

ROBERT BRANDON GRAMACY

CONTACT INFO

Statistical Laboratory
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RESEARCH INTERESTS

Bayesian modeling methodology, statistical computing, Monte Carlo inference, nonparametric regression, sequential design, and optimization under uncertainty. Application areas include spatial data, sequential computer experiments, ecology, epidemiology, finance and public policy.

EDUCATION

UNIVERSITY OF CALIFORNIA, SANTA CRUZ
Ph.D. Applied Mathematics & Statistics, December 2005
Dissertation: *Bayesian treed Gaussian process models*
Committee: Herbert K. H. Lee (advisor), Bruno Sansó, David P. Helmbold

UNIVERSITY OF CALIFORNIA, SANTA CRUZ
M.Sc. Computer Science, April 2003
Thesis: *Adaptive Caching by Experts*
Committee: Manfred K. Warmuth (advisor), David P. Helmbold, Scott A. Brandt

UNIVERSITY OF CALIFORNIA, SANTA CRUZ
College Honors; 4.00 GPA
B.Sc. (Highest Honors) Computer Science, June 2001
Honors Thesis: *Shortest Paths and Network Flow Algorithms for ESD Analysis*
Advisor: David P. Helmbold
B.A. (Honors) Mathematics, June 2001
Project: *Combinatorial Optimization by Matchings*
Advisor: Debra Lewis

PROFESSIONAL POSITIONS

Lecturer¹, Statistical Laboratory, UNIV. OF CAMBRIDGE, UK, 2006 – Present
Fellow, JESUS COLLEGE Cambridge, 2006 – Present
Visiting Professor, Dept. of Probability and Statistics, UC SANTA BARBARA, Aug – Dec 2009
Postdoc, Statistical Laboratory under Steve Brooks, UNIV. OF CAMBRIDGE, UK, 2006

HONORS & AWARDS

INQUIRE UK/Europe best paper/presentation prize, 1 of 2 winners; 2008
Savage Award for best Ph.D. thesis in Bayesian application methodology; 2006
ASA Statistical Computing & Graphics student paper competition, 1 of 4 winners; 2005
UCSC Applied Math & Stats nomination for UC Presidents Dissertation fellowship; 2005
Huffman Prize, given to the top graduating UCSC Engineering student; 2001
Chancellor's Award, UC Santa Cruz; 2001
Dean's Award, UC Santa Cruz Baskin Engineering School; 2001
UCSC Student Employee of the Year; 2000

¹Note that in the United Kingdom the position of *Lecturer* is a "tenured" research post, with light teaching, situated between the *Assistant* and *Associate Professor* positions in the United States

**PEER-
REVIEWED
JOURNAL
ARTICLES**

D. Merl, L.R. Johnson, R.B. Gramacy, M.S. Mangel. *A statistical framework for the adaptive management of epidemiological interventions*. (2009) PLoS ONE 4(6): e5087

R.B. Gramacy, H.K.H. Lee. *Adaptive design and analysis of supercomputer experiments*. (2009) Technometrics, 51(2), pp. 130–145; arXiv:0805.4359

M.L. Cule, R.B. Gramacy, R.J. Samworth. *LogConcDEAD: an R package for maximum likelihood estimation of a multivariate log-concave density*. (2009) Journal of Statistical Software, 29(2)

R.B. Gramacy, R.J. Samworth, Ruth King. *Importance tempering*. (2008) *To appear in Statistics and Computing*; arXiv:0707.4242

R.B. Gramacy, H.K.H. Lee. *Bayesian treed Gaussian process Models with an application to computer modeling*. (2008) Journal of the American Statistical Association, 103(483), pp. 1119–1130; arXiv:0710.5837

R.B. Gramacy, H.K.H. Lee. *Gaussian Processes and Limiting Linear Models*. (2008) Computational Statistics and Data Analysis, 53, pp. 123–136; arXiv:0804.4685 (full version of JSM06)

R.B. Gramacy. *tgp: an R package for Bayesian nonstationary, semiparametric nonlinear regression and design by treed Gaussian process models*. (2007) Journal of Statistical Software, 19(9)

**PEER-
REVIEWED
CONFERENCE
PROCEEDINGS**

T. Broderick, R.B. Gramacy. *Treed Gaussian Process Models for Classification*. (2009) Hermann Locarek-Junge, Claus Weihs (Eds.) in Proceedings of the International Federation of Classification Societies (IFCS) Conference, Dresden, Germany, 13-18 March. *To appear*.

