An Introduction To Heavy Tailed And Subexponential Distributions Springer Series In Operations Research And Financial Engineering


This book emphasizes the applications of statistics and probability to finance. The basics of these subjects are reviewed and more advanced topics in statistics, such as regression, ARMA and GARCH models, the bootstrap, and nonparametric regression using splines, are introduced as needed. The book covers the classical methods of finance and it introduces the newer area of behavioral finance. Applications and use of MATLAB and SAS software are stressed. The book will serve as a text in courses aimed at advanced undergraduates and masters students. Those in the finance industry can use it for self-study.

The study of heavy-tailed distributions allows researchers to represent phenomena that occasionally exhibit very large deviations from the mean. The dynamics underlying these phenomena is an interesting theoretical subject, but the study of their statistical properties is itself a very useful endeavor from the point of view of managing assets and controlling risk. In this book, the authors are primarily concerned with the statistical properties of heavy-tailed distributions and with the processes that exhibit jumps. A detailed overview with a Matlab implementation of heavy-tailed models applied in asset management and risk management is presented. The book is not intended as a theoretical treatise on probability or statistics, but as a tool to understand the main concepts regarding heavy-tailed random variables and processes as applied to real-world applications in finance. Accordingly, the authors review approaches and methodologies whose realization will be useful for developing new methods for forecasting of financial variables where extreme events are not treated as anomalies, but as intrinsic parts of the economic process.

A cutting-edge guide for the theories, applications, and statistical methodologies essential to heavy tailed risk modeling focusing on the quantitative aspects of heavy tailed loss processes in operational risk and relevant insurance analytics, Advances in Heavy Tailed Risk Modeling: A Handbook of Operational Risk presents comprehensive coverage of the latest research on the theories and applications in risk measurement and modeling techniques. Featuring a unique balance of mathematical and statistical perspectives, the handbook begins by introducing the motivation for heavy tailed risk processes in high consequence low frequency loss modeling. With a companion, Fundamental Aspects of Operational Risk and Insurance Analytics: A Handbook of Operational Risk, the book provides a complete framework for all aspects of operational risk management and includes: Clear coverage on advanced topics such as spliced loss models, extreme value theory, heavy tailed closed form loss distributional approach models, flexible heavy tailed risk models, risk measures, and higher order asymptotic approximations of risk measures for capital estimation An exploration of the characterization and estimation of risk and insurance modelling, which includes sub-exponential models, alpha-stable models, and tempered alpha stable models An extended discussion of the core concepts of risk measurement and capital estimation as well as the details on numerical approaches to evaluation of heavy tailed loss process model capital estimates Numerous detailed examples of real-world methods and practices of operational risk modeling used by both financial and non-financial institutions Advances in Heavy Tailed Risk Modeling: A Handbook of Operational Risk is an excellent reference for risk management practitioners, quantitative analysts, financial engineers, and risk managers. The book is also a useful handbook for graduate-level courses on heavy tailed processes, advanced risk management, and actuarial science.

This book offers a unified approach to the study of crises, large fluctuations, dependence and contagion effects in economics and finance. It covers important topics in statistical modeling and estimation, which combine the notions of copulas and heavy tails — two particularly valuable tools of today's research in economics, finance, econometrics and other fields — in order to provide a new way of thinking about such vital problems as diversification of risk and propagation of crises through financial markets due to contagion phenomena, among others. The aim is to arm today's economists with a toolbox suited for analyzing multivariate data with many outliers and with arbitrary dependence patterns. The methods and topics discussed and used in the book include, in particular, majorization theory, heavy-tailed distributions and copula functions — all applied to study robustness of economic, financial and statistical models, and estimation methods to heavy tails and dependence.

