



IASSL NEWSLETTER



Institute of Applied Statistics Sri Lanka
The Professional Centre
275/75
Prof. Stanley Wijesundara Mawatha
Colombo 07 Sri Lanka



+94 11 2588291



admin@iassl.lk



<http://www.iassl.lk>



<http://www.facebook.com/iassl2020/>



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"Statistical thinking will one day
be as necessary for efficient
citizenship as the ability to
read and write."
- H. G. Wells

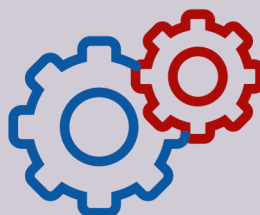
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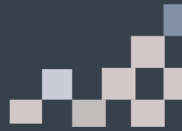
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ISSUE 3, 2026**

From IASSL President's pen

Dr. Rajitha M. Silva
President/IASSL



When I wrote my message for the first newsletter of 2026, I described IASSL as a **compass on a growing statistical map**. As we move through the year, I am pleased to see that this compass is not only giving us direction, but also taking us into new spaces where statistics can reach, connect, and inspire more people.

The period from May to August has been an active one for IASSL. Our education and training activities continued to expand through short courses in areas such as Power BI, Tableau, systematic literature review, bibliometric analysis, and machine learning with Python. At the same time, our Certificate in Applied Statistics and Higher Diploma in Applied Statistics programmes continue to provide structured pathways for those who wish to strengthen their statistical knowledge and professional skills.

These activities reflect an important part of what IASSL stands for. Statistics is changing rapidly, and the needs of students, researchers, academics, and professionals are changing with it. Our responsibility is therefore not simply to repeat what we have done before, but to identify where statistical knowledge is needed and create opportunities that are relevant and accessible.

Our attention is now also turning towards two of our flagship initiatives.

STAT ReTreat 2026 continues our effort to bring together university students in Statistics and Data Science in an environment that goes beyond the traditional classroom. The first STAT ReTreat showed us the value of bringing young statisticians together to learn, exchange ideas, build professional networks, and see the wider possibilities of their discipline. In 2026, we hope to strengthen this platform further and create an experience that participants will carry with them beyond the programme itself.

Equally important is the **National Statistics Olympiad**, approved by the Ministry of Education, which gives us a valuable opportunity to take statistical thinking closer to school students across Sri Lanka. For me, this is particularly meaningful. If we want a society that understands data and uses evidence carefully, that journey must begin long before university. The Olympiad provides a platform to encourage curiosity, reasoning, and an early interest in Statistics among the next generation.

These initiatives remind us that IASSL serves people at different stages of their statistical journey, from school students discovering Statistics for the first time, to university students preparing for their careers, and researchers and professionals continuing to develop new skills.

There is still much to be done. But the direction is becoming clearer.

I sincerely appreciate the contribution of our Executive Council, committees, resource persons, members, partners, office staff, and everyone who continues to give their time and expertise to IASSL. Each programme and initiative represented in this newsletter is the result of that collective effort.

As we move into the remaining months of 2026, let us continue to widen the statistical map, create meaningful opportunities, and bring Statistics closer to the people and communities it can serve.

Together, we will continue to grow, inspire, and lead.

President,
Institute of Applied Statistics, Sri Lanka (IASSL)

Editorial

Dr. S.G.J. Senarathne
Editor/IASSL



Dear Readers,

It is indeed a great honour to address you once again as the Editor of IASSL. I am delighted to present the second issue of the IASSL Newsletter for 2026, which continues our tradition of sharing knowledge, fostering collaboration, and celebrating the achievements and contributions of the statistical community.

In this issue, we will recount various events, projects, and activities organized by the IASSL from 1 May 2026 to 31 August 2026. The Newsletter also brings together a diverse collection of contributions from academics, researchers, industry practitioners, and students, reflecting the breadth and vitality of Statistics in Sri Lanka and beyond. The articles and event highlights showcase various achievements and developments in the statistical community, demonstrating the continued growth and impact of Statistics across different disciplines. In addition, we continue the popular Sudoku challenge, providing readers with an enjoyable opportunity to test their problem-solving skills. We encourage all readers to take part in the new puzzle and look forward to celebrating the winners in the next edition.

In addition to these articles and event highlights, we also provide information on forthcoming events, courses, and activities organized by the IASSL. These highlights provide members with an overview of upcoming initiatives and opportunities for professional engagement, while reflecting the Institute's continued commitment to strengthening connections within the statistical community.

I would like to express my sincere gratitude to the authors, reviewers, editorial team, and all those who contributed to the preparation of this newsletter. Their dedication and support have been invaluable. I also extend my appreciation to our readers, whose continued interest and engagement inspire us to maintain the quality and relevance of this publication. I invite you to share your feedback, ideas, and contributions for future editions. We also encourage readers to submit articles and other relevant contributions for consideration in the third issue of the IASSL Newsletter for 2026 (editor@iassl.com). Together, we can continue to strengthen the role of IASSL as a platform for knowledge exchange, professional development, and the promotion of excellence in Statistics.

I hope you find this issue informative, engaging, and inspiring.

Warm regards,
Editor,
Institute of Applied Statistics, Sri Lanka (IASSL)

CONTACT INFORMATION

Institute of Applied Statistics
Sri Lanka
The Professional Centre
275/75, Prof. Stanley Wijesundara Mawatha
Colombo 07
Sri Lanka



+94 112588291



facebook.com/iassl2020



linkedin.com/company/iassl/



editor@iassl.lk

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Bayesian Thinking in the Age of Data Science: From Uncertainty to Intelligent Decisions

Dr. A.W.L. Pubudu Thilan

B.Sc., BIT (Dip.), M.Sc. (USA), M.Phil. (SL), Ph.D. (AUS)

Senior Lecturer,

Department of Mathematics,

Faculty of Science, University of Ruhuna



Introduction

It is Monday morning, and you are driving to an important meeting. Before leaving home, you open Google Maps, enter your destination, and the application estimates that you will arrive at **9:15 a.m.** Satisfied that you have enough time, you begin your journey. A few minutes later, your phone vibrates. Heavy traffic has developed ahead, and your estimated arrival time has changed to **9:21 a.m.** You continue driving, wondering whether you should take an alternative route. Soon afterwards, traffic begins to ease, and the estimate changes once again, this time to **9:17 a.m.** By the time you reach your destination, the prediction has been updated several times.

For most of us, this is an ordinary experience. We rely on navigation systems every day and rarely question how they work. Yet behind these constantly changing predictions lies an interesting question. **How can a prediction become more accurate while the journey is still in progress?** After all, when you first entered your destination, Google Maps had already analysed the route, the distance, and the available traffic information. Why, then, does it keep changing its estimate?

The answer illustrates one of the central principles of modern data science: predictions should be continually updated as new information becomes available. Rather than treating an initial estimate as fixed, new observations are incorporated to refine predictions and reduce uncertainty over time. Navigation systems provide a familiar example of this principle, where traffic conditions, road closures, and changes in vehicle speeds are continuously integrated to improve estimated arrival times. Although these systems employ a variety of computational algorithms, they exemplify the broader concept of updating beliefs in response to new evidence. This principle lies at the heart of Bayesian thinking. As illustrated in Figure 1, Bayesian statistics provide a systematic framework for combining prior knowledge with newly observed data to produce updated inferences.

