

BHASKAR BHATTACHARYA

Department of Mathematics
Southern Illinois University
Carbondale, IL 62901-4408

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EDUCATION

Ph.D., Statistics, University of Iowa, 1993.

M.S., Statistics, Mathematics, Indian Statistical Institute, Calcutta, India, 1986.

B.S., Statistics, Mathematics, Economics, Indian Statistical Institute, Calcutta, India, 1984.

EMPLOYMENT

Chair, Department of Mathematics, SIUC, 2016, August – present.

Interim Chair, Department of Mathematics, SIUC, 2015, August – 2016, July.

2006 – present: Professor, Dept. of Mathematics, Southern Illinois University Carbondale.

1998 – 2006: Associate Professor, Dept. of Mathematics, Southern Illinois Univ. Carbondale.

1999 Fall: Visiting Scientist, Indian Statistical Institute, Calcutta,.

1993 – 1998: Assistant Professor, Dept. of Mathematics, Southern Illinois University Carbondale.

1992 – 1993: Teaching Assistant, Department of Management Sciences, University of Iowa.

1986 – 1992: Teaching/Research Assistant, Dept. of Statistics /Actuarial Sc., University of Iowa.

AWARDS AND HONORS

1. Henry Rietz Award, statistics (best performance in Ph.D. qualifying exam), U. of Iowa, 1988.
2. Best Teaching Assistant award nomination, statistics, University of Iowa, 1991.
3. National Merit Scholarship, Government of India, 1979.

RESEARCH INTERESTS

Order restricted statistical inference, I-divergence in probability distributions, statistical applications.

GRANTS RECEIVED

1. NSF Research grant, DMS- 1007528: Constrained Statistical Inference and Information Theory, 2010 – 2015 (single PI, \$100,000).
2. NSF Research grant, DMS-0706041: Statistics and Information Theory, 2007 – 2010 (single PI, \$118,213).
3. NSF/CBMS travel grant to the summer conference on ‘Bayesian Statistics’, 1994 (\$700).
4. Summer Research Fellowship Award, Southern Illinois University, 1996.
5. Sabbatical Extension Award, Southern Illinois University, 1999.

EDITORIAL APPOINTMENT

- (i) Associate Editor of **Sankhya, Series B (2009-2012)**.
- (ii) Associate Editor of **Far East Journal of Theoretical Statistics (2010-present)**.

PUBLICATIONS

- 33. Bhattacharya, B. and M. Al-Talib, “A Minimum Relative Entropy based Correlation Model between the Response and Covariates”, *Journal of the Royal Statistics Society – Series B*, 2017. (To appear)
- 32. Peiris, T. B., and Bhattacharya, B. “Constrained Inference in Linear Regression”, *Journal of Multivariate Analysis*, 151, 133-150, 2016.
- 31. Yi, H. and Bhattacharya, B. “Constrained Inference when the Sampled and Target Populations Differ”, *Entropy*, 18, 1-10, 2016.
- 30. Bhattacharya, B. and Hughes, G., “On Shape Properties of the Receiver Operating Characteristic Curve”, *Statistics and Probability Letters*, 2015.
- 29. Hughes, G. and Bhattacharya, B., Symmetry Properties of Bi-Normal and Bi-Gamma Receiver Operating Characteristic Curves are Described by Kullback-Leibler Divergences. *Entropy* **2013**, 15, 1342-1356.
- 28. Bhattacharya, B., “Covariance Selection and Multivariate Dependence”, *Journal of Multivariate Analysis*, 106, 212–228, 2012.
- 27. Bhattacharya, B. and Hughes, G., Symmetry of receiver operating characteristic curves and Kullback-Leibler divergences between the signal and noise populations, *Journal of Mathematical Psychology*, 55, 365-367, 2011.
- 26. Choudhary, R., Bandla, S., Watson, D.G., Haddock, J., Abughazaleh, A. and Bhattacharya, B., “Performance of coiled tube ultraviolet reactors to inactivate *Escherichia coli* W1485 and *Bacillus cereus* endospores in raw cow milk and commercially processed skimmed cow milk, *Journal of Food Engineering*, 107, 14-20, 2011.
- 25. Ye, P. and Bhattacharya, B., “Tests of Symmetry with One-sided Alternatives in Three-way Contingency Tables”, *Statistical Papers*, vol 52, 33-51, 2011.
- 24. Bhattacharya, B., “Relative Entropy Measures of Asymmetry with Applications”, *Sankhya – series B*, 71, 97-122, 2009.
- 23. Bhattacharya, B., “Optimal Use of Historical Information”, *Journal of Statistical Planning and Inference*, 139, 4051-4063, 2009.
- 22. Bhattacharya, B. and Gregory, J., “A General Maximum Entropy Theory: Constraint Optimization in Probability”, *Journal of Computational Mathematics and Optimization*, 4, No. 1, **15 – 29**, 2008.