Features a broad introduction to recent research on Turing's formula and presents modern applications in statistics, probability, information theory, and other areas of modern data science. Turing's formula is, perhaps, the only known method for estimating the underlying distributional characteristics beyond the range of observed data without making any parametric or semiparametric assumptions. This book presents a clear introduction to Turing's formula and its connections to statistics. Topics with relevance to a variety of different fields of study are included such as information theory; statistics; probability; computer science inclusive of artificial intelligence and machine learning; big data; biology; ecology; and genetics. The author provides examinations of many core statistical issues within modern data science from Turing's perspective. A systematic approach to long-standing problems such as entropy and mutual information estimation, diversity index estimation, domains of attraction on general alphabets, and tail probability estimation is presented in light of the most up-to-date understanding of Turing's formula. Featuring numerous exercises and examples throughout, the author provides a summary of the known properties of Turing's formula and explains how and when it
works well; discusses the approach derived from Turing's formula in order to estimate a variety of quantities, all of which mainly come from information theory, but are also important for machine learning and for ecological applications; and uses Turing's formula to estimate certain heavy-tailed distributions. In summary, this book: • Features a unified and broad presentation of Turing's formula, including its connections to statistics, probability, information theory, and other areas of modern data science • Provides a presentation on the statistical estimation of information theoretic quantities • Demonstrates the estimation problems of several statistical functions from Turing's perspective such as Simpson's indices, Shannon's entropy, general diversity indices, mutual information, and Kullback–Leibler divergence • Includes numerous exercises and examples throughout with a fundamental perspective on the key results of Turing's formula Statistical Implications of Turing's Formula is an ideal reference for researchers and practitioners who need a review of the many critical statistical issues of modern data science. This book is also an appropriate learning resource for biologists, ecologists, and geneticists who are involved with the concept of diversity and its estimation and can be used as a textbook for graduate courses in mathematics, probability, statistics, computer science, artificial intelligence, machine learning, big data, and information theory. Zhiyi Zhang, PhD, is Professor of Mathematics and Statistics at The University of North Carolina at Charlotte. He is an active consultant in both industry and government on a wide range of statistical issues, and his current research interests include Turing's formula and its statistical implications; probability and statistics on countable alphabets; nonparametric estimation of entropy and mutual information; tail probability and biodiversity indices; and applications involving extracting statistical information from low-frequency data space. He earned his PhD in Statistics from Rutgers University.

This book aims to present a comprehensive, self-contained, and concise overview of extreme value theory for time series, incorporating the latest research trends alongside classical methodology. Appropriate for graduate coursework or professional reference, the book requires a background in extreme value theory for i.i.d. data and basics of time series. Following a brief review of foundational concepts, it progresses linearly through topics in limit theorems and time series models while including historical insights at each chapter’s conclusion. Additionally, the book incorporates complete proofs and exercises with solutions as well as substantive reference lists and appendices, featuring a novel commentary on the theory of vague convergence.

The role of Yuri Vasilyevich Prokhorov as a prominent mathematician and leading expert in the theory of probability is well known. Even early in his career he obtained substantial results on the validity of the strong law of large numbers and on the estimates (bounds) of the rates of convergence, some of which are the best possible. His findings on limit theorems in metric spaces and particularly functional limit theorems are of exceptional importance. Y.V. Prokhorov developed an original approach to the proof of functional limit theorems, based on the weak convergence of finite dimensional distributions and the condition of tightness of probability measures. The present volume commemorates the 80th birthday of Yuri Vasilyevich Prokhorov. It includes scientific contributions written by his colleagues, friends and pupils, who would like to express their deep respect and sincerest admiration for him and his scientific work. Mathematics, natural disasters of all types are characterized by heavy tailed distributions. The analysis of such distributions with common methods, such as averages and dispersions, can therefore lead to erroneous conclusions. The statistical methods described in this book avoid such pitfalls. Seismic disasters are studied, primarily thanks to the availability of an ample statistical database. New approaches are presented to seismic risk estimation and forecasting the damage caused by earthquakes, ranging from typical, moderate events to very rare, extreme disasters. Analysis of these latter events is based on the limit theorems of probability and the duality of the generalized Pareto distribution and generalized extreme value distribution. It is shown that the parameter most widely used to estimate seismic risk – Mmax, the maximum possible earthquake value – is potentially non-robust. Robust analogues of this parameter are suggested and calculated for some seismic catalogues. Trends in the costs inferred by damage from natural disasters as related to changing social and economic situations are examined for different regions. The results obtained argue for sustainable development, whereas entirely different, incorrect conclusions can be drawn if the specific properties of the heavy-tailed distribution and change in completeness of data on natural hazards are neglected. This pioneering work is directed at risk assessment specialists in general, seismologists, administrators and all those interested in natural disasters and their impact on society.