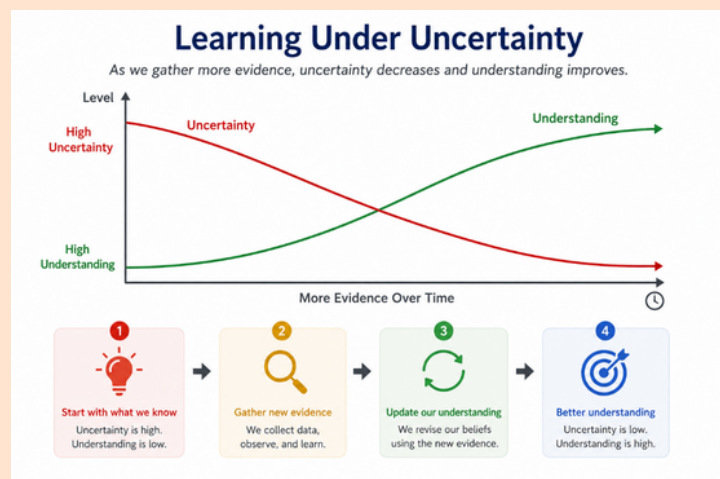


Figure 1. The Bayesian learning process. Existing knowledge (prior knowledge) is combined with new evidence to develop an updated understanding through continuous learning.

By treating uncertainty as an integral component of learning rather than a limitation, Bayesian methods offer a principled approach for decision-making in environments where information evolves continuously. Consequently, Bayesian thinking has become a cornerstone of modern statistics, artificial intelligence, and data science.

The World Has Changed

The Google Maps example is far from unique. It illustrates a much broader shift in how information is generated and used across modern society. Many of the systems we rely on today operate in environments where new data arrive continuously, requiring predictions and decisions to be updated as fresh evidence becomes available. In this sense, the principle of Bayesian learning extends well beyond navigation and has become increasingly relevant across science, industry, and everyday life.

Every day, billions of observations are generated through smartphones, satellites, sensors, financial markets, healthcare systems, and countless digital technologies. Instead of receiving information occasionally, we now live in an age where new data arrive continuously. This transformation has changed the way decisions are made. In the past, statistical analyses were often based on datasets collected over weeks, months, or even years, with conclusions drawn once the data collection was complete. Today, however, many decisions must be made while new information is still arriving. Traffic conditions change by the minute, financial markets react instantly to global events, and hospitals continuously monitor patients using real-time data.

The increasing availability of data does not necessarily reduce uncertainty. Instead, new information may reinforce previous conclusions, challenge existing assumptions, or reveal entirely unexpected patterns. Consequently, statistical methods must do more than simply analyse data; they must continuously learn from new evidence while recognising that uncertainty is an inherent part of decision-making. This evolving perspective has prompted statisticians to rethink not only how data are analysed but also how knowledge is updated as new evidence becomes available.

Bayesian Thinking: A Framework for Learning

The idea of learning from new evidence is both intuitive and familiar. We naturally revise our opinions as we gain more experience, observe new facts, or receive additional information. Bayesian statistics provides a mathematical framework for describing this process in a logical and consistent way.

The foundations of Bayesian thinking date back to the eighteenth century, when the English statistician, philosopher, and Presbyterian minister **Reverend Thomas Bayes** (1701–1761) developed the ideas that later became known as **Bayes' theorem**, describing how probabilities can be updated as new evidence becomes available. Although Bayes' work attracted little attention during his lifetime and was published posthumously in 1763 by his friend **Richard Price**, the ideas were later extended and formalized by the French mathematician and astronomer **Pierre-Simon Laplace** (1749–1827). Together, their contributions laid the foundations of Bayesian inference, which has since become one of the cornerstones of modern statistical science.

At the heart of Bayesian statistics is a simple principle, illustrated in Figure 2. Every analysis begins with existing knowledge or beliefs, often referred to as prior information. As new data are collected, this prior information is combined with the observed evidence to produce an updated understanding, known as the posterior. Rather than discarding previous knowledge, Bayesian methods refine it as new evidence becomes available, allowing learning to occur in a systematic and coherent manner.



Figure 2. Conceptual illustration of Bayesian learning, where existing knowledge is refined through new evidence to develop an updated understanding.

Although this process is mathematically rigorous, its underlying idea is remarkably intuitive. A medical diagnosis becomes more precise as test results are received, weather forecasts improve as new observations arrive, and scientific understanding evolves as additional evidence accumulates. In each case, existing knowledge is continually refined rather than replaced. By providing a principled framework for learning from new information while explicitly accounting for uncertainty, Bayesian statistics has become particularly well suited to today's data-rich and rapidly changing world.

Bayesian Statistics in the Age of Data Science

The rapid growth of data science and artificial intelligence has created new opportunities as well as new challenges for statisticians. Today's analytical problems often involve enormous volumes of data, complex systems, and environments that change continuously. Predictive models are expected not only to produce accurate results but also to adapt as new information becomes available and to communicate the uncertainty associated with their predictions.

These challenges have renewed interest in Bayesian statistics. By combining prior knowledge with newly observed data, Bayesian methods provide a natural framework for sequential learning and decision-making under uncertainty. Rather than producing a single fixed answer, Bayesian analysis generates probability distributions that describe both the most likely outcomes and the uncertainty surrounding them. This additional information is particularly valuable when decisions involve risk, limited data, or rapidly changing conditions.

At the same time, advances in computing have transformed the practical use of Bayesian methods. Problems that were once considered computationally intractable can now be analysed using modern algorithms such as Markov Chain Monte Carlo (MCMC), Hamiltonian Monte Carlo, and variational inference. Together with powerful statistical software and high-performance computing, these developments have enabled Bayesian models to be applied to increasingly complex real-world problems.

Today, Bayesian statistics plays an important role in many areas of data science, including machine learning, healthcare, environmental modelling, finance, robotics, and scientific research (Figure 3). While the specific techniques differ across disciplines, they all share a common goal: making better decisions by continuously learning from evidence while explicitly accounting for uncertainty. As data continue to grow in both volume and complexity, Bayesian thinking is likely to remain one of the defining approaches to statistical modelling in the years ahead.



Figure 3. Applications of Bayesian thinking across modern data science and decision-making.

Looking Ahead

The world will continue to generate more data than ever before. Advances in artificial intelligence, the Internet of Things (IoT), remote sensing, and digital technologies are transforming how we live, work, and make decisions. From personalised healthcare and autonomous vehicles to smart cities and climate monitoring, future decisions will increasingly rely on systems that can learn continuously from new information.

In this evolving landscape, the role of statisticians is also changing. Beyond designing studies and analysing completed datasets, statisticians are now expected to develop models that adapt to changing conditions, communicate uncertainty clearly, and support evidence-based decision-making in complex environments. This requires not only strong statistical knowledge but also skills in computation, programming, and interdisciplinary collaboration.

Bayesian statistics is particularly well suited to these challenges. By providing a coherent framework for updating knowledge as new evidence becomes available, it enables decision-makers to move beyond fixed conclusions and embrace learning as an ongoing process. While no statistical method can eliminate uncertainty, Bayesian thinking offers a principled way to understand, quantify, and manage it.

The next time Google Maps updates your estimated arrival time, it may seem like nothing more than a convenient feature on your smartphone. Yet it also illustrates a profound idea that extends far beyond navigation. In science, medicine, economics, engineering, and countless other fields, our understanding of the world improves not because we have perfect information, but because we continually refine our knowledge as new evidence emerges. Perhaps that is the most valuable lesson Bayesian statistics has to offer. In an increasingly uncertain and data-driven world, the ability to learn, adapt, and make informed decisions by embracing uncertainty rather than ignoring it will remain one of the defining strengths of modern statistics.

