Editorial

Indian Contribution to Statistics and Computations

Rabi N. Subudhi
Professor, School of Management, KIIT University Bhubaneswar, India
rabisubudhi@gmail.com

DOI: 10.23862/kiit-parikalpana/2021/v17/i2/210539

Statistics is now applied in almost every field and every subject, which includes Engineering, Medical & Physical Sciences, Agriculture & Fisheries Sciences, Social Sciences and Management. From theoretical Statistics to applied and official Statistics, each of its sub-fields has its own innovative and original research outputs. Many Indians have such famous contributions, for which we get global appreciation. It is really a great feel-good factor to note that many Indians have world famous contributions in Statistical theory and Applied Statistics. Like many historic, epoch-making contributions in the field of Mathematics (particularly in Geometry, Trigonometry, Algebra and other branches of Mathematics), Indian contributions to Statistical theories and their applications are noteworthy, and worth discussing even now. Though there are many notable contributions and contributors, among them, three legendary figures are worth remembering, for such Indian contributions. They are *P.C. Mahalanobis, C.R. Rao and Pathani Samanta Chandrasekhar*.

P.C. Mahalanobis: (1893-1972)

Prasanta Chandra Mahalanobis, who founded the famous Indian Statistical Institute (ISI) in 1932, and its reputed scholarly journal '***Sankhya***' (likes of Biometrika), had lots of original contributions, in the fields of Applied Statistics and Sampling. He had close academic interactions with the likes of Sir RA Fisher, H Hotelling, JBS Haldane and Djordge Kostic. Among many others, his pioneering work on (Mahalanobis') residual-distance statistic, better known as **Mahalanobis D^2 statistic** is notable. It measures the distance of a multi-variate variable (un-known sample set) from a known unit. It is slightly different from Euclidean distance.

Mahalanobis developed this in 1930, to study the 'racial likeness' (or similarity). This distance measure could be used to answer the questions like: "Are the Anglo-Indians more similar to the upper castes of Bengal than to the lower castes? Did the Jabel Moya people (of Sudan) arise from dynastic and pre-dynastic Egyptian and Nubian peoples or from people of

the negroid stock? How different are the metabolic characteristics of normal persons, chemical diabetics and overt diabetics as determined by a total glucose tolerance test and how to make a diagnosis? On the basis of remote sensing data from a satellite, how do you classify various tracts of land by vegetation type, rock type, etc.?" [GJ McLachlan, 1999].

Mahalanobis distance is widely used in cluster analysis and classification techniques.

He also contributed in many diverse fields like Anthropometry, Quantitative-Linguistics etc. He applied statistics in Anthropology, Meteorology, Agricultural Sciences etc. His contributions in the planning commission, in the early years of independent-India are note worthy. He suggested methodological reforms in Census methods, Crop and agricultural statistics and other issues, under Five-Year Plan coverage. He was an ardent follower of Rabindranath Tagore, and worked for/ under him in Viswabharati, Shantiniketan (in West Bengal).

Indian Government now celebrates his birth day (on June 29) as the ***National Statistical day***.

C. Radhakrishna Rao (CR Rao): Born on September 10, 1920.

CalyampudiRadhakrshnaRao(popularly known as CR Rao), the other legendary contributor, is an Indian-American Mathematician and Statistician. He was one among the first few persons of the world to get MA in Statistics (which was preceded by an M.Sc. in Mathematics from Andhra University). He later on did his PhD (under the guidance of Sir RA Fisher) and D.Sc. from Cambridge University. He has served many leading Universities like, University of Pittsburg, Pennsylvania State University, ISI, University at Buffalo etc. He has received many prestigious awards from USA, UK and India which includes United States' Medal of Science (highest award of USA for lifetime achievement in the field of scientific research) and 37 honorary doctoral degrees. (The 37th degree came from New York State University). He was instrumental in the establishment of Statistical Institute for Asia & Pacific, Tokyo.

Cramer-Rao bound and Rao-Blackwell theorem are some of his best known discoveries, in the field of Statistics (particularly related to Theory of Estimation). These are for checking the quality of 'estimators'. An unbiased estimator which achieves this (Cramer-Rao) lower bound is said to be (fully) efficient. This bound, popularly known as CRB, states that the variance of any unbiased estimator is at least as high as the inverse of the Fisher information.

A road, near IIIT Hyderabad (India), has been named in his honour (as Prof. CR Rao Road) and a research Institute is in operation in India, C.R. Rao Advanced Institute of Mathematics, Statistics and Computer Science **(AIMSCS)** [visit web at: http://www.crraoaimscs.org/].

Both the legendary figures have been awarded with '***Padma-vibhusan***' award by Govt. of India.