The goal of this thesis is to treat the temporal tail dependence and the cross-sectional tail dependence of heavy tailed functional time series. Functional time series are aimed at modelling spatio-temporal phenomena; for instance rain, temperature, pollution on a given geographical area, with temporally dependent observations. Heavy tails mean that the series can exhibit much higher spikes than with Gaussian distributions for instance. In such cases, second moments cannot be assumed to exist, violating the basic assumption in standard functional data analysis based on the sequence of autocovariance operators. As for random variables, regular variation provides the mathematical backbone for a coherent theory of extreme values. The main tools introduced in this thesis for a regularly varying functional time series are its tail process and its spectral process. These objects capture all the aspects of the probability distribution of extreme values jointly over time and space. The development of the tail and spectral process for heavy tailed functional time series is followed by three theoretical applications. The first application is a characterization of a variety of indices and objects describing the extremal behavior of the series: the extremal index, tail dependence coefficients, the extremogram and the point process of extremes. The second is the computation of an explicit expression of the tail and spectral processes for heavy tailed linear functional time series. The third and final application is the introduction and the study of a model for the spatio-temporal dependence for functional time series called maxima of moving maxima of continuous functions (CM3 processes), with the development of an estimation method. Long Range Dependence is a wide ranging survey of the ideas, models and techniques associated with the notion of long memory. It will serve as an invaluable reference source for researchers studying long range dependence, for those building long memory models, and for people who are trying to detect the possible presence of long memory in data. Heavy-tailed probability distributions are an important component in the modeling of many stochastic systems. They are frequently used to accurately model inputs and outputs of computer and data networks and service facilities such as call centers. They are an
essential for describing risk processes in finance and also for insurance premia pricing, and such distributions occur naturally in models of epidemiological spread. The class includes distributions with power law tails such as the Pareto, as well as the lognormal and certain Weibull distributions. One of the highlights of this new edition is that it includes problems at the end of each chapter. Chapter 5 is also updated to include interesting applications to queueing theory, risk, and branching processes. New results are presented in a simple, coherent and systematic way. Graduate students as well as modellers in the fields of finance, insurance, network science and environmental studies will find this book to be an essential reference.

Twenty-four contributions, intended for a wide audience from various disciplines, cover a variety of applications of heavy-tailed modeling involving telecommunications, the Web, insurance, and finance. Along with discussion of specific applications are several papers devoted to time series analysis, regression, classical signal/noise detection problems, and the general structure of stable processes, viewed from a modeling standpoint. Emphasis is placed on developments in handling the numerical problems associated with stable distribution (a main technical difficulty until recently). No index. Annotation copyrighted by Book News, Inc., Portland, OR

The book gives a comprehensive treatment of the classical and modern ruin probability theory. Some of the topics are Lundberg's inequality, the Cramér-Lundberg approximation, exact solutions, other approximations (e.g., for heavy-tailed claim size distributions), finite horizon ruin probabilities, extensions of the classical compound Poisson model to allow for reserve-dependent premiums, Markov-modulation, periodicity, change of measure techniques, phase-type distributions as a computational vehicle and the connection to other applied probability areas, like queueing theory. In this substantially updated and extended second version, new topics include stochastic control, fluctuation theory for Levy processes, Gerber-Shiu functions and dependence. The volatility of financial returns changes over time and, for the last thirty years, Generalized Autoregressive Conditional Heteroscedasticity (GARCH) models have provided the principal means of analyzing, modeling and monitoring such changes. Taking into account that financial returns typically exhibit heavy tails - that is, extreme values can occur from time to time - Andrew Harvey's new book shows how a small but radical change in the way GARCH models are formulated leads to a resolution of many of the theoretical problems inherent in the statistical theory. The approach can also be applied to other aspects of volatility. The more general class of Dynamic Conditional Score models extends to robust modeling of outliers in the levels of time series and to the treatment of time-varying relationships. The statistical theory draws on basic principles of maximum likelihood estimation and, by doing so, leads to an elegant and unified treatment of nonlinear time-series modeling.

