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EDITORIAL

Advances in Statistical Inference: Bayesian and likelihood interplay

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This volume has been inspired by the aim of gathering a number of theoretical papers that, though from different schools of inference—frequentist and Bayesian, share the same interest towards studying complex statistical models. Indeed, both frequentist and Bayesian inference can entail various drawbacks, due to the complexity or misspecification of the model, or to the presence of many nuisance parameters. These difficulties may be overcome from a theoretical point of view through approximate likelihoods and scoring rules, and from a computational point of view through higher-order asymptotic expansions or computational tools from Bayesian inference. Specifically, the volume focuses on the interplay between Bayesian and frequentist inference in addressing these problems. The goal is to highlight and to disseminate some of the topics emerged in the international Workshop *Recent advances in Statistical Inference: Theory and case studies*, held in Padova, Italy, March 21–23, 2013. The Workshop has been a forum for the exchange of new ideas and thoughts on recent and ongoing research in both Bayesian methodology and modern likelihood inference. Although the topics covered in this volume are diverse, similar themes recur, as research is mostly fueled by the need to deal with complex models, for which traditional methods do not provide viable solutions. Among the topics presented we have Bayesian/frequentist challenges for categorical data analysis, Bayesian-frequentist sample size determination, integrated likelihood inference in semi parametric regression models, approximate Bayesian computation with modified log-likelihood ratios, theory and applications of proper scoring rules, quasi likelihood approximation of posterior distributions for likelihood-intractable complex models, mitigating multicollinearity with spike-and-slab priors, empirical Bayes methods in classical and Bayesian inference. While not exhaustive, this list should give a feeling of the issues discussed at the Workshop.

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The relationships between Bayesian and likelihood methods have a long history. An important occasion for the merging of ideas from the two inferential approaches has been represented by the series of *Workshop on Objective Bayesian Methodology*, started in 1996 and held, since then, in the USA, Europe and, more recently, in Asia. The seminal workshop was organized by Jim Berger and held in Purdue University. The title of that conference was *International Meeting on Default Bayesian Methodology*. Just one year before, in June 1995, more or less the same researchers met (always in Purdue) for the *Workshop on Intrinsic Bayes factors*: those were the years of strong development in the area of objective model selection. The 1996 Workshop widened the scope of the previous meeting by extending the focus on the whole objective Bayesian approach to inference and by establishing a further bridge with likelihood theory. It was at the end of that meeting that partecipants chose the terminology *Objective Bayesian methodology* for that specific area of research. Of course, it was not the beginning of default Bayesian inference and not even the start of a collaboration between Bayes and likelihood researchers but, in a way, it was the beginning of a sort of awareness of a specificity. After the Purdue conference, the following meetings took place in Valencia (Spain, 1999), Ixtapa (Mexico, 2000), Granada (Spain, 2002), Assois (France, 2003), Branson (USA, 2005), Rome (Italy, 2007), Philadelphia (USA, 2009), Shangai (China, 2011) and Raley (USA, 2013). In addition, we must mention also several initiatives organized by Walter Racugno and collegues at the University of Cagliari, such as the *Workshop on Model Selection* in 1997. During the last years the University of Cagliari has given a great contribution in consolitading the bridge between alternative approaches to statistical inference. We are very glad to point out that a large part of the people that were at that meetings in Purdue in 1995 and 1996 (and at the other conferences mentioned above) have attended the Padua meeting in 2013 and contributed to the Metron's Special Issue either as authors or referees.

In the same years, international conferences on approximate likelihood functions, likelihood and Bayesian asymptotics and estimating equations were organized in Brixen (1995), Ascona (2001) and Warwick (2008). And, from the Italian side, the collaboration between researchers in likelihood methods and Bayesian statistics have determined a series of joint national scientific projects (from 1996 to 2008), called PRIN and founded by the Italian Ministry of the University. Among the reserachers who contributed to this area of research we must mention statisticians from the Universities of Cagliari, Milano, Padova, Udine and from Sapienza University of Rome. All the Objective Bayes meetings, the Modern Likelihood Conferences and, in Italy, the PRIN scientific projects have had the merit of bringing together people from the Bayesian and the likelihood worlds: this merging of ideas have undeniably contributed to advances in statistical inference, as the Padua's Workshop and, we hope, this Special Issue witness.

At this point we would like to thank all the authors that have contributed to this volume: only their enthusiasm and kindness made it possible the realization of this Special Issue of *Metron*. Warm thanks go also to the reviewers of the articles, who provided the authors with valuable comments and suggestions. We are also very grateful to Walter Racugno, for several suggestions and for having discussed with us the project that has produced the present volume. Special thanks go to Giovanni Maria Giorgi, Editor-in-Chief of *Metron*, who has invited us to act as Guest Editors and supported us. Last but not the least, we thank the Editorial Board and the Staff of the journal for giving us the chance of putting together this contribution.