Initiatives should be taken by the scholars and teachers of Statistics-fraternity, to see if their great works can be cited/ used in the research of their fields. Attempts should also be made to compile other notable contributions in one such conference or other academic events. There are many other legendary local talents, not very much known to outside world, who have contributed in their own way, to similar scientific thinking, even without much formal education. One such wonder-talent is Samanta Chandra Sekhar, narrated below.

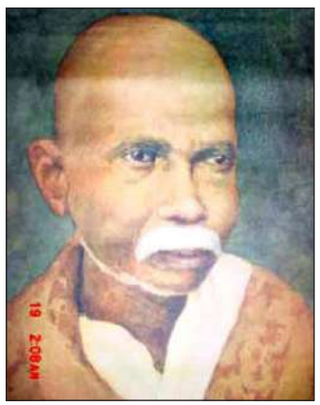
Samanta Chandra Sekhar Harichandan (Pathaani samamta): 1834 – 1904 (Odisha)

Pandit Samanta Chandra Sekhar Harichandan Mohapatra, popularly known as ***Pathani Samanta***, was an illustrious son of Odisha of pre-independence period. Without any formal education, this 'miracle' personality had immense interest in astronomy, in line with ***vedic*** philosophy and Mathematics. He was gifted with in-born engineering skill. He is the author of ***Siddhanta Darpan***-record of his life-long relentless work in metrical Sanskrit verses. This book (written during 1869 – 1892, with about 2500 verses, 24 chapters) is really a mirror of India's astronomical knowledge.

He had prepared of ***Mana-yantra*** (measuring instrument), ***Gol-yantra*** (spherical instrument) and ***Surya-Ghadi*** (Sun dial to measure the time), like a skillful 'engineer' without formal education. As moon changes its position more frequently than any other planet, it is very difficult to ascertain the exact longitude of moon. Hence, Chandra Sekhar innovated three principles, i.e. Tungatanra, Pakshika and Digamsa to know the exact longitude of moon. These three formulas are verified to be correct and they hold good in every respect. He had devised many formulas for ascertaining the exact longitude of other planets. His formulas regarding the solar and lunar eclipse are still considered to be invaluable.

PC Mahalanobis

CR Rao



Pathani Samanta Chandrasekhar

References:

Ekstrom, Joakim (2011). 'Mahalanobis' Distance Beyond Normal Distributions', University of California, USA (http://statistics.ucla.edu/system/resources/.../Mahalanobis'DistanceBeyondNormalDistributions.pdf), accessed on Dt. 4.3.12.

http://en.wikipedia.org/wiki/C._R._Rao]

http://en.wikipedia.org/wiki/Mahalanobis

http://www.britannica.com/EBchecked/topic/1908279/PC-Mahalanobis

McLachlan, GJ (1999). 'Mahalanobis distance', Resonance, June 1999.

Mohapatra, Prabhukalyan. (2007) Pathani Samanta: The Great Hindu Astrologer, Odisha Review (Dec. 2007), Govt. of Odisha Publication.

Rao, Calyampudi Radakrishna (1994). S. Das Gupta, ed. *Selected Papers of C. R. Rao*. New York: Wiley. ISBN 978-0-470-22091-7.

Chaos, Complexity and Resilience: A Review and Research Agenda

Brajaballav Kar
Associate Professor, Production and Operations Management
KIIT School of Management, KIIT University
ORCID: 0000-0002-2127-1147
braja.kar@ksom.ac.in, brajkar@gmail.com
DoI: 10.23862/kiit-parikalpana/2021/v17/i2/210537

Abstract

The objectives of this paper are (a) to purposively review recent literature based on chaos, complexity and resilience theories and (b) to indicate the applicability of these theories to wider business and social contexts.

We believe that the pandemic of Covid-19 has introduced an additional dimension to various decision making process in different forms of social and business organisations. At the least, the concepts of social distancing and its practice is the delta change of the theory of chaos with wider and meaningful repercussions. Secondly, as postulated by the theory of chaos and complexity, the path traversed from one state to another is not exactly reversible. The pandemic related changes may not be reversible in future. There is a need for discussion on various possibilities of outcomes, finding patterns in chaos and complexity. During the Covid-19 pandemic many individuals have undergone the trauma of personal suffering, loss of near and dear ones. The delay in access to medical supervision due to capacity mismatch, inadequate knowledge, confusion regarding the policy response, and public response to rules are some of the additional dimensions of complexities experienced. At the same time, individuals and organisations have demonstrated resilience to overcome adversities. There is a contextual necessity and opportunity to extend our knowledge base.

This review discusses illustrative but non-exhaustive researches conducted so far in different social science and business organisations to help conceptualisation of future researches. The structure of the paper includes a brief introduction, the theories, application and conclusion.

Keywords: Theory, Chaos, Complexity, Resilience, Pandemic, Covid-19