21. Bhattacharya, B., "Testing for ordered failure rates under general progressive censoring", *Journal of Statistical Planning and Inference*, 137, 1775 – 1786, 2007.
20. Bhattacharya, B., "Maximum entropy characterization for the multivariate Louisville distribution", *Journal of Multivariate Analysis*, 97, 1272 – 1283, 2006.
19. Bhattacharya, B., "An Iterative Procedure for General Probability Measures to obtain I-Projection onto Intersection of Convex Sets", *Annals of Statistics*, 34, 878 – 902, 2006.
18. Bhattacharya, B., "Disparity based goodness-of-fit tests for and against isotonic order restrictions for multinomial models", *Journal of Nonparametric Statistics*, 15, no. 1, 1 – 10, 2003.
17. Bhattacharya, B. and Habtzghi, D., "Median of the p-value under the alternative hypothesis", *The American Statistician*, 56, no. 3, 202-206, 2002.
16. Bhattacharya, B., "Tests of parameters of γ distributions with inequality restrictions", *Annals of the Institute of Statistical Mathematics*, 54, no. 3, 565-576, 2002.
15. Bhattacharya, B., "Csiszar divergence from constant failure rate model for grouped data", *Communications in Statistics – Theory & Methods*, 30, no. 6, 1131-1141, 2001.
14. Bhattacharya, B., "Testing homogeneity of scale parameters against restricted alternatives for γ distributions with unknown common shape parameter", *Journal of Statistical Computation and Simulation*, 69, no. 4, 353-368, 2001.
13. Bhattacharya, B., "Measures of departure from constant failure rate models and measures of departure from proportional hazards rate models for discrete data", *Biometrical Journal*, 41, 2, 187-196, 1999.
12. Bhattacharya, B. and Sarkar, S., "Negative exponential disparity based robust estimates of ordered means in normal models", *Korean Journal of Communications in Statistics*, vol 7, no 2, 371-383, 2000.
11. Bhattacharya, B., "Testing conditional symmetry against one-sided alternatives in square contingency tables", *Metrika*, 47, 71-84, 1998.
10. Bhattacharya, B., "Testing multinomial parameters under order restrictions", *Communication in Statistics - Theory and Methods* 26, no. 8, 1839 -1865, 1997.
9. Bhattacharya, B., "On testing symmetry versus one-sided alternatives", *Annals of the Institute of Statistical Mathematics* 49, no. 2, 237 - 254, 1997.
8. Bhattacharya, B. and Dykstra, R. L., "A Fenchel duality aspect of iterative I-projection procedures", *Annals of the Institute of Statistical Mathematics* 49, no. 3, 435 - 446, 1997.
7. Bhattacharya, B., "On testing homogeneity with a one-sided alternative in the analysis of variance", *Sankhya (A)* 59, Pt. 2, 198-214, 1997.

6. Bhattacharya, B., "Tests of bivariate symmetry with a one-sided alternative in the analysis of variance", *Biometrical Journal* 38, 791-808, 1996.
5. Bhattacharya, B. and Nandram, B., "Bayesian inference for multinomial populations under stochastic ordering", *Journal of Statistical Computation and Simulation* 54, 145-163, 1996.
4. Bhattacharya, B. and Basu, A., "Robust estimates of ordered means in normal models", *Journal of Statistical Computation and Simulation* 54, 165-175, 1996.
3. Bhattacharya, B., "Restricted tests for and against the increasing failure rate ordering on multinomial parameters", *Statistics and Probability Letters* 25, 309-316, 1995.
2. Bhattacharya, B. and Dykstra, R. L., "A general duality approach to I-projections", *Journal of Statistical Planning and Inference* 3, 203-216, 1995.
1. Bhattacharya, B. and Dykstra, R. L., "Statistical inference for stochastic ordering", in *Stochastic Orders and Their Applications* by M. Shaked, J. Shantikumar and Collaborators, Academic Press, 221-249, 1994.

