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The Normal Distribution in natural phenomena: Finding Equilibrium through Standardization versus Normalization

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Abstract

In this comprehensive article, we extensively explore the intricacies surrounding the concept, design, and fundamental principles underlying the normal distribution. Our endeavor encompasses a detailed analysis of its validity and typology, offering a nuanced understanding of this statistical model. At the core of our investigation lies the pivotal issue of normality and standardization, an area ripe with complexity. Through our scientific lens, we delve into the premise that standardization can only be achieved subsequent to data normalization, a process achieved either through conformity to established norms or through meticulous adjustments tailored to address empirical challenges encountered in the treatment of data. By navigating these critical aspects, our work aims to shed light on the nuanced interplay between normality, standardization, and the intricate methods of ensuring empirical robustness in statistical analysis.

Key words: normal distribution, normalization, normalized, standardized.

1. Introduction

Statistics moves beyond pure mathematics by prioritizing applied knowledge and the practical application of statistical techniques over theoretical principles alone. Nevertheless, fundamental theoretical concepts are crucial for understanding. By employing probability models as standards, statistics requires gathering samples that accurately represent the wider population's diversity. Frequently, these samples must be chosen randomly, involving the use of probabilistic methods based on the inherent randomness of the phenomenon under study. This methodology involves skilfully managing potential errors, where probabilities play a crucial role.**[1, 16, 22, 23]**

In biology, the concept of normal distribution theory posits that living beings are inherently structured to function at an optimal level of health and wellness. Any deviations from this state can result in illnesses and malfunctions. This notion finds application in applied science, particularly in deciphering the origins of disorders and devising methods to eliminate and manage them.**[2, 8]**
Broadly speaking, in biology, the concept of normal distribution suggests that biological phenomena adhere to consistent rules and patterns governed by scientific principles. This implies that scientists can analyze biological processes and mathematically model them to comprehend their typical functioning and forecast how external disruptions might affect them.**[2, 15]**
It's crucial to recognize that the concept of normalcy in biology isn't a legally defined natural trait; instead, it's an idea formed through observation and scientific investigation. Additionally, it's important to note that this principle may not universally apply, as some situations might be deemed as deviating from what is considered typical or normal.**[3, 13]**
Even with the advancement of mathematical theory in applied sciences, particularly during the rise of the Big Data era, the relationship between mathematical theory and biology remains a contentious topic, often sidestepped by researchers, particularly those in the life sciences. Most studies tend to focus on the technical aspects or the practical application of mathematical methods, especially in the realm of statistics. Interpreting findings still hinges on predicting general trends or handling atypical cases and their associated variations.**[3, 6, 18]**
Our research will delve into the scientific puzzle revolving around normality and standardization, spanning from intricate mathematical concepts to their manifestation in the biological domain.

Biostatistics is the application of mathematical concepts and methods to biological, medical and public health data.

We differentiate between two categories of random events: those following precise laws and those whose outcomes can be predicted without conducting the experiment. For instance, Newton's laws of gravity allow us to accurately estimate the duration of a fall based on measurements of an object from a fixed distance.**[7, 11, 12]**
However, there are also other phenomena that do not follow any specific logic. Take, for example, the throwing of a dice: you can't predict with any certainty which dots will appear on the top face. This leads us to the following definitions: a phenomenon is considered as random if it is impossible to predict with certainty prior to the observation of the event which outcome will occur. Even if the experiment is repeated several times under the same conditions, the result will vary from one observation to the next; a random experiment is the mechanism by which a random phenomenon is observed.**[9, 20]**
The normal distribution, rooted in the theoretical framework of inductive statistics, applies the reduced centered variable "t" of the test variable εα to determine subsequent properties within this distribution(Figure 1). **[13, 14, 17]**
Any continuous random variable *x* follows a normal distribution with mean $\mu$and standard deviation σ if the probability density is expressed as

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(x-m)^2}{2\sigma^2}}$$

π = 3.14 constant e = 2.71 (Neperian logarithm basis) μ Mean σ Standard deviation.

