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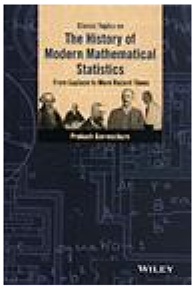
Classic Topics on The History of Modern Mathematical Statistics: From Laplace to More Recent Times



Prakash Gorroochurn

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[Reviewed by Joel Haack, on 08/8/2016]

Prakash Gorroochurn's *Classic Topics on The History of Modern Mathematical Statistics: From Laplace to More Recent Times* is a valuable resource for researchers and instructors with an interest in the history of statistics. It will not replace Stigler's *The History of Statistics: The Measurement of Uncertainty before 1900*, nor is it meant to. Instead, Gorroochurn has focused on details of the mathematical results that are important for statistics. He has continued the story through Fisher and Neyman-Pearson to the revival and re-formation of Bayesian statistics up to 1960. This book also covers topics that are frequently discussed in core liberal arts courses to introduce statistical methods, such as confidence intervals and hypothesis testing, which were outside the purview of Stigler's book. It is *not* easy reading, but having Gorroochurn at hand when reading the original articles he discusses will make the originals far more accessible.

The first part of the book is devoted to the work of Pierre-Simon de Laplace in mathematical statistics. Topics include Laplace's definition of probability and his considerations of inverse probability, characteristic functions, the method of least squares, and his proofs of the Central Limit Theorem. The detailed calculations often include asymptotic approximations. Gorroochurn also provides quotations that exhibit Laplace's philosophy of universal determinism underlying Laplace's interpretations of the problems he poses and solves. Other topics here include Bayes' Theorem, a definition of conditional probability, generating functions, the principle of indifference, the integration of e^{-x^2}, Stirling's formula, and the need for a table of normal probabilities. In line with Gorroochurn's decision to focus on mathematical statistics, extensive discussions of Laplace's papers on the application of statistics to geodesy and astronomy are omitted. Of course, a discussion of Laplace's results would be incomplete without some consideration of other mathematicians of the time, so Gorroochurn also mentions the contributions of De Moivre, Gauss, Fourier, Lyapunov, Legendre, and Adrain.

The second part of the book carries the story from Galton to Fisher, tracking the beginnings of regression and correlation, Karl Pearson's development of the chi-Squared test for goodness of fit, and Student's t-distribution before introducing R. A. Fisher. Among Fisher's contributions were the development of estimation theory, including such now common notions as sample statistics and population parameters, estimators, and maximum likelihood. He also introduced properties of statistics such as consistency, efficiency, and sufficiency and both the term and the notion of “variance.” In significance testing, we see the common procedure of testing a null hypothesis, finding the value of a test statistic, computing its p-value, and comparing this with a predetermined level of significance — Fisher says that “we shall not often be astray if we draw a conventional line at .05” (p. 431). We also see his development of ANOVA.

The second part continues with the contributions of Jerzy Neyman and Egon Pearson. Here, for example, we find the development of the topic of interval estimation (confidence intervals). In hypothesis testing, Neyman-Pearson also introduced the concept of an alternative hypothesis, defined Type I and Type II errors, and discussed the power of a test. The second part concludes by circling back to look at forerunners of Fisher in the topics of maximum likelihood, including the contributions of Lambert, Lagrange, Daniel Bernoulli, Adrain,and Edgeworth, and of significance testing, including Arbuthont, Nicholas Bernoulli, Daniel Bernoulli, ‘sGravesande, d’Alembert, Todhunter, Michell, Herschel, Forbes, Laplace, Edgeworth, Karl Pearson, and Student (Gosset).

The third part of Gorroochurn’s book concerns developments in mathematical statistics after Fisher and Pearson-Neyman. The table of contents provides a good guide toward the results in this part, each of which is traced through its development in the works of a number of statisticians. I will mention just two of the intriguing topics in this part. I found Wald’s development of the idea that a statistical decision can be viewed as a two-person zero-sum game between nature and the experimenter to be provocative. Within the section on the Bayesian revival, I was glad to be introduced to Ramsey’s work laying the foundations of a subjective theory of probability.

Many of the statisticians involved in the history were a bit prickly, and some far more than a bit! Gorroochurn includes discussions of the feuds between Gauss and Legendre, K. Pearson and Yule, Fisher and K. Pearson, Fisher and Neyman and E. Pearson, Fisher and Jeffreys, and Fisher and many others.

Throughout the book, Gorroochurn provides brief biographical details and portraits or photographs of the statisticians discussed; his references to more complete biographical information make it convenient to dig further into their lives if one wishes to do so.

There are a number of minor errors, but it wasn’t difficult to correct the ones I found.

This book is likely to be of most interest to those with an exposure to statistics at the level of a masters or doctoral degree. Certainly those teaching introductory statistics courses will be pleased to see how the topics they teach were developed. My having read this book will certainly enrich my own teaching.

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