Ott and Longnecker's AN INTRODUCTION TO STATISTICAL METHODS AND DATA ANALYSIS, Seventh Edition, provides a broad overview of statistical methods for advanced undergraduate and graduate students from a variety of disciplines who have little or no prior course work in statistics. The authors teach students to solve problems encountered in research projects, to make decisions based on data in general settings both within and beyond the university setting, and to become critical readers of statistical analyses in research papers and news reports. The first eleven chapters present material typically covered in an introductory statistics course, as well as case studies and examples that are often encountered in undergraduate capstone courses. The remaining chapters cover regression modeling and design of experiments. Important Notice: Media content referenced within the product description or the product text may not be available in the ebook version.

A step-by-step explanation of the mathematical models used to price derivatives. For this second edition, Salih Neftci has expanded one chapter, added six new ones, and inserted chapter-concluding exercises. He does not assume that the reader has a thorough mathematical background. His explanations of financial calculus seek to be simple and perceptive. This book focuses on general frameworks for modeling heavy-tailed distributions in economics, finance, econometrics, statistics, risk management and insurance. A central theme is that of (non-)robustness, i.e., the fact that the presence of heavy tails can either reinforce or reverse the implications of a number of models in these fields, depending on the degree of heavy-tailed ness. These results motivate the development and applications of robust inference approaches under heavy tails, heterogeneity and dependence in observations. Several recently developed robust inference approaches are discussed and illustrated, together with applications.

In this monograph the authors give a systematic approach to the probabilistic properties of the fixed point equation \(X=AX+B\). A probabilistic study of the stochastic recurrence equation \(X_t=A_tX_{t-1}+B_t\) for real- and matrix-valued random variables \(A_t\), where \((A_t,B_t)\) constitute an iid sequence, is provided. The classical theory for these equations, including the existence and uniqueness of a stationary solution, the tail behavior with special emphasis on power law behavior, moments and support, is presented. The authors collect recent asymptotic results on extremes, point processes, partial sums (central limit theory with special emphasis on infinite variance stable limit theory), large deviations, in the univariate and multivariate cases, and they further touch on the related topics of smoothing transforms, regularly varying sequences and random iterative systems. The text gives an introduction to the Kesten-Goldie theory for stochastic recurrence equations of the type \(X_t=A_tX_{t-1}+B_t\). It provides the classical results of Kesten, Goldie, Guivarc'h, and others, and gives an overview of recent results on the topic. It presents the state-of-the-art results in the field of affine stochastic recurrence equations and shows relations with non-affine recursions and multivariate regular variation.

From the reviews: "The material is self-contained, but it is technical and a solid foundation in probability and queuing theory is beneficial to prospective readers. [...] It is intended to be accessible to those with less background. This book is a must to researchers and graduate students interested in these areas." ISI Short Book Reviews

A comprehensive monograph presenting a unified systematic exposition of the large deviations theory for heavy-tailed random walks.

This book offers a unified approach to the study of crises, large fluctuations, dependence and contagion effects in economics and finance. It covers important topics in statistical modeling and estimation, which combine the notions of copulas and heavy tails -- two particularly valuable tools of today's research in economics, finance, econometrics and other fields -- in order to provide a new way of thinking about such vital problems as diversification of risk and propagation of crises through financial markets due to contagion phenomena, among others. The aim is to arm today's
economists with a toolbox suited for analyzing multivariate data with many outliers and with arbitrary dependence patterns. The methods and topics discussed and used in the book include, in particular, majorization theory, heavy-tailed distributions and copula functions -- all applied to study robustness of economic, financial and statistical models, and estimation methods to heavy tails and dependence.

