
Preface

The publication in 1979 of Bradley Efron's first article on bootstrap methods was a major event in Statistics, at once synthesizing some of the earlier resampling ideas and establishing a new framework for simulation-based statistical analysis. The idea of replacing complicated and often inaccurate approximations to biases, variances, and other measures of uncertainty by computer simulations caught the imagination of both theoretical researchers and users of statistical methods. Theoreticians sharpened their pencils and set about establishing mathematical conditions under which the idea could work. Once they had overcome their initial skepticism, applied workers sat down at their terminals and began to amass empirical evidence that the bootstrap often did work better than traditional methods. The early trickle of papers quickly became a torrent, with new additions to the literature appearing every month, and it was hard to see when would be a good moment to try to chart the waters. Then the organizers of COMPSTAT '92 invited us to present a course on the topic, and shortly afterwards we began to write this book.

We decided to try to write a balanced account of resampling methods, to include basic aspects of the theory which underpinned the methods, and to show as many applications as we could in order to illustrate the full potential of the methods — warts and all. We quickly realized that in order for us and others to understand and use the bootstrap, we would need suitable software, and producing it led us further towards a practically oriented treatment. Our view was cemented by two further developments: the appearance of two excellent books, one by Peter Hall on the asymptotic theory and the other on basic methods by Bradley Efron and Robert Tibshirani; and the chance to give further courses that included practicals. Our experience has been that hands-on computing is essential in coming to grips with resampling ideas, so we have included practicals in this book, as well as more theoretical problems.

As the book expanded, we realized that a fully comprehensive treatment was beyond us, and that certain topics could be given only a cursory treatment because too little is known about them. So it is that the reader will find only brief accounts of bootstrap methods for hierarchical data, missing data problems, model selection, robust estimation, nonparametric regression, and complex data. But we do try to point the more ambitious reader in the right direction.

No project of this size is produced in a vacuum. The majority of work on the book was completed while we were at the University of Oxford, and we are very grateful to colleagues and students there, who have helped shape our work in various ways. The experience of trying to teach these methods in Oxford and elsewhere — at the Université de Toulouse I, Université de Neuchâtel, Università degli Studi di Padova, Queensland University of Technology, Universidade de São Paulo, and University of Umeå — has been vital, and we are grateful to participants in these courses for prompting us to think more deeply about the

material. Readers will be grateful to these people also, for unwittingly debugging some of the problems and practicals. We are also grateful to the organizers of COMPSTAT '92 and CLAPEM V for inviting us to give short courses on our work.

While writing this book we have asked many people for access to data, copies of their programs, papers or reprints; some have then been rewarded by our bombarding them with questions, to which the answers have invariably been courteous and informative. We cannot name all those who have helped in this way, but D. R. Brillinger, P. Hall, M. P. Jones, B. D. Ripley, H. O'R. Sternberg and G. A. Young have been especially generous. S. Hutchinson and B. D. Ripley have helped considerably with computing matters.

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We are particularly indebted to two people. V. Ventura read large portions of the book, and helped with various aspects of the computation. A. J. Canty has turned our version of the bootstrap library functions into reliable working code, checked the book for mistakes, and has made numerous suggestions that have improved it enormously. Both of them have contributed greatly — though of course we take responsibility for any errors that remain in the book. We hope that readers will tell us about them, and we will do our best to correct any future versions of the book; see its WWW page, at URL

<http://statwww.epfl.ch/davison/BMA/>

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