Statistics and Data Analysis at DTU Compute

In the digital age of society, statistics and data analysis play an increasingly important role in transforming data into knowledge.

The rapid growth in data availability creates new technological and economic opportunities, but also fundamental challenges.

The Statistics and Data Analysis section at DTU Compute develops novel methods and designs innovative solutions addressing these complex challenges.

By advancing and combining theoretical and applied research in mathematics, we tackle pressing societal issues related to climate, public health, and equality.

Our research involves statistical analysis of various data modalities, for example images, text, and audio, with applications across science and engineering in diverse fields such as healthcare, finance, educational technology, and manufacturing.

Close collaborations with hospitals, multinational companies, and research institutions around the world ensure that our work remains scientifically rigorous and practically relevant.

Core Research Areas

The section conducts research across a broad spectrum of pure and applied mathematics ranging from analysis of stochastic processes to development of computational methods in machine learning and artificial intelligence.

Our work can broadly speaking be categorized into four core research areas: Applied Probability, Statistical Design and Analysis of Experiments, Modern Statistical Models and Statistical Process Control.

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Applied Probability – We formulate and apply stochastic models for dynamical systems in a variety of fields. By combining theoretical analysis with numerical simulation, our research enables parameter estimation and statistical testing in complex multivariate models. Representative examples include modelling delays in railway systems, bed occupancy rates in hospital wards, and insurance risks.

Modern Statistical Models – Modern computing facilities enable us to analyse vast amounts of data from our society using statistical learning and statistical engineering. The research focuses on regularisation strategies, bias mitigation, and sparse methods, and we apply deep neural networks and similar computational methods from machine learning within domains like psychiatry, chemistry, and genetics.

Statistical Design and Analysis of Experiments – Experiments in manufacturing processes and clinical trials in the pharmaceutical industry are typically expensive and time-consuming. Rigorous planning based on statistical analysis and optimisation is therefore indispensable for efficiently obtaining reliable test results, thereby reducing production costs and increasing consumer safety.

Statistical Process Control – In collaboration with leading industrial partners, we design control schemes to monitor and improve industrial products and processes. Analysing time series and process data obtained from sensors, we decompose the variability in data to identify issues such as material impurities and defective machine components and to prescribe corrective actions.

Data Insights Team

The Data Insights Team, DIT, constitutes a dedicated function within the Statistics Section, focusing on the application and dissemination of data analytical methods.

DIT is a research-based group working with data analysis, statistics, machine learning and AI across a broad range of application areas, including sectors such as construction, food, production and healthcare, as well as technologies like drones, translating advanced methodology into practical solutions.

The team collaborates widely with companies, public authorities, and colleagues across DTU, with the aim of strengthening data-driven methods and digital competencies across disciplines and sectors.

An explicit goal of the team is to engage broadly across DTU and beyond, fostering new interdisciplinary collaborations.

Much of the work is carried out within the framework of publicly and privately funded innovation programmes, where the focus is on targeted development of competences within small and medium-sized enterprises, SME's, and the application of data-driven methods in practice.

In practice, collaborations are characterised by a two-way exchange of knowledge, providing both the team and the DTU Compute with valuable insight into the application of data-driven methods in industry and society.

Education

We are responsible for teaching the mandatory introductory courses in statistics and offer advanced graduate-level courses in areas such as stochastic processes, computational data analysis, and statistical modelling and quality control.

Across all levels, we emphasise scientific reasoning and critical thinking, providing a solid foundation for students in the Applied Mathematics (BSc) and Mathematical Modelling and Computation (MSc) programmes.