Lecture Notes in Statistics

Proceedings

Volume 205

For further volumes:
http://www.springer.com/series/8440

Andrew D. Barbour · Hock Peng Chan
David Siegmund
Editors

Probability Approximations and Beyond

Springer

Andrew D. Barbour
Institut für Mathematik
Universität Zürich
Winterthurerstr. 190
8057 Zürich, Switzerland
e-mail: A.D.Barbour@math.uzh.ch

Hock Peng Chan
Department of Statistics
and Applied Probability
National University of Singapore
Singapore 119260
Republic of Singapore
e-mail: stachp@nus.edu.sg

David Siegmund
Department of Statistics
Stanford University
Serra Mall 390, Sequoia Hall
94305 Stanford
CA, USA
e-mail: dos@stat.stanford.edu

ISSN 0930-0325
ISBN 978-1-4614-1965-5 e-ISBN 978-1-4614-1966-2
DOI 10.1007/978-1-4614-1966-2
Springer New York Dordrecht Heidelberg London

Library of Congress Control Number: 2011941623

Preface

Louis Chen: A Celebration

On 25 and 26 June 2010, a conference, Probability Approximations and Beyond, was held at the National University of Singapore (NUS) to honor Louis Chen on his 70th birthday. Professor Chen is the Tan Chin Tuan Centennial Professor and Professor in both the Department of Mathematics and the Department of Statistics and Applied Probability. He is also the founding Director of the Institute for Mathematical Sciences at the NUS.

Growing up as one of five brothers and a sister during WorldWar II and the immediate postwar period, Louis developed his life-long interests in mathematics and music. He graduated from the University of Singapore[1] in 1964; and after teaching briefly in Singapore, he began graduate studies in the United States. He earned a Master's and a Ph.D. in Statistics at Stanford University, where he wrote his Ph.D. thesis under the supervision of Professor Charles Stein. During his time at Stanford, Louis met his future wife, Annabelle, who was then a summer school student at Stanford.

During his Ph.D. studies, Louis made the first of several seminal contributions to the theory and application of Stein's method. This appeared in his famous 1975 paper on Poisson approximation for dependent trials, and laid the foundation for what is now known simply as the Stein–Chen method. The Poisson approximation, sometimes called the "law of small numbers," has been known for nearly two centuries, and is taught in introductory probability courses as the limiting approximation for the distribution of the number of occurrences of independent, rare events. Louis showed that independence is not a necessary prerequisite for the law to hold, and proved, by a simple and elegant argument, that the error in the approximation can be explicitly bounded (and shown to be small) in an amazingly large number of problems involving dependent events. This approximation has

[1] NUS was formed through the merger of the University of Singapore and Nanyang University in 1980.

found widespread application, in particular in the field of molecular sequence comparison.

For much of his research career, Louis has been fascinated by a circle of ideas centered on probability inequalities and the central limit theorem. Apart from his work on Poisson and compound Poisson approximation, he has written a number of papers exploring the relationships between Stein's method and Poincaré inequalities; he has established martingale inequalities that, in particular, sharpen Burkholder's inequalities; and he has returned again and again to the central limit theorem. One of his most important contributions here has been to turn Stein's concentration inequality idea into an effective tool for providing error bounds for the normal approximation in many settings, and in particular for sums of random variables exhibiting only local dependence. He has recently co-authored a book, 'Normal approximation by Stein's method', that promises to be the definitive text on the subject for years to come.

After his graduate studies, Louis spent almost a year as Visiting Assistant Professor at Simon Fraser University in Canada, before returning to Singapore in 1972. Since then, he has been engaged in teaching and research at NUS, apart from short visiting appointments in France, Sweden and the United States. Annabelle worked for many years for IBM, and together they raised two daughters, Carmela and Jacinta. In addition to research and teaching, Louis has played a leading role in the transition of NUS from a largely teaching institution to a leading research university. Louis has served as Chair of Mathematics, helped to found the Department of Statistics and Applied Probability, where he was also Chair, and since 2000 has been the director of the Institute for Mathematical Sciences (IMS). Under Louis's leadership, the IMS has developed short programs to bring international groups of mathematicians and related scientists to Singapore, to discuss recent research and to work with the local mathematical community on problems of common interest, both theoretical and applied. It has also pursued outreach programs and organized public lectures to stimulate interest in mathematics and science among Singapore students at the high school/junior college level.

Louis's professional service has not been confined to NUS. He has also served as President of the Bernoulli Society (1997–1999), of the Institute of Mathematical Statistics (2004–2005), and as Vice President of the International Statistical Institute (2009–2011). He has also served on numerous committees of these and other international organizations.