Heavy tailed data appears frequently in social science, internet traffic, insurance and finance. Statistical inference has been studied for many years, which includes recent bias-reduction estimation for tail index and high quantiles with applications in risk management, empirical likelihood based interval estimation for tail index and high quantiles, hypothesis tests for heavy tails, the choice of sample fraction in tail index and high quantile inference. These results for independent data, dependent data, linear time series and nonlinear time series are scattered in different statistics journals. Inference for Heavy-Tailed Data Analysis puts these methods into a single place with a clear picture on learning and using these techniques. Contains comprehensive coverage of new techniques of heavy tailed data analysis Provides examples of heavy tailed data and its uses Brings together, in a single place, a clear picture on learning and using these techniques

This book examines the fundamental mathematical and stochastic process techniques needed to study the behavior of extreme values of phenomena based on independent and identically distributed random variables and vectors. It emphasizes the core primacy of three topics necessary for understanding extremes: the analytical theory of regularly varying functions; the probabilistic theory of point processes and random measures; and the link to asymptotic distribution approximations provided by the theory of weak convergence of probability measures in metric spaces. This monograph provides a complete and comprehensive introduction to the theory of long-tailed and subexponential distributions in one dimension. New results are presented in a simple, coherent and systematic way. All the standard properties of such convolutions are then obtained as easy consequences of these results. The book focuses on more theoretical aspects. A discussion of where the areas of applications currently stand in included as is some preliminary mathematical material. Mathematical modelers (for e.g. in finance and environmental science) and statisticians will find this book useful.

While mainstream financial theories and applications assume that asset returns are normally distributed, overwhelming empirical evidence shows otherwise. Yet many professionals don’t appreciate the highly statistical models that take this empirical evidence into consideration. Fat-Tailed and Skewed Asset Return Distributions examines this dilemma and offers readers a less technical look at how portfolio selection, risk management, and option pricing modeling should and can be undertaken when the assumption of a non-normal distribution for asset returns is violated. Topics covered in this comprehensive book include an extensive discussion of probability distributions, estimating probability distributions, portfolio selection, alternative risk measures, and much more. Fat-Tailed and Skewed Asset Return Distributions provides a bridge between the highly technical theory of statistical distributional analysis, stochastic processes, and econometrics of financial returns and real-world risk management and investments.

The Handbooks in Finance are intended to be a definitive source for comprehensive and accessible information in the field of finance. Each individual volume in the series should present an accurate self-contained survey of a sub-field of finance, suitable for use by finance and economics professors and lecturers, professional researchers, graduate students and as a teaching supplement. The goal is to have a broad group of outstanding volumes in various areas of finance. The Handbook of Heavy Tailed Distributions in Finance is the first handbook to be published in this series. This volume presents current research focusing on heavy tailed distributions in finance. The contributions cover methodological issues, i.e., probabilistic, statistical and econometric modelling under non-Gaussian assumptions, as well as the applications of the stable and other non-Gaussian models in finance and risk management.

This book is written to help graduate students and young researchers to enter quickly into the subject of Risk Theory. It can also be used by actuaries and financial practitioners for the optimization of their decisions and further by regulatory authorities for the stabilization of the insurance industry. The topic of extreme claims is especially presented as a crucial feature of the modern ruin probability.

