

Statistics For High Dimensional Data Methods Theory And Applications

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In statistical theory, the field of high-dimensional statistics studies data whose dimension is larger than dimensions considered in classical multivariate analysis. High-dimensional statistics relies on the theory of random vectors. In many applications, the dimension of the data vectors may be larger than the sample size.

~~High-dimensional statistics - Wikipedia~~

Buy Statistics for High-Dimensional Data: Methods, Theory and Applications (Springer Series in Statistics) 2011 by Buhlmann, Peter, Van de Geer, Sara (ISBN: 9783642201912) from Amazon's Book Store. Everyday low prices and free delivery on eligible orders.

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A special characteristic of the book is that it contains comprehensive mathematical theory on high-dimensional statistics combined with methodology, algorithms and illustrations with real data examples. This in-depth approach highlights the methods' great potential and practical applicability in a variety of settings.

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Statistics for high-dimensional data: Introduction, and the Lasso for linear models Peter Buhlmann and Sara van de Geer" Seminar fur Statistik, ETH Z" urich May 2012. High-dimensional data Riboflavin production with Bacillus Subtilis (in collaboration with DSM (Switzerland))

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Over the past decade, statistics have undergone drastic changes with the development of high-dimensional statistical inference. Indeed, on each individual, more and more features are measured to

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a point that their number usually far exceeds the number of observations. This is the case in biology and

~~High Dimensional Statistics — MIT Mathematics~~

Our experiments show that on high-dimensional data, the X-tree outperforms the TV-tree and the R*-tree by orders of magnitude (cf. section 4). For dimensionality larger than 2, the X-tree is up to 450 times faster than the R*-tree and between 4 and 12 times faster than the TV-tree.

~~High Dimensional Data — an overview | ScienceDirect Topics~~

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There are 20,200 parameters in the covariance matrix. This is a high-dimensional statistical problem and estimating it accurately poses challenges. Covariance matrices pervade every facet of financial econometrics, from asset allocation, asset pricing, and risk management, to derivative pricing and proprietary trading.

~~Statistical challenges with high dimensionality: feature ...~~

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3. Contributions to high-dimensional data analysis. As a way to foster links between FDA and high-dimensional statistics, this Special Issue includes some contributions on the latter theme, most notably the paper by Bodnar, Okhrin, and Parolya . However, other papers are at the cross-roads between the two fields and are therefore highly ...

~~Recent advances in functional data analysis and high ...~~

Bühlmann, P. (2007). Variable selection for high-dimensional data: with applications in molecular biology. Bulletin of the International Statistical Institute, 56nd session. PDF; Schäfer, J. and Bühlmann, P. (2007). Modeling inhomogeneous high-dimensional data-sets: with applications in learning large-scale gene correlations. S.Co. 2007. PDF

~~Peter Bühlmann — Publications — Seminar for Statistics~~

However, the eld of Statistics must constantly adapt and innovate to develop methods that accommodate the data it is tasked with to study, and today, much of that data is high-dimensional: pis very large and often greatly exceeds n .

Modern statistics deals with large and complex data sets, and consequently with models containing a large number of parameters. This book presents a detailed account of recently developed approaches, including the Lasso and versions of it for various models, boosting methods, undirected graphical modeling, and procedures controlling false positive selections. A special characteristic of the book is that it contains comprehensive mathematical theory on high-dimensional statistics combined with methodology, algorithms and illustrations with real data examples. This in-depth approach highlights the methods' great potential and practical applicability in a variety of settings. As such, it is a valuable resource for researchers, graduate students and experts in statistics, applied mathematics and computer science.

This book features research contributions from The Abel Symposium on Statistical Analysis for High Dimensional Data, held in Nyvågar, Lofoten, Norway, in May 2014. The focus of the symposium was on statistical and machine learning methodologies specifically developed for inference in "big data" situations, with particular reference to genomic applications. The contributors, who are among the most prominent researchers on the theory of statistics for high dimensional inference, present new theories and methods, as well as challenging applications and computational solutions. Specific themes include, among others, variable selection and screening, penalised regression, sparsity, thresholding, low dimensional structures, computational challenges, non-convex situations, learning graphical models, sparse covariance and precision matrices, semi- and non-parametric formulations, multiple testing, classification, factor models, clustering, and preselection. Highlighting cutting-edge research and casting light on future research directions, the contributions will benefit graduate students and

researchers in computational biology, statistics and the machine learning community.

A coherent introductory text from a groundbreaking researcher, focusing on clarity and motivation to build intuition and understanding.