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Inference on Clustered Data with Informative Cluster Size and Informative Intra-Cluster Group Size



Dr. Hasika Wickrama Senevirathne
Biostatistician
Singapore Eye Research Institute
Singapore National Eye Centre,
Singapore



Dr. Sandipan Dutta
Associate Professor
Department of Mathematics and Statistics
Old Dominion University,
USA

Clustered data arise whenever multiple observations are collected from the same sampling unit, and are common in biomedical, public health, educational, and social science research. In many studies, observations are naturally grouped into clusters, such as teeth within a mouth, eyes belonging to the same individual, students within a classroom, or repeated clinical measurements collected over time. Because observations within the same cluster share biological, environmental, or social characteristics, they are correlated rather than independent. Statistical methods that ignore this correlation may underestimate variability and lead to misleading statistical inference. Consequently, developing robust methods for analysing clustered data has become an important area of modern statistics.

A further challenge arises when the number of observations in a cluster is itself associated with the outcome of interest, a phenomenon known as Informative Cluster Size (ICS) (Williamson et al., 2003). For example, individuals with more diseased teeth may also experience greater attachment loss, so that cluster size carries information about the responses. ICS violates a fundamental assumption underlying many conventional methods for clustered data, namely that cluster size is independent of the outcome. When this assumption is violated, larger or smaller clusters contribute disproportionately to statistical estimation, and parameter estimates, hypothesis tests, and confidence intervals may all be biased.

Therefore, specialised analytical methods are required to obtain reliable inference under ICS.

Many clustered datasets also contain meaningful group structures. Within a mouth, for example, teeth can be classified as upper and lower, while within a classroom, students may be grouped by gender. Whereas ICS concerns the total number of observations in a cluster, informativeness can also arise in the way those observations are distributed among groups. When group sizes within a cluster are associated with group-specific outcomes, the phenomenon is referred to as Informative Intra-Cluster Group Size (IICGS). The distinction matters because the overall cluster size may be non-informative even when the sizes of the individual groups within that cluster are informative, and ignoring IICGS can lead to biased group comparisons and misleading conclusions.

To address this issue, Dutta and Datta (2016, 2018) developed a series of rank-based within-cluster resampling and bootstrapping procedures that accommodate IICGS. Their nonparametric framework repeatedly samples one observation per group within each cluster and averages results across many resamples, so that each group carries equal weight regardless of how many observations it contributes. This yields valid inference for group comparisons even when group sizes are unbalanced and informative, whereas conventional procedures may inadvertently give greater influence to larger groups.

Gregg et al. (2018) carry these ideas into time-to-event data, proposing a log-rank-based procedure for comparing survival distributions among groups within clustered data when group sizes are informative. Related work on variance estimation for tests of clustered categorical data under informative cluster size followed shortly afterwards (Gregg et al., 2020). Together, these contributions extend the treatment of informative clustering to survival and categorical outcomes, where conventional tests may otherwise produce biased results.

Building on this foundation, Senevirathne and Dutta (2024) developed a bootstrap-based hypothesis-testing procedure for detecting IICGS in clustered data, extending the balanced bootstrap scheme of Nevalainen et al. (2017). The contribution here is as much one of principle as of method: informativeness can be formally assessed from the data rather than assumed, so the choice of analysis is guided by evidence rather than convention.

More recently, Wickrama Senevirathne and Dutta (2026) proposed a nonparametric association test for ordinal outcomes in clustered data with informative cluster sizes. Ordinal outcomes are common in biomedical and clinical research, including disease severity classifications, symptom grading scales, chronic kidney disease stages, and diabetic retinopathy grades. Although numerous methods exist for analysing such outcomes, most assume that cluster sizes are non-informative and may yield biased inference when they are not. The proposed test relaxes that assumption while retaining the distribution-free character of the rank-based approaches described above.

Overall, these methodological developments trace a clear line of progress, from establishing the problem of informative cluster size, through nonparametric rank-based inference and survival analysis, to formal tests of informativeness and inference for ordinal outcomes. These advances provide researchers with robust statistical tools for analysing complex clustered datasets encountered in biomedical, public health, educational, and social science research, thereby enabling more reliable and valid statistical inference in the presence of informative cluster structures.

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Nature inspired Meta heuristic algorithms: What Crocodiles, Bird Flocks and Cooling Steel Have in Common

Mr. Ruwinda Gerard Rowel
Analyst – Acuity Analytics



The Japanese bullet train is no doubt one of the marvels of modern day engineering, a prime example as to what human curiosity and ingenuity can achieve. From being one of the fastest land vehicles, a title it still holds to this day, to cutting down thousand mile journeys to a matter of hours, it is a breathtaking invention. But there was a flaw, where it 'boomed' so to say when moving through tunnels which was caused by the train compressing air. The Japanese looked no further than behind their own bodies of water towards the humble kingfisher whose beak, made to cut through water was the perfect inspiration for the train engine to simply CUT through the air.

This is bio-mimicry, and it has been used for millennia to solve problems in various disciplines spanning engineering, medicine, mathematics, statistics and even data science all the way to our very own data science problems. This is where meta-heuristic algorithms rain. Just as the kingfishers beak has evolved and been optimised through natural selection, optimisation in nature is not. Meta-heuristics simply translate these biological survival strategies into lines of code.

What are meta-heuristic algorithms?

In essence, according to the Metaheuristics Handbook (2023), a metaheuristic algorithm is characterized on its ability to arrive at general conclusion to complex optimization problems by mimicking natural & physical phenomena which has been into providing solutions towards NP-Hard problems in computer science. And data scientists used this to find near-optimal conditions from refining neural-network hyperparameters to finding the best feature set.

For meta-heuristic algorithms to work, they must carry out a balancing act between intensification, which in summary is focusing a search primarily in the promising regions and areas of a solution space, diversification, which is basically exploring the solution space to find the most promising regions, which in turn feeds, and learning, which is the algorithm accumulating knowledge based on previous iterations which in turn direct the algorithms' future search decisions.

Meta-heuristic algorithms can be broadly categorized based on how they approach a problem, which the common denominator will be optimization but their search patterns will differ. A notable point is that by category a significant majority of meta-heuristic algorithms fall under the category of being inspired by nature.

Evolutionary Algorithms

Evolutionary Meta-heuristic Algorithms are inspired by Darwinian Evolution and Natural Selection. They mimic the process of natural selection by maintaining a population of candidate solutions and applying genetic operators such as mutation, crossover, and selection to generate new solutions over multiple generations. They include algorithms such as the Genetic Algorithm, Differential Evolution, Genetic Programming and Estimation of Distribution Algorithms.

Genetic Algorithm

Inspired by Darwinian natural selection, the Genetic Algorithm maintains a population of potential solutions encoded as chromosomes. It iteratively evolves these solutions using three operators: Selection which choosing the fittest individuals; Crossover, combining traits from two parents to create offspring; and Mutation which is simply introducing random changes to maintain diversity. Over successive generations, the population converges toward an optimal solution by favoring individuals with the highest fitness scores relative to the objective function.

This algorithm is excellent at navigating complex and rugged search spaces without getting stuck in local optima and it is particularly well suited to parallel computing since multiple individuals in a population can be evaluated simultaneously. However performance heavily depends on the correct tuning mutation rates, crossover types and population size and evaluating the fitness function for every individual in every generation can be time-consuming for large datasets.

The Genetic Algorithm is widely used as a wrapper method to select the most predictive subset of features, especially in high-dimensional genomics or finance data as well as for optimizing tasks where it performs well with regard to Neural Networks and Support Vector Machines.

Swarm Intelligence Algorithms

Swarm Intelligence Algorithms are inspired by the collective behavior of decentralized, self-organized systems found in nature. They mimic the social interactions of groups such as flocks of birds, schools of fish, and colonies of insects by maintaining a population of simple agents that communicate and cooperate to collectively navigate the search space. They include algorithms such as Particle Swarm Optimization, Ant Colony Optimization, Artificial Bee Colony, and Firefly Algorithm.