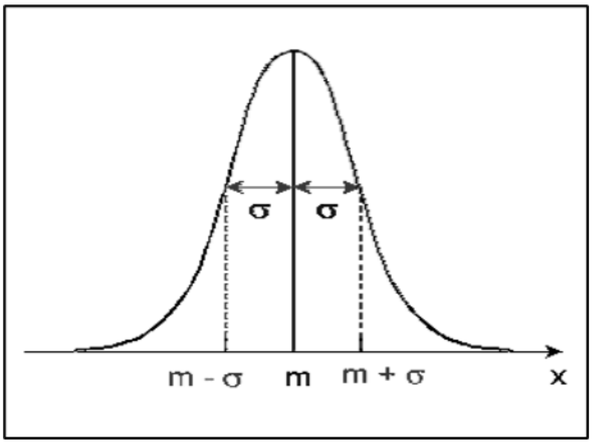

Figure 1. Skeleton of the standard equation

2. Normality: validation and typological

In assessing the normality of standard data, multiple methods are utilized. These include a rough approach involving the construction of histograms and the identification of central tendency parameters. Additionally, a more precise method involves using tools like Henry's line or anamorphic adjustment. For higher accuracy, a high-precision technique relies on fit calculations to evaluate and confirm normality within the distribution.**[10, 19, 21]**

Regarding this aspect, it's important to delve into the prevalence of the Normal distribution, particularly its association with continuous data. This distribution notably characterizes numerous medical measurements such as blood pressure, height, and weight. **[4, 18]**

Equation of the frequency curve of a normal distribution depends on just two parameters***m*** mean of the variable and ***σ*** it Standard deviation. (Figure 2)

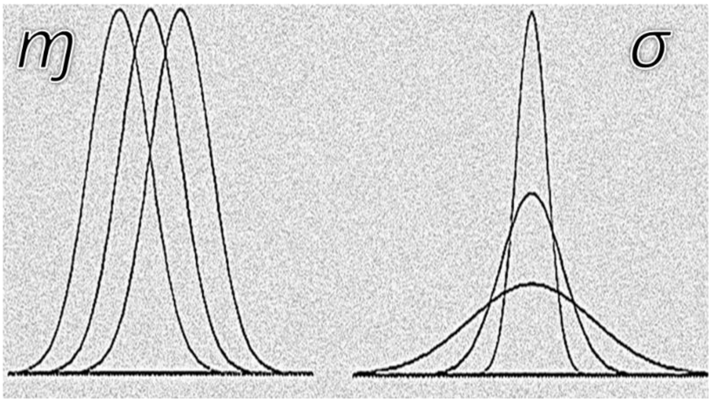

Figure 2. Different aspects of the Normal formula

3. Normalized or standardized

Numerous observed distributions often mirror the bell-shaped pattern of the Normal distribution. They exhibit a characteristic where a majority of individuals cluster around the mean, with fewer occurrences as one moves away from it, maintaining a balanced distribution pattern.**[5, 24]**

The Normal distribution, although a theoretical concept, serves as a mathematical idealization never precisely replicated in nature. However, it transcends mere mathematics by striving to minimize variation between and within variables, aiming to standardize the parameters of phenomena and experimentally regulate processes. Standardization, therefore, establishes an optimized and predetermined norm, transitioning from normative standards to immediate evaluation criteria. (Figure 3)**[11, 25].**

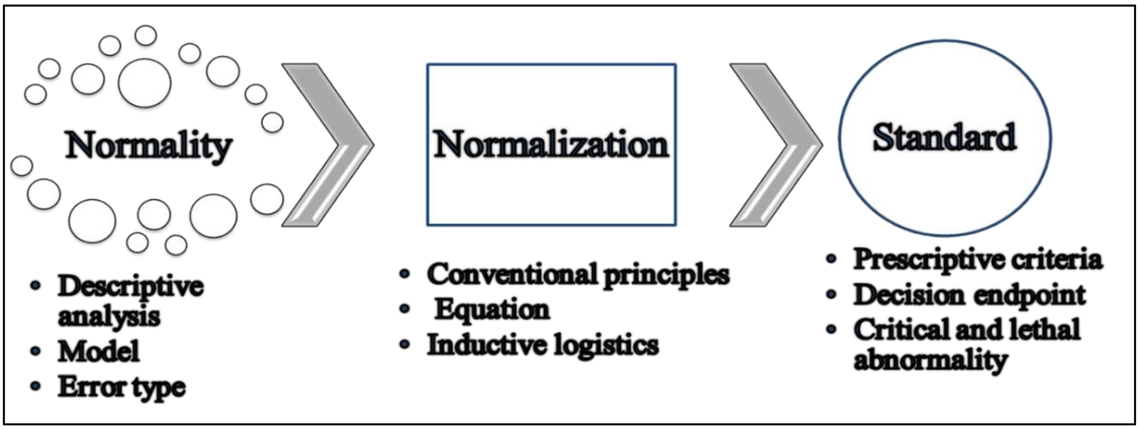

Figure 3. Standardization of normative experimentations

4. Conclusion

In conclusion, the pervasive prevalence of the normal distribution across diverse natural phenomena underscores its foundational role in scientific inquiry. From minute organisms to massive creatures, and across a spectrum of measurable physical attributes, its omnipresence underscores its significance.

