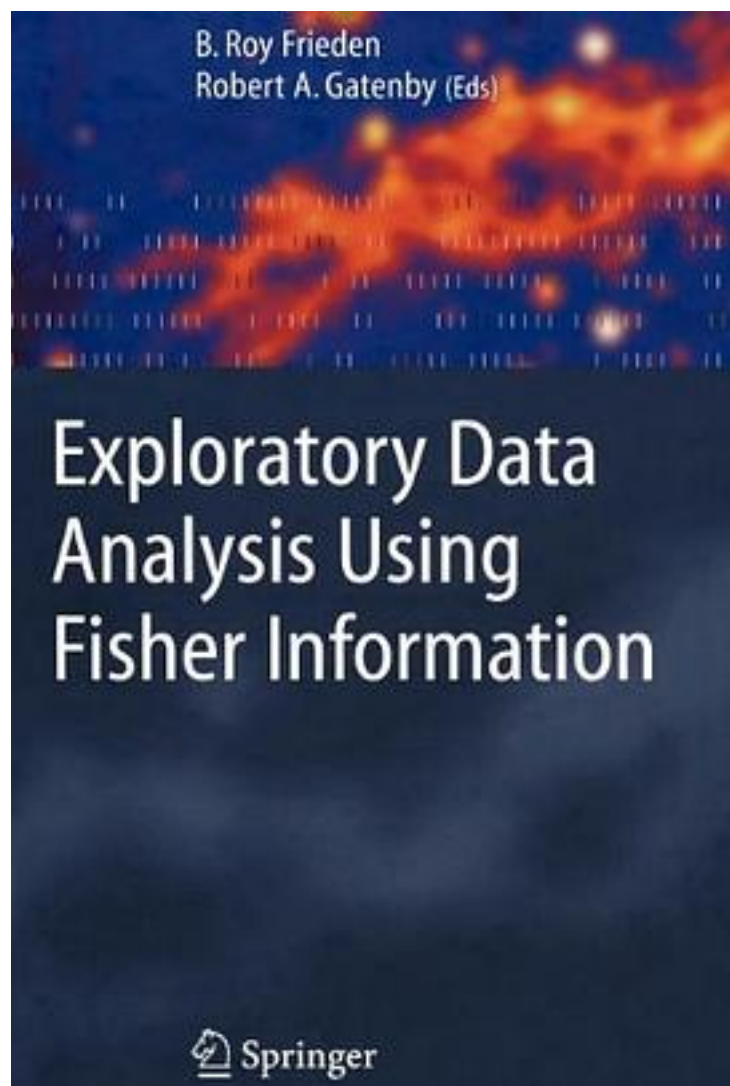


Exploratory Data Analysis Using Fisher Information



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The basic goal of a research scientist is to understand a given, unknown system. This innovative book develops a systematic approach for achieving this goal. All science is ultimately dependent upon observation which, in turn, requires a flow of information. Fisher information, in particular, is found to provide the key to understanding the system. It is developed as a new tool of exploratory data analysis, and is applied to a wide scope of systems problems. These range from molecules in a gas to biological organisms in their ecologies, to the socio-economic organization of people in their societies, to the physical constants in the universe and, ultimately, to proto-universes in the multiverse. Examples of system input-output laws discovered by the approach include the famous quarter-power laws of biology and the Tobin q-theory of optimized economic investment. System likelihood laws that can be determined include the probability density functions defining in situ cancer growth and a wide class of systems (thermodynamic, economic, cryptographic) obeying Schrodinger-like equations. Novel uncertainty principles in the fields of biology and economics are also found to hold. B. Roy Frieden and Robert A. Gatenby are professors at the University of Arizona. Frieden is in the College of Optics, and Gatenby is Chairman of the Radiology Dept. at the Arizona Health Sciences Center. Frieden has pioneered the use of information for developing image restoration approaches, and for understanding the physics of unknown systems, both nonliving and living. Gatenby has actively promoted the study of information as a determinant of healthy and malignant growth processes, and has developed integrated mathematical models and empirical techniques for this purpose.

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