Particle Swarm Optimization

Particle Swarm Optimization simulates the social behavior of bird flocks or fish schools. It initializes a swarm of particles where each particle represents a candidate solution. Every particle moves through the search space with a specific velocity, influenced by two factors: its own personal best position achieved so far and the global best position found by the entire swarm. By iteratively updating their velocities and positions, particles converge toward the most optimal region in the landscape.

A relatively simple algorithm compared with its counterparts in the Evolutionary Algorithms, Often reaches a near-optimal solution much faster than Genetic Algorithms, especially in smooth, continuous search spaces. Often reaches a near-optimal solution much faster, especially in smooth, continuous search spaces.

This in turn could lead to a premature convergence, where all particles rush toward a deceptive local minimum and stop exploring.

Particle Swarm Optimization is used in medicine, primarily in medical imaging to find optimal thresholds for identifying tumors or anatomical structures in MRIs as well as in the energy sector to optimize Economic Load Dispatch to ensure power demand is met at the lowest possible cost while minimizing emissions.

Physics-Based

Physics-Based Algorithms are inspired by fundamental laws and phenomena observed in the physical sciences. They mimic physical processes such as thermodynamic cooling, gravitational attraction, and electromagnetic field interactions by maintaining a population of candidate solutions and applying physics-derived operators that govern how solutions move, attract, or transform across the search space over successive iterations. They include algorithms such as Simulated Annealing, Gravitational Search Algorithm, Charged System Search, and Central Force Optimization.

Simulated Annealing

Inspired by the metallurgical process of heating and controlled cooling to toughen steel, Simulated Annealing is a probabilistic search technique. It starts at a high temperature, allowing the algorithm to accept worse solutions to escape local optima which constitutes the exploration phase. As the temperature gradually decreases according to a cooling schedule, the algorithm becomes more selective, eventually settling into a global minimum, which is the step called as exploitation. This slow cooling ensures a thorough search of the landscape.

Simulated Annealing can be applied to any optimization problem where a cost function can be defined, regardless of whether the space is discrete or continuous and its ability to accept bad moves early on makes it incredibly robust against getting stuck in local valleys. However, unlike evolution and swarm intelligence based methods Simulated Annealing moves one point at a time, which can be less efficient for certain parallel processing tasks. Furthermore, finding the perfect balance between the initial temperature, the cooling rate, and the number of iterations at each step requires significant trial and error.

This algorithm can be used to tune complex machine learning models, especially boosting models like XGBoost even when the search space is non-convex.

Bio-Inspired Algorithms

Bio-Inspired Algorithms are inspired by biological processes and survival mechanisms observed across living organisms beyond the scope of evolution or swarm behavior. They mimic phenomena such as immune responses, the foraging behavior of individual organisms, and the growth patterns of plants by maintaining a population of candidate solutions and applying biologically motivated operators that replicate adaptation, learning, and self-regulation. They include algorithms such as the Artificial Immune System, Bacteria Foraging Optimization, Bees Algorithm, and Invasive Weed Optimization.

Reptile Search

Inspired by the hunting behavior of crocodiles, Reptile Search Algorithm simulates two key stages: Encircling and Hunting. During the exploration phase which is known as Encircling, the algorithm mimics the crocodile's high-walk or belly-walk to scout a wide area for prey. In the exploitation phase or Hunting, it simulates hunting coordination and predatory cooperation to converge on the target. It utilizes mathematical models of these behaviors to iteratively update the position of candidate solutions toward the global optimum.

The transition between encircling and hunting allows the algorithm to cover a vast search space while refining solutions precisely and often reaches optimal regions faster than traditional nature inspired algorithms due to its aggressive hunting mathematical operators. The strengths Reptile Search possess also mean that high-dimensional problems with expensive objective functions can lead to longer processing times. Furthermore, the mathematical modeling of various crocodile behaviors makes it slightly more complex to implement than simpler algorithms like PSO.

Reptile Search can be used and works well for optimizing weights of Long Short-Term Memory (LSTM) networks. It can also be employed in feature selection for high-dimensional medical datasets to identify the most critical biomarkers for diseases like cancer.

While we have covered only a handful of techniques in this article, metaheuristic algorithms constitute a vast field, with each of them having their strengths, weaknesses and specific niches where they perform near miracles to instances one might question why such an algorithm was explored in the first place.

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Perfect Theories, Imperfect Data: A Guide to Robust Estimation

Mr. K.S.D. Fernando

**Department of Statistics & Computer Science,
Faculty of Science,
University of Peradeniya**



1. The Challenge of Real-World Data

In a perfect world, the data we collect is completely accurate. However, in practical applications, data is often “dirty”. It gets contaminated by measurement errors, improper labeling, or human mistakes. When dealing with discrete data, such as counting the number of defective items in manufacturing (Binomial) or predicting a simple yes/no outcome in a clinical trial (Bernoulli) - these errors present a massive challenge. Traditional statistical methods assume the data is perfect. If a hospital uses a standard model to analyze patient recovery, a few mislabeled files (outliers) could drastically alter the results, potentially hiding a treatment’s true effectiveness. This research focuses on identifying “robust” estimation methods that can ignore this noise, ensuring decision-makers get accurate insights even when the data is flawed.

2. The Estimation Methods

To solve the problem of outliers, we compared three estimation methods. Let $X_1, X_2, \dots, X_n$ be a random sample from a distribution (Bernoulli, Binomial and Geometric) with parameter p .

I. Maximum Likelihood Estimator ($\hat{p}_{MLE}$)

This is the classical method, designed to find the parameter that makes the observed data most probable.

$$\hat{p}_{MLE} = \arg \max_p \sum_{i=1}^n \log f(x_i; p)$$

where $f(x_i; p)$ is the theoretical model density, and n is the total sample size.

II. Minimum Hellinger Distance Estimator ($\hat{p}_{MHDE}$)

MHDE is a robust alternative that works by minimizing the “distance” between the theoretical model and the actual data collected (empirical density).

$$\hat{p}_{MHDE} = \arg \min_p \sum_i \left[\sqrt{f(x_i; p)} - \sqrt{g(x_i)} \right]^2$$

where $g(x_i)$ is the empirical density representing the actual data collected.

III. Minimum Density Power Divergence Estimator ($\hat{p}_{MDPDE}$)

This is a flexible method that uses a tuning parameter to balance efficiency with robustness.

$$\hat{p}_{MDPDE} = \arg \min_p \sum_{i=1}^n \left[f(x_i; p)^{1+\alpha} - \left(1 + \frac{1}{\alpha} \right) g(x_i) f(x_i; p)^\alpha + \frac{1}{\alpha} g(x_i)^{1+\alpha} \right]$$

where α ($\alpha > 0$) is the tuning parameter

Throughout this research, a constant value of $\alpha = 0.5$ was utilized to achieve a balance between efficiency and robustness.

3. The Simulation Arena and Key Results

To test these estimators, we designed a Monte Carlo simulation covering various sample sizes ($n = 10$ to 500). The complete workflow is mapped out in the flowchart below.