Moreover, its pivotal role in inferential analysis, coupled with the intriguing phenomenon where random variables gravitate towards normality with increasing sample sizes, highlights its enduring relevance in statistical modelling.

However, the road to standardization within experiments governed by the normal distribution is a labyrinthine path. It demands unwavering repeatability and comparability on a monumental scale within normalized analyses. Alternatively, it mandates adept adjustments of data to conform to the stringent criteria of normality. This complexity underscores the necessity for meticulous precision and methodological rigor in scientific endeavors governed by this distribution pattern.

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REFERENCES

1. Amine, B. (2021). STATISTICS & MEDICINE: THE EXACT LINK. *Global Journal of Public Health Medicine*, *3*(2), 409-413.

2. Berghiche, A., Zeghdoudi, M., Asnoune, Z., Djebrane, C., Labied, I., Attia, K., & Bouzid, R. (2023). Modeling a capital approach to biological risk assessment: An updated overview of the entropic scenario and the outcome of the upcoming microbial and ecological crises. *Tobacco Regulatory Science (TRS)*, 4752-4771.
3. Berlin, I. (1960). History and theory: the concept of scientific history. *History and Theory*, *1*(1), 1-31.
4. Campbell, M. J., Machin, D., & Walters, S. J. (2010). *Medical statistics: a textbook for the health sciences*. John Wiley& Sons.
5. Christensen, R. (1996). *Analysis of variance, design, and regression: applied statistical methods*. CRC Press.
6. Coveney, P. V., Dougherty, E. R., & Highfield, R. R. (2016). Big data need big theory too. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, *374*(2080), 20160153.
7. De Muth, J. E. (2014). *Basic statistics and pharmaceutical statistical applications*. CRC Press.
8. Egbert, E. (1980). Concept of wellness. *Journal of Psychosocial Nursing and Mental Health Services*, *18*(1), 9-9.
9. Epstein, R. A. (2012). *The theory of gambling and statistical logic*. Academic Press.
10. Fitzmaurice, G. M., Laird, N. M., & Ware, J. H. (2012). *Applied longitudinal analysis*. John Wiley & Sons.
11. Gainsburg, J. (2006). The mathematical modeling of structural engineers. *MathematicalThinking and Learning*, *8*(1), 3-36.
12. Guisan, A., &Thuiller, W. (2005). Predicting species distribution: offering more than simple habitat models. *Ecologyletters*, *8*(9), 993-1009.
13. Harvey, P. H., &Pagel, M. D. (1991). *The comparative method in evolutionary biology* (Vol. 239). Oxford: Oxford universitypress.
14. Hopkins, K. D., & Weeks, D. L. (1990). Tests for normality and measures of skewness and kurtosis: Their place in research reporting. *Educational and psychologicalmeasurement*, *50*(4), 717-729.
15. Josephson, B. D., &Pallikari-Viras, F. (1991). Biological utilization of quantum nonlocality. *Foundations of Physics*, *21*(2), 197-207.
16. Karpatne, A., Atluri, G., Faghmous, J. H., Steinbach, M., Banerjee, A., Ganguly, A., ... & Kumar, V. (2017). Theory-guided data science: A new paradigm for scientific discovery from data. *IEEE Transactions on knowledge and data engineering*, *29*(10), 2318-2331.
17. Konold, C. (1989). Informal conceptions of probability. *Cognition and instruction*, *6*(1), 59-98.
18. Leonelli, S. (2014). What difference does quantity make? On the epistemology of Big Data in biology. *Big data & society*, *1*(1), 2053951714534395.
19. Manning, W. G., Basu, A., &Mullahy, J. (2005). Generalized modeling approaches to risk adjustment of skewed outcomes data. *Journal of healtheconomics*, *24*(3), 465-488.
20. Mishra, P., Pandey, C. M., Singh, U., Gupta, A., Sahu, C., &Keshri, A. (2019). Descriptive statistics and normality tests for statistical data. *Annals of cardiac anaesthesia*, *22*(1), 67.
21. Muthén, B. O., &Satorra, A. (1995). Complex sample data in structural equation modeling. *Sociologicalmethodology*, 267-316.
22. Mutihac, L., &Mutihac, R. (2008). Mining in chemometrics. *AnalyticaChimica Acta*, *612*(1), 1-18.
23. Pyle, D. (1999). *Data preparation for data mining*. morgankaufmann.
24. Richter, S. H. (2017). Systematic heterogenization for better reproducibility in animal experimentation. *Lab animal*, *46*(9), 343-349.
25. Rothman, K. J. (1990). No adjustments are needed for multiple comparisons. *Epidemiology*, 43-46.