Praise for the first edition: "[This book] succeeds singularly at providing a structured introduction to this active field of research. ... it is arguably the most accessible overview yet published of the mathematical ideas and principles that one needs to master to enter the field of high-dimensional statistics. ... recommended to anyone interested in the main results of current research in high-dimensional statistics as well as anyone interested in acquiring the core mathematical skills to enter this area of research." –Journal of the American Statistical Association Introduction to High-Dimensional Statistics, Second Edition preserves the philosophy of the first edition: to be a concise guide for students and researchers discovering the area and interested in the mathematics involved. The main concepts and ideas are presented in simple settings, avoiding thereby unessential technicalities. High-dimensional statistics is a fast-evolving field, and much progress has been made on a large variety of topics, providing new insights and methods. Offering a succinct presentation of the mathematical foundations of high-dimensional statistics, this new edition: Offers revised chapters from the previous edition, with the inclusion of many additional materials on some important topics, including compress sensing, estimation with convex constraints, the slope estimator, simultaneously low-rank and row-sparse linear regression, or aggregation of a continuous set of estimators. Introduces three new chapters on iterative algorithms, clustering, and minimax lower bounds. Provides enhanced appendices, minimax lower-bounds mainly with the addition of the Davis-Kahan perturbation bound and of two simple versions of the Hanson-Wright concentration inequality. Covers cutting-edge statistical methods including model selection, sparsity and the Lasso, iterative hard thresholding, aggregation, support vector machines, and learning theory. Provides detailed exercises at the end of every chapter with collaborative solutions on a wiki site. Illustrates concepts with simple but clear practical examples.

- Real-world problems can be high-dimensional, complex, and noisy
- More data does not imply more information
- Different approaches deal with the so-called curse of dimensionality to reduce irrelevant information
- A process with multidimensional information is not necessarily easy to interpret nor process
- In some real-world applications, the number of elements of a class is clearly lower than the other. The models tend to assume that the importance of the analysis belongs to the majority class and this is not usually the truth
- The analysis of complex diseases such as cancer are focused on more-

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than-one dimensional omic data • The increasing amount of data thanks to the reduction of cost of the high-throughput experiments opens up a new era for integrative data-driven approaches • Entropy-based approaches are of interest to reduce the dimensionality of high-dimensional data

Over the last few years, significant developments have been taking place in high-dimensional data analysis, driven primarily by a wide range of applications in many fields such as genomics and signal processing. In particular, substantial advances have been made in the areas of feature selection, covariance estimation, classification and regression. This book intends to examine important issues arising from high-dimensional data analysis to explore key ideas for statistical inference and prediction. It is structured around topics on multiple hypothesis testing, feature selection, regression, classification, dimension reduction, as well as applications in survival analysis and biomedical research. The book will appeal to graduate students and new researchers interested in the plethora of opportunities available in high-dimensional data analysis.

Ever-greater computing technologies have given rise to an exponentially growing volume of data. Today massive data sets (with potentially thousands of variables) play an important role in almost every branch of modern human activity, including networks, finance, and genetics. However, analyzing such data has presented a challenge for statisticians

This modern approach integrates classical and contemporary methods, fusing theory and practice and bridging the gap to statistical learning.

High-dimensional probability offers insight into the behavior of random vectors, random matrices, random subspaces, and objects used to quantify uncertainty in high dimensions. Drawing on ideas from probability, analysis, and geometry, it lends itself to applications in mathematics, statistics, theoretical computer science, signal processing, optimization, and more. It is the first to integrate theory, key tools, and modern applications of high-dimensional probability. Concentration inequalities form the core, and it covers both classical results such as Hoeffding's and Chernoff's inequalities and modern developments such as the matrix Bernstein's inequality. It then introduces the powerful methods based on stochastic processes, including such tools as Slepian's, Sudakov's, and Dudley's inequalities, as well as generic chaining and bounds based on VC dimension. A broad range of illustrations is embedded throughout, including classical and modern results for covariance estimation, clustering, networks, semidefinite programming, coding, dimension reduction, matrix completion, machine learning, compressed sensing, and sparse regression.

A comprehensive examination of high-dimensional analysis of multivariate methods and their real-world applications. *Multivariate Statistics: High-Dimensional and Large-Sample Approximations* is the first book of its kind to explore how classical multivariate methods can be revised and used in place of conventional statistical tools. Written by prominent researchers in the field, the book focuses on high-dimensional and large-scale approximations and details the many basic multivariate methods used to achieve high levels of accuracy. The authors begin with a fundamental presentation of the basic tools and exact distributional results of multivariate statistics, and, in addition, the derivations of most distributional results are provided. Statistical methods for high-dimensional data, such as curve data, spectra, images, and DNA microarrays, are discussed. Bootstrap approximations from a methodological point of view, theoretical accuracies in MANOVA tests, and model selection criteria are also presented. Subsequent chapters feature additional topical coverage including: High-dimensional approximations of various statistics, High-dimensional statistical methods, Approximations with computable error bound, Selection of variables based on model selection approach, Statistics with error bounds and their appearance in discriminant analysis, growth curve models, generalized linear models, profile analysis, and multiple comparison. Each chapter provides real-world applications and thorough analyses of the real data. In addition, approximation formulas found throughout the book are a useful tool for both practical and theoretical statisticians, and basic results on exact distributions in multivariate analysis are included in a comprehensive, yet accessible, format. *Multivariate Statistics* is an excellent book for courses on probability theory in statistics at the graduate level. It is also an essential reference for both practical and theoretical statisticians who are interested in multivariate analysis and who would benefit from learning the applications of analytical probabilistic methods in statistics.

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