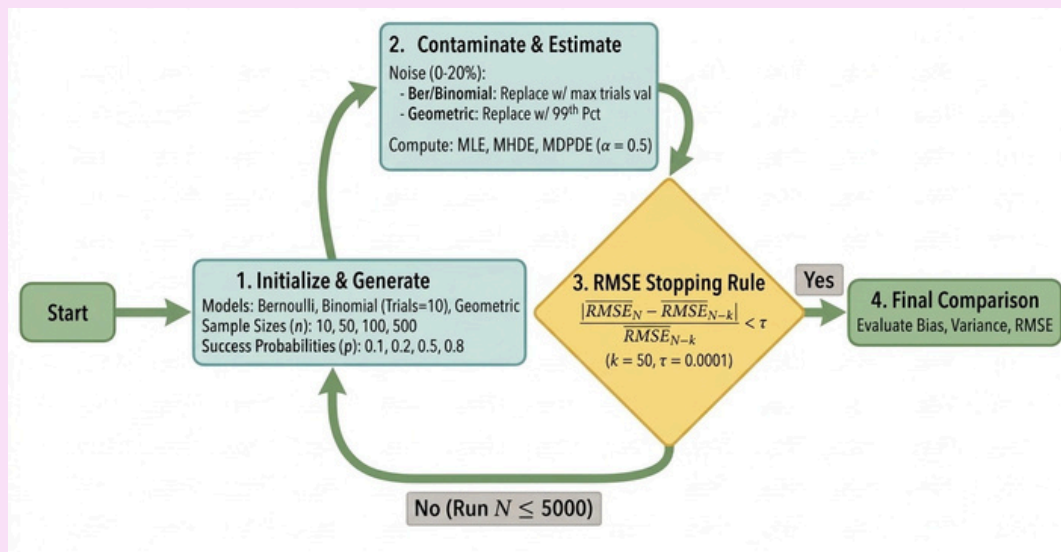


Figure 1: Monte Carlo Simulation Workflow

Figure 1 details the initialization of parameters, the application of targeted contamination for each distribution, the parameter estimation phase, and the cumulative RMSE stopping rule that rigorously ensures mathematical stability before evaluating the final accuracy metrics. The simulation yielded several findings for each distribution.

I. Bernoulli Distribution: In clean data, all methods behaved almost similarly. However, under contamination, MLE and MHDE showed higher RMSE, while MDPDE maintained significantly lower errors, indicating greater robustness, especially for large samples.

II. Binomial Distribution:

An increase in sample size steadily reduced the RMSE for all methods. For clean data and higher success probabilities, MLE displayed slightly better efficiency. However, at lower success probabilities with contamination, MHDE and MDPDE remained much more stable than MLE. Overall: MHDE is more suitable for small p , MDPDE showed the best performance under contamination in the scenarios considered, and MLE is suitable only when data are clean and p is high.

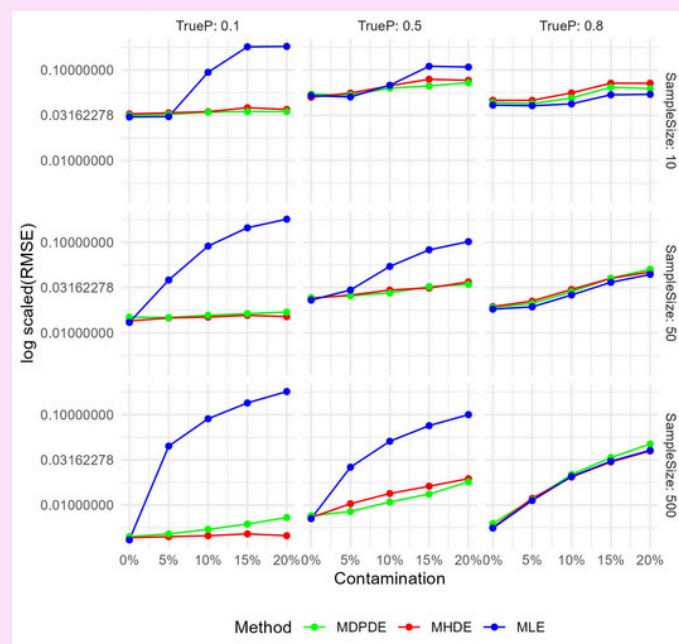


Figure 2: Impact of Contamination on RMSE (Binomial) for some selected n and p values

III. Geometric Distribution:

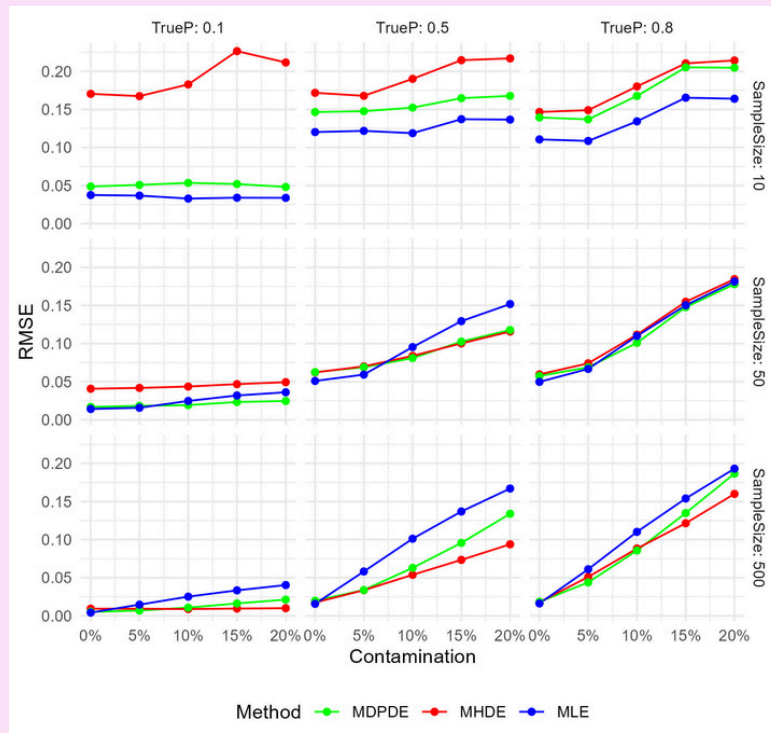


Figure 3: Impact of Contamination on RMSE (Geometric) for some selected n and p values

For small and medium sample sizes without contamination, MLE works best with lowest RMSE because it is efficient when the model is correct. Under contamination, MHDE demonstrated the best overall performance for very large sample sizes. MDPDE maintained the best trade-off between efficiency and robustness at moderate sample sizes. Under the simulation scenarios considered, MHDE performed well for low values of p and large samples; use MDPDE for medium samples requiring both efficiency and robustness; use MLE only when data are clean and small sample sizes.

4. Real-World Validation and Practical Impact

To evaluate these methods work beyond computer simulations, they were applied to a real Bank Customer Dataset to predict term deposit subscriptions. To identify potentially mislabeled data in the bank's records, we applied a Binary Logistic Regression model and used two distinct detection strategies on a sample set:

I. Probabilistic Approach: Flagged anomalous data points where the model predicted a highly likely outcome that directly contradicted the actual recorded label.

II. Deviance Residual Approach: Calculated deviance residuals to measure how unusual an observation was given the model, successfully flagging extreme outliers.

General Findings and Matching Patterns:

After identifying and correcting these real-world errors using the two strategies above, we compared how the MLE, MHDE, and MDPDE estimators behaved before and after the data were cleaned. The empirical outcomes perfectly mirrored our theoretical simulations. When the mislabeled data was corrected, the robust estimators—particularly MDPDE—exhibited the smallest absolute change compared to their original estimates. This indicates that MDPDE was naturally resisting the pull of the errors from the very beginning, providing evidence of its robustness under the conditions considered under real-world stress without the need for manual data cleaning.

