SpringerBriefs in Statistics

More information about this series at http://www.springer.com/series/8921

Basilio de Bragança Pereira
Carlos Alberto de Bragança Pereira

Model Choice in Nonnested Families

Springer

Basilio de Bragança Pereira
COPPE
Federal University of Rio de Janeiro
Rio de Janeiro
Brazil

Carlos Alberto de Bragança Pereira
Department of Statistics
University of São Paulo
São Paulo
Brazil

ISSN 2191-544X
SpringerBriefs in Statistics
ISBN 978-3-662-53735-0
DOI 10.1007/978-3-662-53736-7

ISSN 2191-5458 (electronic)
ISBN 978-3-662-53736-7 (eBook)

Library of Congress Control Number: 2016961264

© The Author(s) 2016
This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.
The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.
The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made.

Printed on acid-free paper

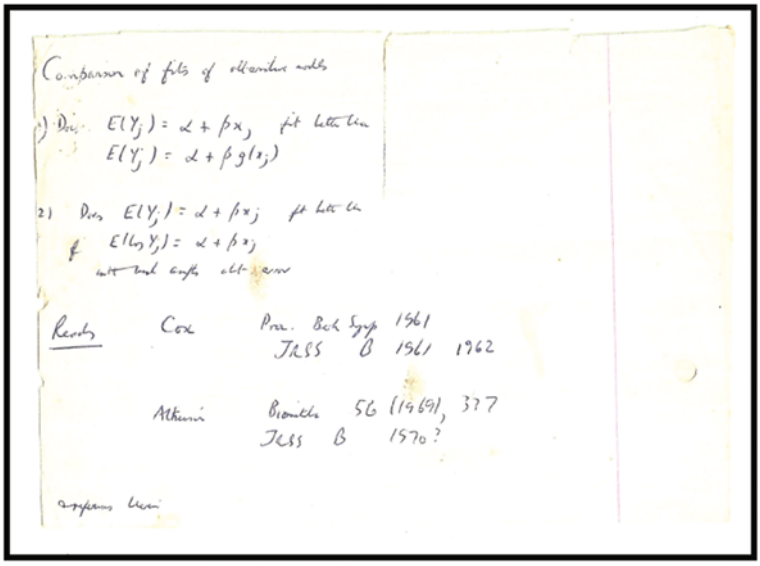
This Springer imprint is published by Springer Nature
The registered company is Springer-Verlag GmbH Germany
The registered company address is: Heidelberger Platz 3, 14197 Berlin, Germany

To Sir David Cox

Preface

Model choice is a subject that involves artistic and individual components that depend on the area of application, the amount of knowledge on the available models, and one's sense of aesthetics.

The first author's interest in model choice began in the summer of 1973: after a year of attending lectures at Imperial College, he made an appointment with his supervisor to decide his thesis topic. They summarized the meeting in the notes shown below. Although he did not pursue exactly the applications discussed at that time, he developed other results and applications concerning separate or nonnested model choice.



The beginning

Being a Bayesian, the second author began to be interested in the choice of models when solving a problem related to pollution in an industrial city in Brazil. He applied Bayesian significance tests to the mixture of models proposed by Cox instead of hypothesis tests and discrimination using Bayes factors.

Both authors have been following the advances in the subject, and this book is the result of their attempts to do so.

The authors are grateful to the writers and researchers on the subject from whom they have benefited and whom they have followed while writing this work, especially Mohammed Hashem Pesaran, and to Annibal P. SantAnna and Marlos Augusto G. Viana, who offered many suggestions for and corrections of the manuscript. The authors are also thankful for the many important contributions of Maria Ivanilde S. Araujo, Edilson F. de Arruda, Cachimo C. Assane, Rodrigo A. Collazo, Marcelo Lauretto, Brian A.R. de Melo, Fernando Poliano, and Julio Stern. They also thank Marcelo Fragoso and Augusto C.G. Vieira for the opportunity to complete their writing at Laboratório Nacional de Computação Científica–LNCC in Petrópolis, Brazil. Evelyn Best and Veronika Rosteck of Springer have been supportive and patient editors.

Petrópolis, Brazil
February 2016

Basilio de Bragança Pereira
Carlos Alberto de Bragança Pereira

Contents

1 Preliminaries 1
1.1 Model Choice 1
1.2 Types of Problems 2
1.3 General Formulation 4
1.4 Plan of the Book 7
1.5 Bibliographic Notes 8
References 8

2 Frequentist Methods 11
2.1 Introduction 11
2.2 The Cox Test 11
2.2.1 Preliminaries 11
2.2.2 Remarks on the Distribution of T_{fg} 13
2.2.3 The Test Procedure 14
2.3 A Test Based on a Compound Model 21
2.4 Alternative Tests 26
2.4.1 Test for Multiple Hypotheses 26
2.4.2 Test Based on Nondirectional Divergence 29
2.4.3 Test of the Nearest Alternative 32
2.4.4 Test Based on the Moment Generating Function 32
2.4.5 Two Further Tests 34
2.5 Efficiencies of False Separate Models 36
2.5.1 Introduction 36
2.5.2 Efficiency of a false regression model 36
2.6 Properties and Comparisons 40
2.6.1 Asymptotic Power 40
2.6.2 Monte Carlo Comparison and Behavior 41
2.6.3 Test Consistency and Finite-Sample Results 44
2.7 Bibliographic Notes 47
References 47

3 Bayesian Methods 51
3.1 Introduction 51
3.2 Modified Bayes Factors 57
3.2.1 Imaginary Training Sample 57
3.2.2 Partial Bayes Factor (PBF) 57
3.2.3 Fractional Bayes Factor (FBF) 58
3.2.4 Intrinsic Bayes Factor (IBF) 58
3.2.5 Posterior Bayes Factor (POBF) 59
3.2.6 Applications 59
3.3 Full Bayesian Significance Test (FBST) 67
3.4 Bibliographic Notes 69
References 71

4 Support and Simulation Methods 73
4.1 Introduction 73
4.2 Likelihood Inference 73
4.3 Simulations and Bootstrap 77
4.3.1 Simulations 77
4.3.2 Bootstrap 78
4.3.3 Applications 78
4.4 Bibliographic Notes 85
References 85

Appendix A: Maximum Likelihood Estimation (MLE) 87

Index 93