PAPERS UNDER REVIEW/SUBMITTED

1. "Order-restricted inference in RC models", jointly with Dharshana Suresh Arachchi-Appuhamillage.
2. "Asymmetric receiver operating characteristic curves", jointly with Dubravka Ban.

TEACHING EXPERIENCE

Have taught numerous statistics courses at the graduate and undergraduate levels:

Theoretical Statistics, Order Restricted Statistical Inference, Mathematical Statistics for Engineers, Applied Multivariate Analysis, Applied Nonparametric Statistics, Applied Linear Statistical Models, Applied Bayesian Data Analysis, Design of Experiments, Introduction to Categorical data Analysis, Basic Statistics, Business Statistics, Statistical Analysis, Statistics and Society.

Have taught numerous mathematics courses at the undergraduate level:

College algebra, Calculus, Finite Mathematics Contemporary Mathematics.

Have served as teaching assistant in several graduate and undergraduate level statistics courses at the University of Iowa.

STUDENT ADVISING

Ph.D. students (graduated):

1. Ping Ye (August, 2008)

Dissertation Title: *Tests of symmetry versus one-sided alternatives in three-dimensional tables*. She was employed as a tenure-track assistant professor at Quincy University, and received tenure there in 2012. Recently she moved to University of North Georgia Gainesville for family reasons.

2. A. Suresh (December, 2010)

Dissertation Title: *Order restricted estimation and testing for fit in RC models*
He received a tenure-track job at Bluefield State College in West Virginia, and has been promoted to associate Professor.

3. Huijun Yi (May, 2014)

Dissertation Title: *Constrained Inference when target and sampled populations differ*
She received a tenure-track assistant professor position at the Troy State University, AL. She is developing the statistics program there.

4. Mohammad Al-Talib (May, 2014)

Dissertation Title: *A model using correlations between variables*
He is an assistant professor at the Jordan University of Science and Technology in Amman, Jordan.

5. Thelge Buddika Peiris (August, 2014)

Dissertation Title: *Constrained statistical inference in linear regression*
He was a post-doc at the Worcester Polytechnic Institute for two years. Now he is employed as an assistant teaching professor at WPI.

Current Ph.D. students:

1. Rasanji Rathnayake (expected graduation date: August, 2017)

Dissertation Title: *Constrained Bayesian Inference under progressive censoring in several exponential families*

2. Naama Lewis (expected graduation date: August, 2018)

Dissertation Title: Item response theory models through information theory

3. Chaturangi Pathiravasan (expected graduation date: August, 2018)

Dissertation Title: Analysis of variance models through information theory

Post-doctoral student

Suju, Yin, Associate Professor, College of Applied Sciences, Beijing University of Technology, China; 2014 - 2015

Current M.S. students:

1. Patrick Soule (expected graduation date: August, 2017)

Thesis Title: Analyzing early warning data for lower level classes at SIUC

M.S. students (graduated):

1. George Matiri (December, 1998)

Thesis Title: *Testing scale parameters of m independent gamma distributions.*

2. Mike Hodge (May, 2000)

Research Paper Title: *Applied Multivariate Analysis.*

3. Zhang Hui (August, 2001)

Thesis Title: *Robustness of a test procedure for the scale parameters of several Gamma populations*

4. Desale Habtzghi (August, 2001)
Thesis Title: *Using median of p-value for testing*
5. Casey Wheeler (May, 2003)
Thesis Title: *Statistical test for the homogeneity of scale parameters of independent gamma distributions using Shannon's entropy function*
6. Yongxing Li (August, 2003)
Thesis Title: *A study of p-values in presence of nuisance parameters.*
7. Mohua Dasgupta (December, 2003)
Thesis Title: *Discrimination and classification with multivariate distributions.*
8. A. Suresh (December, 2005)
Thesis Title: *Bayesian hypothesis testing.*
9. Buddika Peiris (August, 2010)
Thesis Title: A research paper on pitfalls in order- restricted inferences in linear regression and meta analysis.
10. Rasanji Rathnayake (December, 2010)
Thesis Title: Bayesian Inference.