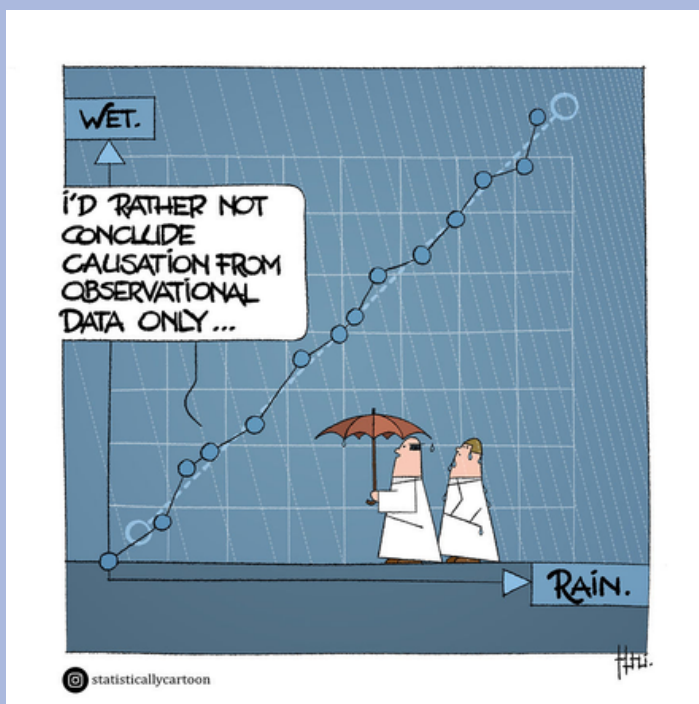
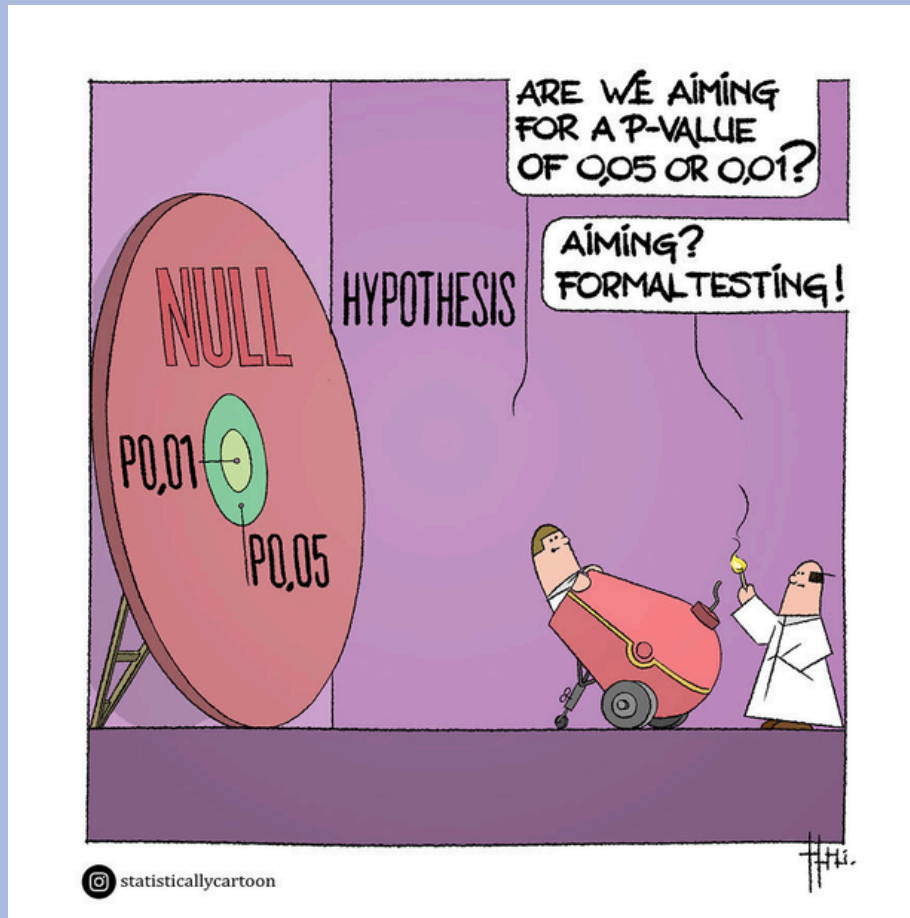
5. Conclusion

This research demonstrates that traditional estimation methods such as maximum likelihood estimation may be sensitive to contamination in real-world datasets that contain inevitable errors. For discrete data subject to contamination, divergence-based robust estimators—especially MDPDE—provide a vastly superior balance of efficiency and stability. By adopting these robust alternatives, data scientists and industry professionals can reduce the influence of contaminated observations on statistical estimation from clerical errors and sensor glitches, saving time, money, and ensuring more accurate conclusions.

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STAT COMICS



Source: <https://www.boredpanda.com/statistically-insignificant-comics-raf-schoenmaekers/>
 Accessed date: 25th August 2026

News & Events Spotlight: Statistics Student Societies

Statistics Society - University of Sri Jayewardenepura

The Statistics Society of the University of Sri Jayewardenepura continued to create opportunities for students to learn, connect, compete, and grow. From May to August 2026, the Society organized a range of academic, professional, and community-focused initiatives, including the inter-university data analytics competition DataXplore 2.0 and Estadistica 2026, the welcoming event StatXO 2.0, the annual quiz competition QUORA 2026, and a Higher Studies Webinar featuring alumni pursuing postgraduate studies overseas. Together, these initiatives encouraged students to take learning beyond the classroom while developing their statistical knowledge, teamwork, communication skills, and awareness of future academic and career opportunities.

DataXplore 2.0 and Estadistica 2026

DataXplore 2.0 was organized as an inter-university data analytics competition designed to strengthen students' ability to explore data, identify meaningful insights, develop visualizations, and communicate findings effectively. The competition progressed through several stages during April and May. Stage 1, held on 16 April, focused on data analysis and insight-report submission. This was followed by a dashboard workshop on 23 and 25 April, 2026 supporting participants in developing their data visualization and dashboard skills. The later stages included the dashboard competition and final presentations on 10 and 17 May 2026, giving shortlisted teams an opportunity to demonstrate their technical abilities and data storytelling skills.

Estadistica 2026, the Society's annual statistics convention, was held on 4 June, 2026 under the theme "Statistics Beyond Boundaries: Diverse Careers, Endless Possibilities." The event brought together students, academics, and industry professionals through career-focused panel discussions, guest sessions, interactive activities, and the DataXplore 2.0 award ceremony. Together, these initiatives created a platform for students to connect statistical knowledge with practical applications and gain wider exposure to opportunities in statistics and data-related careers.



StatXO 2.0

StatXO 2.0, organised in collaboration with the second-year students of the Department of Statistics to warmly welcome the newly enrolled first-year students to the Statistics family was held on the 23rd of May 2026. The event was designed as a day of fun, adventure, and interaction, giving freshers an opportunity to get to know their peers and seniors and become familiar with the vibrant student community.

Through team games, challenges, and interactive activities, participants were encouraged to develop teamwork, friendship, creativity, and communication. Beyond being a welcoming event, StatXO 2.0 provided a memorable beginning to the students' university journey and helped establish stronger connections within the Department of Statistics.

QUORA 2026 – Freshers' Quiz Competition

QUORA 2026, the Society's annual quiz competition for newly enrolled first-year undergraduates of the Faculty of Applied Sciences, continued a tradition that encourages curiosity, knowledge sharing, and healthy competition among freshers.

The competition challenged participants with a series of engaging questions, allowing them to demonstrate knowledge beyond the classroom while developing teamwork and critical thinking. It also provided an opportunity for newly enrolled students to interact and experience the collaborative spirit of university life. At the conclusion of the competition, three outstanding teams secured the top three places. QUORA 2026 therefore served not only as a quiz, but also as a celebration of knowledge, teamwork, curiosity, and the beginning of a new university chapter.



Higher Studies Webinar 2026 – “Transform Your Tomorrow”

The Higher Studies Webinar provided undergraduates and other interested participants with practical guidance on pursuing postgraduate studies and exploring academic opportunities beyond their undergraduate journey. The session featured University of Sri Jayewardenepura alumni currently pursuing higher studies overseas.

