NATIONAL CONFERENCE ON
STATISTICAL METHODS AND APPLICATIONS IN INTERDISCIPLINARY AREAS
(SMAIA-2025)
APRIL 11-12, 2025

ORGANIZED BY
DEPARTMENT OF STATISTICS, UNIVERSITY OF DELHI - 110007

CONFERENCE SUMMARY

The two-day National Conference on **Statistical Methods and Applications in Interdisciplinary Areas (SMAIA-2025)** commenced on April 11, 2025, with an inaugural session graced by distinguished guests including Dr. Dalip Singh, Additional Director General, Ministry of Statistics and Programme Implementation; Prof. Ashish Sen Gupta from Augusta University; Prof. Padam Singh, former member of the Indian Statistical Commission; and Prof. Naveen Kumar, former Dean, Faculty of Mathematical Sciences, University of Delhi.

Prof. Ranjita Pandey, Head of the Department of Statistics at the University of Delhi, extended a warm welcome to the esteemed academicians and experts in attendance. Dr. Dalip Singh in the inaugural session underscored the significance of the conference theme in the era of ChatGPT and Artificial Intelligence. He emphasized the need for "Right Collaboration" and "Right Data" through initiatives such as the Ministry's Data Innovation Lab, by enhancing access to quality datasets using platforms like the Statistical Business Register and e-Sankhyiki.
Throughout the two days of the conference, a total of 18 dynamic technical sessions were held across 3 parallel rooms, offering a rich tapestry of insights, innovative discussions, and expert presentations.

Technical sessions began with a thought-provoking keynote address by **Prof. Padam Singh**, **ADG ICMR** who critically examined the Global Hunger Index (GHI), arguing that it misrepresents India's hunger status by relying on limited indicators such as child undernutrition. He emphasized the need for methodological transparency in statistical reporting and called for a more nuanced and nationally relevant index to inform better policy decisions in tackling food insecurity.

The first set of **Technical Session TS01: Statistical Computing,** the session opened with a talk on the opportunities and challenges of AI in SML for Big Manifold data analytics, followed by a practical approach on Bayes modelling. Subsequent talks explored the application of statistics in machine learning algorithms for predictive analytics in business contexts including prediction of Big Mart Sales, bank loan defaults, and effectiveness of telemarketing strategies.

TS02: Agricultural and Forestry Statistics, featured discussions on national forest inventory, parameter estimation for forestry data, and crop modelling. Presentations covered diverse applications such as forecasting yield enhancement in oilseeds, Apple production, Area prediction and Pearl Millet production, walnut production, and small area estimation for growing stock. The session emphasized the integration of classical methods with machine learning to address challenges in environmental and agricultural monitoring.

TS03: Design of Experiments, researchers presented new insights into Analysis of Neutrosophic data, experimental design for breeding trials, efficient two-way design, optimal covariate design, multi-session sensory testing, asymmetric factorial experiments and fold-over designs. The session highlighted practical challenges in structuring statistically efficient experiments, while addressing heterogeneity and order effects.

TS04: Econometrics and Inference, focused on advanced topics like non-parametric measurement error models, model averaging, econometric modelling, performance of biased estimator, regression analysis on the Indian economy and Russian war impacts, ordinal regression to extract social dysfunction levels and Inference using progressive censored data. Contributions addressed both theoretical aspects and applied econometric analysis.

TS05: Survey Sampling I, centered on contemporary methodologies, with the focus on tackling challenges in survey data collection. Session started with sequential population selection, survey-weighted composite indices, simulation-based estimators under non-response, calibration estimators, class of memory type estimators in non-response adjustments, design-based adjustments and acceptance sampling plans. Overall, the session showcased a blend of theoretical advances and practical strategies for dealing with data imperfections in surveys.

TS06: Distribution Theory, focused on the development and application of probability distributions. Topics included Wilson Hilferty distributions, Super heavy tailed distribution, modified XGamma, Perk distribution. Researchers showcased applications of Rayleigh-type distribution, zero-inflated Rayleigh model, new size-biased Kumaraswamy-G distribution and accelerated ailamujia distribution. Some talks focused on moments of upper record values, mid-truncated distributions and exponentiated lifetime distribution. The session emphasized developing flexible models suitable for real-life data complexities.

TS07: Survey Sampling II, includes building on earlier discussions with a sharper focus on robust estimation under complex sampling conditions. Researchers presented new insight on

graph sampling, probability sampling strategies for enhancing efficiency, and correlated measurement errors. Applications included random forest regression models for forest stock assessments and memory-type estimators, were also discussed.

