principles of Probability Relations and Philosophical Science”, Part-I and II, Educreation Publications, India.

Footnote

1. The matching of the lines of the difference of average entropy from originating function |delSav| and the average uncertainty (du) can be made exactly coinciding, by using a multiplicative constant of 0.66 with (du) term. However, this would increase computational difficulties. Moreover, the increasing non-linearity of the |delSav| function, with subsequent recursions, would increase the distance from the originating function even more. Therefore, the assumption of equality stands justified.

2. The single unified law is unique, owing to an inherent reversibility, such as, starting from an empirical data, the uncertainty as a complement to the power function is computable, that gives the average entropy and the entropy difference is obtained and the two simultaneous equations of the average and the difference are solved to give the two

unknowns of the upper and the lower bounds of entropy, where the actual location of the data is meant to be found and a metadata is so construed.

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