- Ms. Ishara Wijayaratne – MSc Student in Statistics, Wake Forest University, North Carolina, USA
- Mr. Thilina Withanage – PhD Candidate in Statistics and Applied Mathematics, The University of Adelaide, Australia
- Ms. Nipuni Opatha – MSc Student in Data Science, TU Dortmund University, Germany

The speakers shared their personal experiences and practical insights on university applications, preparation, scholarships, and adapting to academic life abroad. The webinar gave participants the opportunity to learn directly from alumni who had already embarked on their higher-studies journeys and offered encouragement and guidance for those considering similar paths.

Through these activities, the Statistics Society continued to promote learning beyond the classroom while creating opportunities for students to connect, collaborate, compete, and explore their future paths. The Society looks forward to continuing these initiatives and strengthening the connection between statistical education, practical experience, professional development, and the wider student community.

Stat Circle - University of Colombo

Nurturing Statistical Minds Beyond the Lecture Halls

The Department of Statistics at the University of Colombo has much more to offer in the way of education than classroom teaching and examinations alone. In the midst of this active community of students lies the Stat Circle, the body of students from the Department of Statistics that continues to make it possible for undergraduate students to learn, interact, discover, and develop. The philosophy behind Stat Circle is to develop the student both as a statistician and researcher as well as a professional and socially responsible citizen.

From research and career development to international academic exchange, industry engagement, and community initiatives, the activities organized between April and July 2026 reflected the diverse spirit and continuing growth of Stat Circle.

The period commenced with a Research Guidance Session on 21 April 2026, organized particularly for fourth year undergraduates with an interest in research-oriented work. The session, conducted by Prof. Chandima Thilakarathne, provided students with valuable guidance on planning research, identifying suitable areas of study, developing research ideas, and approaching undergraduate research projects effectively. More than simply introducing students to the mechanics of research, the session encouraged them to look at research as an opportunity to ask meaningful questions and contribute to knowledge. It served as an important stepping stone for students preparing to undertake their own research journeys.

Continuing its emphasis on professional development, Stat Circle launched the first chapter of its ASCENIX initiative with the CV Crafting Workshop on 27 May 2026. Conducted online via Zoom by Mr. M. L. Irsath Ali, Senior Data Scientist at Sysco Labs and Visiting Lecturer at NIBM and IIT, the session addressed one of the most important challenges faced by university students entering the professional world, presenting themselves effectively. Participants gained practical insights into preparing professional CVs, highlighting academic achievements, technical skills, projects, and experiences, and tailoring their profiles towards industry opportunities. The workshop reminded students that a strong career begins not only with what they know, but also with how effectively they communicate their capabilities.

The academic horizons of students were further broadened on 18 June 2026, when Stat Circle, in collaboration with the Colombo University Faculty of Science Alumni Association - North America (CUFSAA-NA), hosted a session under the CUFSAA-NA Distinguished Speaker Series. The programme featured Dr. Soutik Ghosal of the University of Virginia, who delivered an insightful lecture on "Biostatistics in Health Research." The session offered students a glimpse into the powerful role statistics plays in health and biomedical research, particularly in supporting evidence based decision making. Beyond the subject matter itself, the opportunity to interact with an international academic helped students appreciate the wide ranging applications of statistics and the possibilities that lie beyond the conventional boundaries of the discipline.

While academic and professional development remain central to Stat Circle, its identity is equally rooted in community and togetherness. On 25 June 2026, the Circle organized a Poson Ice Cream Dansala within the University of Colombo premises. Bringing students and staff together in the spirit of sharing, the initiative added a cultural and social dimension to university life. It was a simple yet meaningful reminder that a strong student community is built not only through academic achievements, but also through kindness, participation, and shared experiences.

The month of July brought another significant milestone with the second chapter of the ASCENIX initiative, NEXORA - Industry Networking Session, held on 25 July 2026 at the Department of Statistics. Designed to bridge the gap between university education and the professional world, NEXORA brought undergraduates closer to industry professionals and organizations. The session featured representatives from Dialog Axiata PLC, Xeynergy, CloudNavision (Private) Limited, Acuity Analytics, and Zone24x7, offering students the opportunity to engage with professionals working across diverse areas of technology, analytics, data, and business. Through industry sessions and direct interaction, students gained valuable insights into career pathways, workplace expectations, and the skills increasingly valued in Statistics, Data Science, and related fields. More importantly, the event created a space for meaningful conversations and connections between the next generation of statistical professionals and the industry they aspire to join.

Together, these initiatives represent more than a calendar of events. They reflect the broader vision of Stat Circle to empower students to look beyond the lecture halls and discover the many dimensions of Statistics. Research guidance encourages them to question and investigate, professional workshops prepare them to step confidently into the workplace, distinguished academic sessions expose them to global perspectives, industry networking connects education with opportunity, and community initiatives strengthen the bonds that make university life memorable.

As Statistics continues to evolve alongside Data Science, Artificial Intelligence, technology, and interdisciplinary research, Stat Circle remains committed to preparing its students for a changing world. Through every lecture, workshop, conversation, collaboration, and shared moment, the Circle continues to build a culture where students are encouraged not merely to learn statistics, but to live its spirit of curiosity, evidence, and continuous discovery.

With pride in its roots and enthusiasm for the future, Stat Circle continues its journey connecting minds, creating opportunities, and shaping the statisticians of tomorrow.

IASSL Collaborations in May - Aug 2026

Webinar on Pathways to Global Postgraduate Education in Statistics, Biostatistics, and Data Science

The Institute of Applied Statistics Sri Lanka (IASSL), in collaboration with the International Statistical Institute (ISI) and the International Indian Statistical Association (IISA), successfully conducted an international webinar titled “Pathways to Global Postgraduate Education in Statistics, Biostatistics, and Data Science” on 9th June 2026. The webinar brought together students, recent graduates, early-career academics, and internationally recognized scholars to provide practical guidance on pursuing postgraduate education and research opportunities overseas.

The webinar was organized as part of IASSL’s continuing efforts to support the academic and professional development of students and young statisticians in Sri Lanka. With growing interest among Sri Lankan students in pursuing MS and PhD programmes abroad, the webinar addressed an important need for reliable and practical information on international postgraduate education. While information about universities and degree programmes is readily available online, prospective students often need additional guidance on selecting suitable programmes, preparing competitive applications, securing financial support, and understanding differences among academic systems across countries. The strong interest in the programme was reflected in the more than 500 registrations received for the webinar, highlighting the growing demand among students, young academics, and members of the statistical community for information on international postgraduate education and research opportunities.

The programme featured two expert panels representing leading universities from several regions of the world. The first panel focused on postgraduate education and research opportunities in Australia and Asia, featuring Prof. Noel Andrew Cressie of the University of Wollongong, Australia, Prof. Philip Yu of The Education University of Hong Kong, and Prof. Ying Chen of the National University of Singapore.



Prof. Noel Andrew Cressie
University of Wollongong
Australia



Prof. Philip Yu
The Education University of
Hong Kong



Prof. Ying Chen
National University of Singapore
Singapore

The second panel highlighted postgraduate opportunities in Canada, the United Kingdom, and Europe. Prof. Alexandra Schmidt of McGill University, Canada, Prof. Karthik Bharath of the University of Nottingham, and Prof. Ansgar Steland of the RWTH Aachen University shared their insights on program selection, application processes, and opportunities.



Prof. Alexandra Schmidt
McGill University
Canada



Prof. Karthik Bharath
University of Nottingham
United Kingdom



Prof. Ansgar Steland
RWTH Aachen University
Germany

A particularly valuable aspect of the webinar was the opportunity for participants to interact directly with the invited speakers. Students and young academics were able to raise questions and seek clarification on matters that can often be difficult to understand through university websites and general online resources. The speakers also highlighted differences among postgraduate education systems across, emphasizing the importance of careful planning and preparation when considering international study opportunities.