Member of the Master's Thesis or Ph.D. Dissertation Committee (of which I am not chair):

1. Sembhaya Gollakota, M.S., Department of Electrical Engineering, 1997.
2. David Ruffato, M.S., Department of Mathematics, 1997.
3. Gary Kelgren, M.S., Department of Mathematics, 1998.
4. Xuanwen Luo, M.S., Department of Mathematics, 1999.
5. Simon Aman, M.S., Department of Mathematics, 1999.
6. K. V. Rao, M.S., Department of Electrical Engineering, 2000.
7. J. Wang, Ph. D., Department of Mathematics, 2001.
8. Flaviu Adrian Hodis, M.S., Department of Mathematics, 2003.
9. Il Jun Youn, Ph.D., Department of Electrical Engineering, 2005.
10. Min (Amy) A, M.S., Department of Mathematics, 2005.
11. Venkateshwara Kanchumarthy, Ph.D., Department of Electrical Engineering, 2006.
12. Huijun Yi, M.S., Department of Mathematics, 2006.
13. Abuhassan Hassan, Ph.D., Department of Mathematics, 2007.
14. Allison Marr, Ph.D., Department of Mathematics, 2007.
15. C. deSouza, Ph.D., Department of Mathematics, 2007.
16. Srinivas Kota, Ph.D., Department of Electrical Engineering, 2010.
17. Lochana Siriwardena, Ph.D., Department of Mathematics, 2014.
18. Yasanthi Kottegoda, Ph.D., Department of Mathematics, 2014.
19. Sunil Lamsal, Ph.D., Department of Educational Psychology, 2015.
20. Ayed Alanzi, MS, Department of Mathematics, 2014.
21. Sarah Wiley, MS, Department of Mathematics, 2014.
22. Kezang C. Choden, MS, Department of Mathematics, 2016.

External examiner for Ph.D. Dissertation

1. Katelyn Alexandria Davis, Department of Mathematics and Statistics, Carleton University, Ontario, Canada.

PAPER PRESENTATIONS/PARTICIPATIONS

INVITED

1. "A Model based on Correlations between the Response and the Covariates", IASSL 2014 International Conference at Colombo, Sri Lanka, 28-30 December, 2014.
2. "Variable selection under Dependence", American Mathematical Society 2012 Spring Central Section Meeting #1081, University of Kansas, Lawrence, Kansas, March 30 – April 1, 2012.
3. "The Order-Restricted Homogeneous RC Model for Ordered Contingency Tables: Estimation and Testing for Fit", 2011 IISA conference on Probability, Statistics, and Data Analysis, Raleigh, NC, USA, April 21-24, 2011.
4. "Covariance Selection and Multivariate Dependence", International Conference on Frontiers of Interface Between Statistics and Sciences, in honor of Professor C. R. Rao's 90th (a living legend in statistics) birthday, Hyderabad, India, 30 December, 2009 – 2 January 2010.
5. "Optimal use of historical information", the International Conference on Statistical Paradigms: Recent Advances and Reconciliations 2008, held at the Indian Statistical Institute, Calcutta, India on 1 - 4 January, 2008.
6. "I-projections on convex sets", Spring 2006 meeting of the Louisiana Chapter of the American Statistical Association, University of Louisiana, Lafayette, Louisiana, April 7, 2006. (1 hour 30 min)
7. "Tests of Parameters of Several Gamma Distributions with Inequality Restrictions", departmental colloquium talk at University of South Florida, Tampa, FL, June 19, 2003.
8. "Tests of Parameters of Several Gamma Distributions with Inequality Restrictions", Fourth Biennial International Conference on Statistics, International Indian Statistical Association Meeting, Northern Illinois University, Dekalb, Illinois, June 13-15, 2002.
9. "On testing diagonal homogeneity with a one-sided alternative in the analysis of variance", Indian Statistical Institute, Calcutta, India, October, 1999.
10. "On testing equality of scale parameters of several gamma distributions against restricted alternatives", Indian Statistical Institute, Calcutta, India, November, 1999.
11. "On testing diagonal homogeneity with a one-sided alternative in the analysis of variance", International Indian Statistical Association Meeting, McMaster University, Hamilton, Ontario, Canada, October 10-11, 1998.