The book investigates the misapplication of conventional statistical techniques to fat tailed distributions and looks for remedies, when possible. Switching from thin tailed to fat tailed distributions requires more than "changing the color of the dress." Traditional asymptotics deal mainly with either $n=1$ or $n=?$, and the real world is in between, under the "laws of the medium numbers"--which vary widely across specific distributions. Both the law of large numbers and the generalized central limit mechanisms operate in highly idiosyncratic ways outside the standard Gaussian or Levy-Stable basins of convergence. A few examples: - The sample mean is rarely in line with the population mean, with effect on "naive empiricism," but can be sometimes be estimated via parametric methods. - The "empirical distribution" is rarely empirical. - Parameter uncertainty has compounding effects on statistical metrics. - Dimension reduction (principal components) fails. - Inequality estimators (Gini or quantile contributions) are not additive and produce wrong results. - Many "biases" found in psychology become entirely rational under more sophisticated probability distributions. - Most of the failures of financial economics, econometrics, and behavioral economics can be attributed to using the wrong distributions. This book, the first volume of the Technical Incerto, weaves a narrative around published journal articles. The authors establish some asymptotic expansions for infinite weighted convolution of distributions having regularly varying tails. Applications to linear time series models, tail index estimation, compound sums, queuing theory, branching processes, infinitely divisible distributions and implicit transient renewal equations are given. A noteworthy feature of the approach taken in this paper is that through the introduction of objects, which the authors call the Laplace characters, a link is established between tail area expansions and algebra. By virtue of this representation approach, a unified method to establish expansions across a variety of problems is presented and, moreover, the method can be easily programmed
so that a computer algebra package makes implementation of the method not only feasible but simple.

Heavy-tailed distributions are typical for phenomena in complex multi-component systems such as biometry, economics, ecological systems, sociology, web access statistics, internet traffic, bibliometrics, finance and business. The analysis of such distributions requires special methods of estimation due to their specific features. These are not only the slow decay to zero of the tail, but also the violation of Cramer’s condition, possible non-existence of some moments, and sparse observations in the tail of the distribution. The book focuses on the methods of statistical analysis of heavy-tailed independent identically distributed random variables by empirical samples of moderate sizes. It provides a detailed survey of classical results and recent developments in the theory of nonparametric estimation of the probability density function, the tail index, the hazard rate and the renewal function. Both asymptotical results, for example convergence rates of the estimates, and results for the samples of moderate sizes supported by Monte-Carlo investigation, are considered. The text is illustrated by the application of the considered methodologies to real data of web traffic measurements.

This title is written for the numerate nonspecialist, and hopes to serve three purposes. First it gathers mathematical material from diverse but related fields of order statistics, records, extreme value theory, majorization, regular variation and subexponentiality. All of these are relevant for understanding fat tails, but they are not, to our knowledge, brought together in a single source for the target readership. Proofs that give insight are included, but for most fussy calculations the reader is referred to the excellent sources referenced in the text. Multivariate extremes are not treated. This allows us to present material spread over hundreds of pages in specialist texts in twenty pages. Chapter 5 develops new material on heavy tail diagnostics and gives more mathematical detail. Since variances and covariances may not exist for heavy tailed joint distributions, Chapter 6 reviews dependence concepts for certain classes of heavy tailed joint distributions, with a view to regressing heavy tailed variables. Second, it presents a new measure of obesity. The most popular definitions in terms of regular variation and subexponentiality invoke putative properties that hold at infinity, and this complicates any empirical estimate. Each definition captures some but not all of the intuitions associated with tail heaviness. Chapter 5 studies two candidate indices of tail heaviness based on the tendency of the mean excess plot to collapse as data are aggregated. The probability that the largest value is more than twice the second largest has intuitive appeal but its estimator has very poor accuracy. The Obesity index is defined for a positive random variable X as: Ob(X) = P (X1 > X2 + X3|X1 ? X2 ? X3 ? X4), Xi independent copies of X. For empirical distributions, obesity is defined by bootstrapping. This index reasonably captures intuitions of tail heaviness. Among its properties, if ? > 1 then Ob(X) Ob(X'). However, it does not completely mimic the tail index of regularly varying distributions, or the extreme value index. A Weibull distribution with shape 1/4 is more obese than a Pareto distribution with tail index 1, even though this Pareto has infinite mean and the Weibull’s moments are all finite. Chapter 5 explores properties of the Obesity index. ppThird and most important, we hope to convince the reader that fat tail phenomena pose real problems; they are really out there and they seriously challenge our usual ways of thinking about historical averages, outliers, trends, regression coefficients and confidence bounds among many other things. Data on flood insurance claims, crop loss claims, hospital discharge bills, precipitation and damages and fatalities from natural catastrophes drive this point home. While most fat tailed distributions are "bad", research in fat tails is one distribution whose tail will hopefully get fatter.