The event demonstrated the value of professional and international collaboration in expanding educational opportunities for the next generation of statisticians, biostatisticians, and data scientists. By bringing together academics from Australia, Asia, North America, and Europe on a single online platform, the webinar provided participants in Sri Lanka with access to a broad range of international perspectives and expertise.

The programme was coordinated by Prof. Lakshika Nawarathna, Department of Statistics and Computer Science, Faculty of Science, University of Peradeniya, on behalf of the IASSL, together with Prof. Nalini Ravishanker, University of Connecticut, USA, and Prof. Veronica Gonzalez-Lopez, State University of Campinas (UNICAMP), Brazil, on behalf of the ISI. The panel was moderated by Ms. Rochelle Ravindradasan of the University of Peradeniya.

The successful organization of the webinar reflected the strong collaboration between the IASSL and ISI, with the participation of the IISA. The initiative also highlighted the important role of IASSL as a professional statistical organization in creating opportunities for Sri Lankan students and young academics to engage with the wider international statistical community and access global academic networks. The event provided participants with an opportunity to engage directly with experienced international academics and offered practical perspectives on postgraduate study and research opportunities.

As Statistics, Biostatistics, and Data Science continue to expand as global disciplines, access to international academic networks, mentorship, and reliable guidance is becoming increasingly important for aspiring postgraduate students. Through initiatives such as this webinar, IASSL continues to strengthen connections between the Sri Lankan statistical community and the global academic community, helping students and young academics explore international opportunities with greater knowledge, confidence, and clarity.

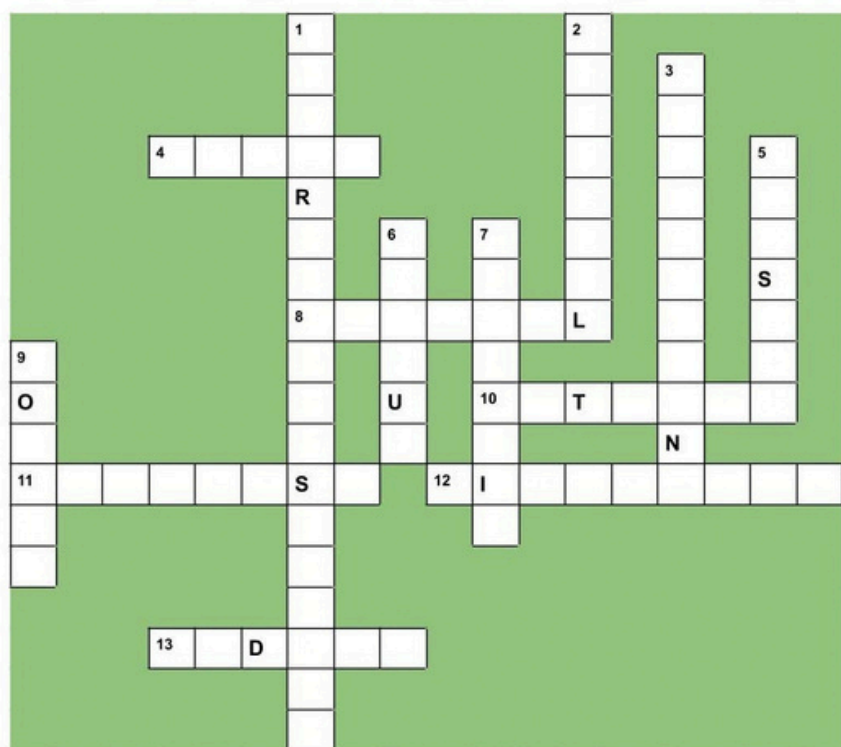
Teacher Training Programme for Eastern Province Teachers

A teacher training workshop for G.C.E. Advanced Level teachers in the Eastern Province was successfully conducted on 30th and 31st July 2026 at the Department of Education, Orr's Hill, Trincomalee, by the Institute of Applied Statistics, Sri Lanka (IASSL), in collaboration with the Ministry of Education, Higher Education and Vocational Education (MOE). Conducted in Tamil medium, the two-day programme provided a platform for teachers to engage in professional development related to Statistics and Probability.

The programme was coordinated by Mr. Uthayakumar, Assistant Director, Eastern Province, Ministry of Education, with Prof. A. Jahufar and Prof. T. Sivananthawerl serving as resource persons. The workshop was organised as part of the efforts to support the professional development of A/L teachers in the Eastern Province.



PUZZLE COMPETITION



Down

1. When the spread of points on a scatterplot looks like a cone, getting wider or narrower.
2. The difference between an observed value and its corresponding predicted value.
3. An outside variable that influences both the factor being studied and the outcome.
5. A sampling method where entire groups are randomly selected instead of individual members.
6. Collecting data from every single member of an entire population, not just a sample.
7. A measure of heaviness of the tails of a distributions.
9. The Guinness brewer who invented the t-test under the name "Student".

Across

4. The 18th-century minister who created a famous rule for updating probabilities when you get new information.
8. The baseline group in an experiment that does not receive the new treatment.
10. A single data point that sits completely separated and far away from the rest of the data.
11. A measure of how tilted a distribution curve is to one side.
12. A bar chart that groups numbers into continuous "bins" to show the shape of the data.
13. The exact middle number when you line up all your data from smallest to largest.

Please email your submission to appstatsl@gmail.com on or before 20th December 2026. The draw will be held on the 28th December, 2026.

Correct submissions will be shortlisted and the winners will be selected randomly and announced in Issue 3 of the 2026 IASSL newsletter.

CONGRATULATIONS

WINNERS OF ISSUE 1, 2026 PUZZLE

- **Gayathri Lakshani Jayawardena**
- **Binali Senaya**

UPCOMING EVENTS

IASSL Convocation 2026 September 5, 2026



September 25-27, 2026

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National Statistics Olympiad November 07, 2026

Registration Form:

<https://iassl.lk/student-registration-olympiad/>

More Details:

[National Statistics Olympiad Website](#)

Ministry-Approved National Competition

“

The National Statistics Olympiad 2026 organized by the Institute of Applied Statistics, Sri Lanka has been approved by the Ministry of Education, Higher Education and Vocational Education.

The forthcoming International Statistics Conference (ISC 2027) is tentatively planned to be held from 18th to 22nd December 2027 in Kandy, Sri Lanka.

International Statistics Conference 2027

NEWS IN BRIEF

Courses conducted by IASSL during MAY-AUG 2026

- Certificate Course on Data Analysis Using Power BI
- Certificate Course on Basic Statistics for Managers and Researchers
- Certificate Course on Data Analysis Using Tableaue
- Certificate Course on Qualitative Data Analysis Using NVivo Software
- Certificate Course on Systematic Literature Review (SLR) with Bibliometric Analysis
- Certificate Course on Machine Learning with Python

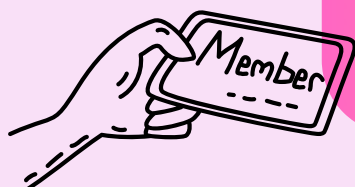
Upcoming Courses (SEPT-DEC 2026)

- Certificate Course on Microsoft Excel for Data Analysis
- Data Analytics with Python: From Data to Insights

New Life Members

New Life Members of IASSL

- D. K. Hemachandra
- A. L. A. R. R. Thanuja
- P. N. Fernando
- S. M. P. Y. R. Subasinghe
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Sri Lankan Journal of Applied Statistics (SLJAS)

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**CONTRIBUTIONS TO THE SEPT-DEC (ISSUE 3) 2026
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If you have any submissions, comments, suggestions or feedback, please send them to editor@iassl.lk.

**WE SINCERELY APPRECIATE ALL WHO
CONTRIBUTED TO THIS ISSUE AND PARTICIPATED
IN ITS PREPARATION.**

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The Professional Centre 275/75
Prof. Stanley Wijesundara Mawatha
Colombo 07 Sri Lanka**

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