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Announcement

We are happy to bring out this special issue on Applications of Concentration Inequalities and Empirical Processes to Modern Statistics that we announced earlier.

We are also delighted to announce that to celebrate the one hundred and twenty-fifth birth anniversary of Professor P. C. Mahalanobis (PCM), the founder of Indian Statistical Institute and the founder Editor of *Sankhyā*, *Sankhyā* will bring out two special issues in 2018, one for each series, in addition to the regular issues. Moreover, the entire 80th volume, to be published in 2018, would be dedicated to PCM as part of the celebration of his one hundred and twenty-fifth birth anniversary.

It is expected that the special issues will focus on PCM's work and beyond, which will highlight his contributions and their influence in modern Statistics, in theory or in different fields of application, including original contributions on topics of contemporary interest.

August 25, 2017

SANGHAMITRA BANDYOPADHYAY
DIRECTOR
INDIAN STATISTICAL INSTITUTE

FOREWORD

In 2015, Professor Moulinath Banerjee, a member of the Editorial Board of Sankhyā, Series A, was invited by Professors B.L.S. Prakasa Rao and Alok Goswami, Editors of the previous Editorial Board, to edit a special issue of Sankhyā, Series A, on the topic: Applications of Concentration Inequalities and Empirical Processes to Modern Statistics. He enthusiastically agreed to the invitation. After the new editorial board was formed and we contacted him in August 2016, we learnt that due to certain unavoidable delays, it would take another year to bring out the issue. His relentless efforts and dedication to complete the issue in the promised time have been unparalleled. We wholeheartedly thank Professor Moulinath Banerjee, the authors and discussants of the discussion paper, and the authors of the invited papers who accepted his invitations, as well as the reviewers for agreeing readily to help in this regard. We hope that the readers of Sankhyā will find this issue interesting and useful.

EDITORS

PREFACE

The development of theoretical statistics over the last few decades has been increasingly driven by powerful tools and techniques from modern empirical process theory and related measure-concentration inequalities. Classical empirical process theory may be said to have started by mid 20'th century with the seminal Glivenko-Cantelli (1933) and Donsker (1951) theorems that provided for the first time quantitative insights into the long run behavior of the empirical process, and were quickly followed up by a number of landmark results, including the Dvoretzky-Kiefer-Wolfowitz inequality (1956) and the celebrated Komlós-Major-Tusnády (1975) embedding theorem. The modern theory of empirical processes which generalized results from Euclidean sample spaces to more general spaces arose largely through the work of Vapnik and Chervonenkis who developed the 'VC-theory of sets' and applied it to establish generalizations of the classical Glivenko-Cantelli theorem. Dudley (1978) used the VC theory to prove generalizations of the classical Donsker theorem for the empirical process indexed by VC classes of sets. Pollard and Koltchinskii generalized Dudley's uniform central limit theorems to classes of functions satisfying conditions closely connected to VC classes of sets, while Giné and Zinn (1984) clarified connections between empirical processes, the theory of Gaussian processes, and central limit theorems for sums of independent random variables in Banach spaces. The closely related area of concentration inequalities, which deals with bounding the probability that a complicated function of independent random variables, for example the supremum of an empirical process, deviates from its expectation (or some other measure of central tendency) by more than a specified threshold, developed rapidly via the use of martingale based methods in the seventies, and then in the nineties with seminal contributions by Talagrand, Ledoux, and Massart, and others.

The crucial role of empirical process theory and concentration inequalities in establishing properties of modern statistical methods (including methods of nonparametric and semiparametric inference, non-smooth statistical problems, nonparametric Bayesian inference) and proving rigorous results in machine learning and the rapidly growing area of high-dimensional statistics is by now, palpable, to say the least. A number of texts, e.g. Shorack and Wellner (1986), van der Vaart and Wellner (1996), Dudley (1999), and more recently, Boucheron, Lugosi and Massart (2013) have recorded, discussed and provided new perspectives on these topics and proved to be enormously useful to practitioners in these fields.

It is therefore a great pleasure to present this special Sankhyā issue on 'Applications of Concentration Inequalities and Empirical Processes to Modern Statistics' which show-cases six papers (including a discussion paper) by

stalwarts in these areas as well as strong emerging researchers. I would like to firstly thank Prof. B.L.S.P. Rao for giving me the opportunity to edit this volume when he was Editor-in-Chief of Sankhyā. Thanks are also due to Prof. Alok Goswami, who along with Prof. Rao provided many important inputs and suggestions. I am no less grateful to current Editor-in-Chief Prof. Dipak Dey and current Sankhyā A editor Prof. Gopal Basak who helped the process evolve seamlessly across the editorial transition and continued to interact actively with many valuable suggestions. Last but not least, heartfelt thanks are due to the authors of the papers in this special volume who agreed most readily to contribute, to the discussants of the discussion paper for their valuable time, and to the publication personnel at Springer for their co-operation and timely reminders.

I hope that the volume will convey the excitement and dynamism of this topical area to the readers of Sankhyā.

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