TS08: Financial Statistics, covered statistical modeling in finance and economics. Key topics included cryptocurrency modeling using time series techniques, portfolio behavior analysis, transition risks of banking, Bayesian GARCH, and outlier detection in financial data were highlighted for their practical utility in risk assessment and forecasting.

TS09: Statistics and Applications, The final session of day 1 highlighted diverse applications of statistics across domains. Topics included mixture designs for dose-response studies, relationships between sigma field, Borel field and random variables, fuzzy systems for comparative analysis, and applied research on healthcare analytics, Aumann-Shapley cost allocation, and literacy-income relationships. This session underlined the versatility of statistics in real-world problem solving across health, economics, and education.

With the conclusion of the technical sessions on Day 1, the conference transitioned into a vibrant cultural evening. The event commenced with an elegant dance tribute, followed by a mesmerizing classical performance that captivated the audience. The atmosphere was enriched by heartfelt poetry recitations and soulful musical renditions, showcasing a blend of artistic expression and cultural pride. The final performance, a spirited group dance brought the evening to a joyous close, leaving a lasting impression of celebration and unity.

Day 2 of the conference featured a diverse and enriching set of technical sessions that showcased the application of statistical methods to real-world challenges.

The day began with **TS10: Official Statistics and Demography**, where discussions centered around stock prediction, measuring quality of life in the elderly, and reducing maternal mortality, presentations highlighted the limitations of current indices, the role of official surveys like PLFS, rural development, spatial and temporal patterns of the elderly population, under-five mortality, and juvenile apprehensions were also explored, emphasizing the importance of data in shaping inclusive policy.

TS11: Survey Sampling III, the focus shifted to methodological advances in sampling. Topics included randomized response techniques, inverse adaptive cluster sampling, and calibration estimators under Two-stage sampling design and stratified random sampling. Researchers presented on ranked set sampling, sampling strategies incorporating auxiliary variables for estimating unknown population mean and time scale survey. These sessions illustrated innovations in design and estimation critical for high-quality survey data.

TS12: Artificial Intelligence (AI), explored the integration of AI techniques with statistical applications. Presenters examined Yule distribution, wavelet-based models, AI's role in the

fashion industry, and empirical investigations into customer engagement through IoT-based systems. Additionally, diabetes prediction and optimized models for understanding disease prevalence showcased the increasing synergy between AI and applied statistics.

TS13: Reliability and Economic Statistics, covered a range of topics including parametric estimation for mission systems, Markov models for reliability, and adaptive lifetime analysis. Techniques for handling censored samples, and modeling stress-strength relationships were presented. Moreover, economic studies explored labor force participation, employment dynamics from PLFS data, and digitalization and sustainability. These sessions reinforced the role of statistical tools in understanding workforce trends and enhancing system reliability.

TS14: Prof. AK Bansal Memorial Session, featured Bayesian approaches to reliability and control chart improvement. Discussions centered on enhancements over classical statistical methods, reaffirming Bayesian statistics as a robust framework in reliability analysis.

TS15: Health Statistics, addressed pressing issues in public health, including kidney infections, non-communicable diseases among women, and AI in public health. Additional topics included maternal healthcare trends, antenatal care quality, infectious disease modeling, zero-inflated Rayleigh model, and moments from weibull-exponential pareto distribution, all emphasizing the application of statistics in health policy and epidemiology.

TS16: Statistical Modelling, highlighted methodological innovations such as tests for heteroscedastic ANOVA models, sports statistics, rainfall simulation, and factor analysis. The session concluded with environmental hazard prediction using statistical modeling, reinforcing the versatility of statistical tools in varied domains.

TS17: Bayesian Statistics, presented sophisticated Bayesian modeling techniques. Topics ranged from gene expression modeling, frailty model comparisons, two-phase repair mechanism, entropy estimation of ILD, queuing models, progressive hybrid censoring, unit-weibull distribution and complex system analysis. The session underscored the power of Bayesian methods in handling uncertainty and heterogeneity in data.

TS18: Survey Sampling IV, concluded the day's technical presentations with a strong focus on sampling efficiency. Papers covered sample allocation, memory type estimators, *अनुप्रयुक्त सांख्यिकी,* predictive estimation in two-phase sampling, difference-cum-ratio estimators, and stress-strength reliability reflecting efforts to enhance estimation precision in survey settings.

The day concluded with the **Valedictory Session**, marking the end of a rich and intellectually engaging day of presentations and discussions that spanned theoretical advances, applied statistics, and interdisciplinary innovations.