12. "Tests of symmetry against one-sided alternatives", invited talk, Stat/Math Division, Indian Statistical Institute, Calcutta, India, January, 1997.
13. An invited attendee at the NSF-CBMS regional conference on 'Bayesian methods in finite sampling techniques', University of Connecticut, Storrs, Connecticut, July 10-14, 1994.
14. "Finding I-projection on intersection of convex sets", invited talk, Department of Mathematics, Southern Illinois University at Carbondale, Carbondale, March, 1993.
15. "Finding I-projection on intersection of convex sets", invited talk, Department of Statistics and Actuarial Science, University of Iowa, Iowa City, February, 1992.

ORGANIZED/CHAired A SESSION (INVITED)

1. Chaired a session "Under Order and Shape Restrictions" at the IASSL 2014 International Conference at Colombo, Sri Lanka, on 30th December, 2014.
2. Organized a session "Order restricted inference" at the 2011 International Conference on Probability, Statistics and Data Analysis (ICPSDA-2011) on April 21-24 2011 at the Department of Statistics (SAS Hall), North Carolina State University, Raleigh, USA, the International Indian Statistical Association (IISA).
3. Chaired a session 'Bioinformatics II' on January 3, 2008, 4:00-5:45pm at the International Conference on Statistical Paradigms: Recent Advances and Reconciliations 2008, held at the Indian Statistical Institute, Calcutta, India on 1 - 4 January, 2008.
4. Chaired a session "Statistical Inference II" on June 16, 7:45am – 9:00am at the Fourth Biennial International Conference on Statistics, International Indian Statistical Association Meeting, Northern Illinois University, Dekalb, Illinois, June 13-15, 2002.

CONTRIBUTED

1. "Constrained Inference in Regression", presented by my student Thelge Buddika Peiris (dissertation topic) at the 2014 International Indian Statistical Association Conference *On Research Innovations in Statistics for Health, Education, Technology, and Society* at Riverside, CA, July, 11-13, 2014.
2. "Relative entropy measures of asymmetry", Joint Statistical Meetings, ASA, Denver, CO, August 3 – 8, 2008.
3. "An Iterative Procedure for General Probability Measures to obtain I-Projections onto Intersections of Convex Sets", Joint Statistical Meetings, ASA, Minneapolis, MN, August 7 – 11, 2005.
4. "Tests of symmetry against one-sided alternatives", IMS/ENAR meeting, Memphis, Tennessee, March 21-23, 1997.
5. "I-projection on intersection of convex sets", American Statistical Association Winter Conference, Louisville, Kentucky, January 21-24, 1992.

6. "An I-divergence test for marginal stochastic ordering", contributed paper, Eugene Lukacs symposium, Bowling Green State University, Bowling Green, Ohio, March 26-28, 1992.

ATTENDED/PARTICIPATED

1. The 8th International Conference on Partial least squares and related methods, 26-28 May, 2014, Paris, France.
2. Active participation as a member of the Iowa team at the 'College Bowl' - a statistical quiz organized by Professor W. Robert Stevenson, Iowa State University at the ASA Winter Conference, Louisville, Kentucky, January 3-5, 1992.

Seminar Presentation at SIUC:

1. Math Dept Statistics seminars: Fall, 1997; Spring, 1996; Spring, 1994; Fall, 1993.
2. Organized Math Dept Statistics seminars: Fall, 1997; Spring, 1996.