Along with this extraordinary level of administrative activity, Louis has continued a very active program of research, infecting students and colleagues alike with his enthusiasm for probability and its applications. As well as exploring new directions in probability theory, he has developed a recent interest in applications of his work on Poisson approximation to problems of signal detection in computational biology. Several of the papers in this volume provide ample evidence that these subjects continue to provide exciting theoretical developments and scientific applications.

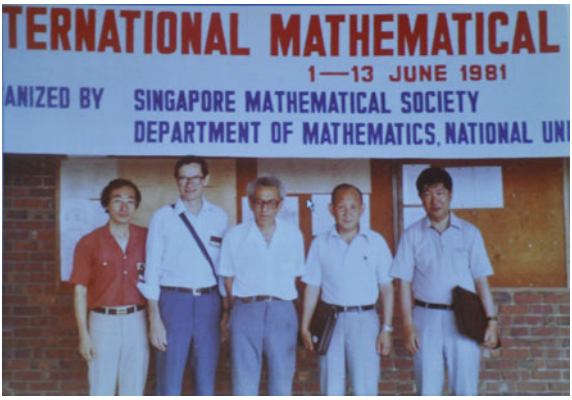
In summary, Louis Chen's professional life has combined outstanding scholarship with exemplary service, to strengthen scientific institutions in Singapore and internationally, and to provide more and better opportunities for all mathematical scientists. This volume is only a small expression of the many contributions he has made to students and colleagues. We hope to see him continuing to participate in mathematical research and enjoying music for many years to come.

Andrew D. Barbour
Hock Peng Chan
David Siegmund

Conference participants at the University Hall

A candid shot of Louis captured during the conference

Chatting with friends during the conference dinner



A younger Louis

晓露天初曙，
云高万里晴！

Poem composed by Lou Jiann-Hua and presented to Louis during the conference dinner, on behalf of the Department of Mathematics. The poem meant that the first dew appearing early in the morning, clouds are high and it is sunny for ten thousand miles. Key in this poem is that the first word in each line forms Louis' Chinese given name

人生七十载，
学海五十年。
探赜获骊珠，
致远登丹墀。
晓云荡环宇，
鲲鹏翱九天。
一臻如如境，
乾坤亦等闲。

Poem composed by Chen Zehua and presented to Louis during the conference dinner, on behalf of the Department of Statistics and Applied Probability

Contents

Contributors

Andrew D. Barbour Universität Zürich, Zurich, Switzerland, e-mail: a.d.barbour@math.uzh.ch

Mu-Fa Chen Beijing Normal University, Beijing, China, e-mail: mfchen@bnu.edu.cn

Yanchu Chen Hong Kong University of Science and Technology, Hong Kong, China, e-mail: cyxab@ust.hk

Goedele Dierckx Hogeschool-Universiteit Brussel and Katholieke Universiteit Leuven, Brussel, Leuven, Belgium, e-mail: Goedele.Dierckx@hubrussel.be

Larry Goldstein University of Southern California, California, CA, USA, e-mail: larry@math.usc.edu

Takeyuki Hida Nagoya University and Meijo University, Nagoya, Japan, e-mail: takeyuki@math.nagoya-u.ac.jp

Guo-Lie Lan Guangzhou University, Guangzhou, China, e-mail: langl@gzhu.edu.cn

Zheng-yan Lin Zhejiang University, Hangzhou, China, e-mail: zlin@zju.edu.cn

Weidong Liu Shanghai Jiao Tong University, Shanghai, China, e-mail: liuweidong99@gmail.com

Wei-Yin Loh University of Wisconsin, Madison, WI, USA, e-mail: loh@stat.wisc.edu

Zhi-Ming Ma Academy of Math and Systems Science, Beijing, China, e-mail: mazm@amt.ac.cn

Anna Pósfai Tufts University and University of Szeged, Medford, MA, USA, e-mail: anna.posfai@tufts.edu

Adrian Röllin National University of Singapore, Singapore, Singapore, e-mail: adrian.roellin@nus.edu.sg

Qi-Man Shao Hong Kong University of Science and Technology, Hong Kong, China, e-mail: maqmshao@ust.hk

Su-Yong Sun Academy of Math and Systems Science, Beijing, China, e-mail: sunsuy@amss.ac.cn

Jef Teugels Katholieke Universiteit Leuven, Leuven, Belgium, e-mail: Jef.Teugels@wis.kuleuven.be

Aihua Xia The University of Melbourne, Melbourne, VIC, Australia, e-mail: xia@ms.unimelb.edu.au