Chapter 23
Introducing "NR–Statistics":
A New Direction in "Statistics"

Ranjit Biswas
Jamia Hamdard University, India

ABSTRACT

The existing volume of literature on the classical subject STATISTICS is renamed by a new nomenclature called by "R-Statistics". The chapter then introduces a new dimension in the subject STATISTICS called by "NR-Statistics". The subject STATISTICS is then reshaped as the union of the two topics: "R-Statistics" and "NR-Statistics". The "NR-Statistics" has grown (and will grow in future) mainly on the basis of soft-computing techniques using Generalized & Hybrid Set like Structures viz. Fuzzy Set, Intuitionistic Fuzzy Set, Bag, Multiset, Solid Matrix, Solid Latrix, Solid Hematrix, Solid Helatrix etc. In the subject STATISTICS in its newly proposed shape, populations are divided into two categories: R-Population and NR-Population. If a population consists of real number data (n-dimensional) only then it is of category 'R-Population', and if a population does not fall into the category of 'R-Population' then it is of the category 'NR-Population'. Thus NR-Population may contain R-population too. The "Theory of NR-Statistics" is a new direction in Statistics which in fact other half of the subject unearthed now for rigorous study and research. The 'Big Data Statistics' is a new era where the population (R or NR) consist of big data.

INTRODUCTION

Statistics is one of the most important subjects in Science and Engineering, part of our everyday life at every moment. By statistics we mean a vast subject of techniques and procedures dealing with the collection, organization, analysis, interpretation, and presentation of data/information. Without the use of statistical methods it would be very difficult to make any good decisions about the raw data, precise or imprecise. From statistical point of view, the term "Universe" refers to the totality of the items or units (or data elements) in any field of enquiry/survey, whereas the term "Population" refers to the total of items about which information is desired by a statistician (or by the statisticians) at some moment of time. Thus, in statistics, by 'population' we mean a large collection of objects of a *similar nature*

which is of interest as a whole - e.g. human beings, households, readings from a measurement device, etc. Whenever we talk about a population P, we can also think of a relevant universe U. Thus all the members (being a multiset/bag) of a population P are also the members of a relevant super set U. But the notion of 'Sample' in statistics is little different. A sample is a sub-collection of objects drawn from a population. A sample is chosen to make inferences about the population just by examining or measuring the elements in the sample.

An important direction in Statistics is unearthed by Biswas in his work in (Biswas, 2014b, 2014c) by introducing a new subject NR-Statistics and then proposing an updated shape of the subject Statistics by proposing R-Statistics and NR-Statistics as two parts of the subject STATISTICS. In STATISTICS in its newly proposed shape as subject, populations can be divided into two categories: *R-Population* and *NR-Population*. If a population consists of real number data (n-dimensional) only then it is of category 'R-Population', and if a population does not fall into the category of 'R-Population' then it is of the category 'NR-Population'. An *NR-Population* may contain R-population too. Thus a 'NR-Population' could be a collection of the type of data viz. a collection of 30 sounds (blows) from a bus horn, a collection of a large number of handwritten characters of the English character "A", a collection of 150 paints of beautiful 'Tajmahal' by 150 number of under-12 aged children, a collection of 5 ECG reports of a patient, a collection of three X-ray images of a fracture bone of a patient, etc.

The justification for categorizing statistical populations into two disjoint mutually exclusive and exhaustive categories: R-population and NR-population, needs to be cleared first of all. Without going for endless amount of justification, we present first of all one simple instance only:-

Consider a population P of real data. Clearly P is a multiset in general. For computing the population mean (arithmetic mean), two operations must be valid in the corresponding multiset data which are "Addition" and "Division by an integer". Suppose that the population P consists of the data which are the ages of 2000 males of height 5ft and above. For computing the mean of this population of size 2000, there is no issue as the two operations "Addition" and "Division by a scalar 2000" are well valid here. For computing the population variance, another operation 'multiplication' must be valid in the multiset P, which is too not an issue in this case. But if we consider a population P consisting of the data which are the collection of 2000 number of handwritten characters of the English character "A" by 2000 children, then the problem is how to compute the population mean, population variance, etc? For computing the mean of this population of size 2000, there must exist two operations "Addition" and "Division by a scalar 2000" valid in the multiset population data! Otherwise we can not compute the mean in this case, as the existing literature of Statistics provide neither any theoretical method nor any experimental technique to find it out. But the daily life of human society, nature, universe, etc. can not ignore such kind of populations which are infinite in numbers. This is a major draw back of the classical Statistics, which we however rename here by a new nomenclature: "R-Statistics".

Thus the various classical measures in Statistics, even in particular the three fundamental measures: mean (arithmetic mean), median and mode, in their present format of respective definitions, are *undefined* measures for NR-population data. But there are a lot of significant analysis, survey, estimations, conclusions, etc. being carried out by the analysts/statisticians for various important objectives over such type of NR-populations in real life circumstances. The failure of these classical measures to play any role over NR-populations has been a hidden truth so far to the statisticians or analysts. In R-Statistics the populations considered so far are mainly R-populations only, but the NR-Statistics deal with R-populations and NR-populations both. The statistics of NR-population is called by "NR-Statistics". All the theories which are developed for *NR-Statistics* are also true for "R-Statistics", the existing Statistics as a subject

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