"A reader's first impression on leafing through this book is of the large number of graphs and diagrams, used to illustrate shapes of distributions...and to show real data examples in various ways. A closer reading reveals a nice mix of theory and applications, with the copious graphical illustrations alluded to. Such a mixture is of course dear to the heart of the applied probabilist/statistician, and should impress even the most ardent theorists." – MATHEMATICAL REVIEWS

This book uses the EM (expectation maximization) algorithm to simultaneously estimate the missing data and unknown parameter(s) associated with a data set. The parameters describe the component distributions of the mixture; the distributions may be continuous or discrete. The editors provide a complete account of the applications, mathematical structure and statistical analysis of finite mixture distributions along with MCMC computational methods, together with a range of detailed discussions covering the applications of the methods and features chapters from the leading experts on the subject. The applications are drawn from scientific discipline, including biostatistics, computer science, ecology and finance. This area of statistics is important to a range of disciplines, and its methodology attracts interest from researchers in the fields in which it can be applied. This textbook highlights the many practical uses of stable distributions, exploring the theory, numerical algorithms, and statistical methods used to work with stable laws. Because of the author’s accessible and comprehensive approach, readers will be able to understand and use these methods. Both mathematicians and non-mathematicians will find this a valuable resource for more accurately modelling and predicting large values in a number of real-world scenarios. Beginning with an introductory chapter that explains key ideas about stable laws, readers will be prepared for the more advanced topics that appear later. The following chapters present the theory of stable distributions, a wide range of applications, and statistical methods, with the final chapters focusing on regression, signal processing, and related distributions. Each chapter ends with a number of carefully chosen exercises. Links to free software are included as well, where readers can put these methods into practice. Univariate Stable Distributions is ideal for advanced undergraduate or graduate students in mathematics, as well as many other fields, such as statistics, economics, engineering, physics, and more. It will also appeal to researchers in probability theory who seek an authoritative reference on stable distributions.

Chapter "Heavy-tailed Kernels Reveal a Finer Cluster Structure in t-SNE Visualisations" is available open access under a Creative Commons Attribution 4.0 International License via link.springer.com. This book constitutes the refereed proceedings of the 11th International Conference on Modelling Tools and Techniques for Computer Communication System Performance Evaluation, TOOLS 2000, held in Schaumburg, IL, USA in March 2000. The 21 revised full papers presented were carefully reviewed and selected from a total of 49 submissions. Also included are 15 tool descriptions and one invited paper. The papers are organized in topical sections on queueing network models, optimization in mobile networks, stochastic Petri nets, simulation, formal methods and performance evaluation, and measurement tools and
Extreme value theory (EVT) deals with extreme (rare) events, which are sometimes reported as outliers. Certain textbooks encourage readers to remove outliers—in other words, to correct reality if it does not fit the model. Recognizing that any model is only an approximation of reality, statisticians are eager to extract information about unknown distribution making as few assumptions as possible. Extreme Value Methods with Applications to Finance concentrates on modern topics in EVT, such as processes of exceedances, compound Poisson approximation, Poisson cluster approximation, and nonparametric estimation methods. These topics have not been fully focused on in other books on extremes. In addition, the book covers: Extremes in samples of random size Methods of estimating extreme quantiles and tail probabilities Self-normalized sums of random variables Measures of market risk Along with examples from finance and insurance to illustrate the methods, Extreme Value Methods with Applications to Finance includes over 200 exercises, making it useful as a reference book, self-study tool, or comprehensive course text. A systematic background to a rapidly growing branch of modern Probability and Statistics: extreme value theory for stationary sequences of random variables.

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