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**Modern Statistical Methods
for Astronomy**

With R Applications

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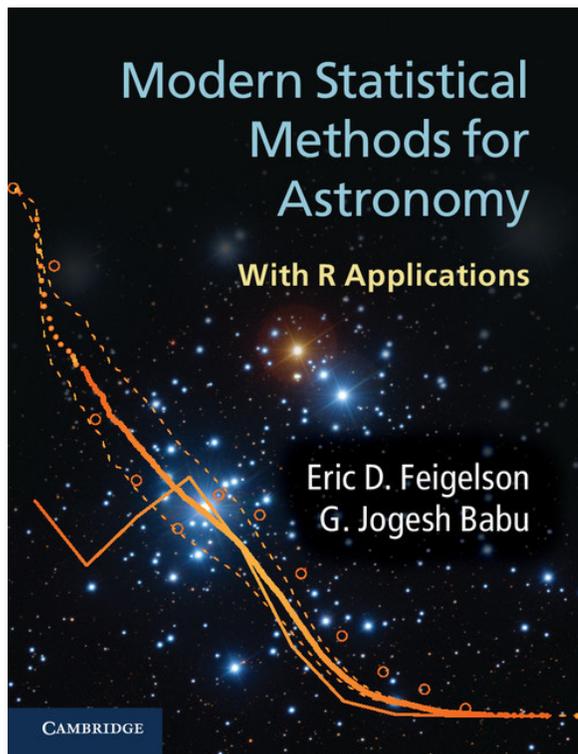
About the Book

Modern astronomical research is beset with a vast range of statistical challenges, ranging from reducing data from megadatasets to characterizing an amazing variety of variable celestial objects or testing astrophysical theory. Yet most astronomers still use a narrow suite of traditional statistical methods. Linking astronomy to the world of modern statistics, this volume is a unique resource, introducing astronomers to advanced statistics through ready-to-use code in the public domain R statistical software environment. The book presents fundamental results of probability theory and statistical inference, before exploring several fields of applied statistics, such as data smoothing, regression, multivariate analysis and classification, treatment of nondetections, time series analysis and spatial point processes. It applies the methods discussed to contemporary astronomical research datasets using the R statistical software, making it invaluable for graduate students and researchers facing complex data analysis tasks.

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"..covers in a single volume both the basic statistical material and more specialized material that is essential for modern astronomers. "The astronomical context" sections, which provide motivation for the ensuing statistical development, are particularly valuable... The discipline of astrostatistics is experiencing a dramatic blossoming, and this book will provide the necessary vehicle for the new generation of astronomers."

– **David Hand, Professor of Statistics, Imperial College London**

"While many astrophysicists have deep training in statistical theory and great practical abilities, others have no or only elementary training in these areas, propagate old mistakes, and carry out sub-optimal data analysis. Modern Statistical Methods for Astronomy addresses this problem and will likely make a significant contribution. And just in time!...Serious readers of this text will be well-equipped to learn the most advanced techniques on their own."

– **Jeffrey D. Scargle, Space Science and Astrobiology Division, NASA Ames Research Center**

Contents

1. Introduction; 2. Probability; 3. Statistical inference; 4. Probability distribution functions; 5. Nonparametric statistics; 6. Density estimation or data smoothing; 7. Regression; 8. Multivariate analysis; 9. Clustering, classification and data mining; 10. Nondetections: censored and truncated data; 11. Time series analysis; 12. Spatial point processes; Appendices; Index.

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