PROFESSIONAL ACTIVITIES

External Reviewer for Promotion and Tenure Evaluation

Wichita State University, Department of Mathematics, 2012 (Associate to Full)
 University of Calgary, Department of Mathematics & Statistics, 2012 (Assistant to Associate)
 University of South Carolina, Department of Statistics, 2009 (Assistant to Associate)

Refereed for the Journals:

Journal of the American Statistical Association (3)
 Lifetime Data Analysis
 Journal of Statistical Planning and Inference (4)
 Journal of Statistical Computation and Simulation
 Journal of Computational Statistics and Data Analysis (2)
 Communications in Statistics (3)
 Psychometrika
 Annals of the Institute of Statistical Mathematics
 American Statistician (2)
 Information Sciences
 Institute of Mathematical Statistics Lecture Notes Series
 Journal of Multivariate Analysis (5)
 Journal of Nonparametric Statistics
 Bayesian Analysis
 IEEE transactions on reliability
 Sankhya – series A
 Sankhya – series B (7)
 Colombian journal of Statistics

Refereed proposals for the Grant Organizations:

National Science Foundation (3)
 Natural Sciences and Engineering Research Council of Canada (2)

Reviewer for Mathematical Reviews, American Mathematical Association,
1993 - present (reviewed 22 papers).

Book Reviews (with honorarium):

1. “Probability and Statistical Inference” by R. V. Hogg and E. A. Tanis (1999), Fifth Edition, Prentice Hall.
2. Class test of three chapters “Elementary Statistics” by M. Pelosi and T. Sandifer (2002), First edition, John Wiley & Sons, Inc.
3. Modern Mathematical Statistics with Applications, by Jay Devore and Ken Berk (2004), Duxbury.

Committees Served:

A. Departmental Committees:

1. Personnel Committee – elected for 2 years (2001 – 02).
2. Undergraduate Programs Committee (1998 – 2000, 2002 – 04).
3. Graduate Programs Committee (2000 – 01, 2005 – 07,12-14).
4. Planning Committee (2000 – 01, 06 – 07, 09 – 13).
5. Promotion and Tenure Committee – elected (98, 00, 02 –03, 06 – 08, 09 –10).
6. Statistics Search Committee (1998 – 2000, 2013 –2014).
7. Ph.D. qualifying exam committee (1995 – 2014).
8. Ph.D. preliminary exam committee (1999 – 2014).
9. Undergraduate advising (2000 – 2004).
10. Math Field Day Examination Committee (1993 – 1999).
11. Textbook Selection Committees: College Algebra (1997), Basic statistics(1996).
12. Telephone campaign for John M. H. Olmsted Memorial fund (1997).

B. College Committees:

1. College of Science Curriculum Committee (2004 – 05).
2. College of Science Promotion and Tenure Committee (2009 –10, ’13-14).
3. College of Science Policy Committee (2012 –14).
4. College of Science Scholar Excellence Selection Committee (2014).

C. University Committees

1. Dean Search Committee for College of Science (2013-14)
2. Task Force for the Institute of Statistics and Methodology (2013)
3. University Core Curriculum Committee (2015-current)
4. Supply Chain Management degree program Committee (2015-16)

MENTORING JUNIOR FACULTY MEMBERS

Abdel Mugdadi, Assistant Professor, Dept. of Mathematics, SIUC, 2000 – 01.
Yaser Samadi, Assistant Professor, Dept. of Mathematics, SIUC, 2014 –15.

CONSULTING

- a) I have detail consulting experience with Professor Ruplal Choudhary, Department of Plant, Soil Science and Agricultural Systems, SIUC, on a project to kill bacteria in raw, skim and soy milk using radiation.
- b) Also, I have some consulting experiences with the following corporations:
 - (i) Chris Beltz, Sr. QA Mgr., Ranir Corporation (2000)
 - (ii) Torri Rush, plant engineer, ExxonMobil (2000)
 - (iii) Keith Shockey, GS Metals, Pinckneyville, IL (2000)

Professional Affiliation:

American Statistical Association (member since 1988)
International Indian Statistical Association

COMMUNITY SERVICE

- (i) I organized a session at 2002 Illinois Junior Science and Humanities Symposium (JSHS) (laboratory visits) on March 25, 2002. Four students and one teacher of area schools attended. This workshop is composed of lecture and hands on experience with statistical data.
- (ii) I am the faculty advisor of the SIU Table Tennis Club (2008 -).

NEWS ARTICLE

An article was published in the front page of Daily Egyptian (07/21/2010) (SIUC newspaper) regarding my NSF grant in 2010, with a correction “courtesy of National Science Foundation” on 07/27/2010.