R. Silva, R.B. Gramacy. *MCMC Methods for Bayesian Mixtures of Copulas*. (2009) In D. van Dyk and M. Welling (Eds.), Proceedings of the Twelfth International Conference on Artificial Intelligence and Statistics (AISTATS), Clearwater Beach, Florida, April 16-18. JMLR: W&CP 5:512-519

G.A. Gray, M. Martinez-Canales, M.A. Taddy, H.K.H. Lee, and R.B. Gramacy, *Enhancing Parallel Pattern Search Optimization with a Gaussian Process Oracle*, SAND2006-7946C. (2006) Proceedings of the 14th NECDC

R.B. Gramacy, H.K.H. Lee, W.G. MacReady. *Parameter Space Exploration with Gaussian Process Trees*. (2004) ICML Proceedings, Banff, AB (Omnipress, pp. 353–360)

R.B. Gramacy, M.K. Warmuth, S.A. Brandt, I. Ari. *Adaptive Caching by Refetching*. (2003) Advances in Neural Information Processing Systems 15, (MIT Press, pp. 1465–1472)

I. Ari, A. Amer, R.B. Gramacy, E.L. Miller, S.A. Brandt, D.D.E. Long. *ACME: Adaptive Caching using Multiple Experts*. WDAS 2002, (Carlton Scientific); 2002

**BOOK
CHAPTERS**

H.K.H. Lee, M.A. Taddy, R.B. Gramacy, G.A. Gray. “Designing and analyzing a circuit device experiment using treed Gaussian processes”. *To appear in the Handbook of Applied Bayesian Analysis*.

IN REVIEW

R.B. Gramacy, N.G. Polson. *Particle learning of Gaussian process models for sequential design and optimization*. (2009) Submitted to *JCGS*; arXiv:0909.5262

R.B. Gramacy, E. Pantaleo. *Shrinkage regression for multivariate inference with missing data, and an application to portfolio balancing*. (2009) Submitted to *BA*; arXiv:0907.2135

T. Broderick, R.B. Gramacy. *Classification and categorical inputs with treed Gaussian process models*. (2009) Submitted to *JoC*; arXiv:0904.4891

D. Merl, L.R. Johnson, R.B. Gramacy, M. Mangel. *amei: an R package for the Adaptive Management of Epidemiological Interventions*. (2009) Submitted to *JSS*; available as a vignette in the *amei* package

R.B. Gramacy, M.A. Taddy. *Categorical inputs, sensitivity analysis, optimization and importance tempering with tgp version 2, an R package for treed Gaussian process models*. (2009) Accepted at *JSS* subject to minor revisions; available as a vignette in the *tgp* package

R.B. Gramacy, J.H. Lee, R. Silva. *On estimating covariances between many assets with histories of highly variable length*. (2007) Submitted to *JEF*; arXiv:0710.5837

OTHER PUBLICATIONS

R.B. Gramacy *tgp: an R package for nonlinear regression by treed Gaussian processes*. (2009) *ISBA Bulletin, Software Spotlight*; September 16(3)

R.B. Gramacy. *A review of “Ecological Models and Data in R” by Benjamin Bolker*. (2009) *The American Statistician*, August, Vol. 63, No. 3, pp. 281–282

R.B. Gramacy, H.K.H. Lee. *Gaussian Processes and Limiting Linear Models*. (2006) *Proceedings of the Joint Statistical Meetings of the ASA, Section on Bayesian Statistical Science, Seattle, WA*

R.B. Gramacy, H.K.H. Lee, W.G. MacReady. *Adaptive exploration of computer experiment parameter spaces*. (2004) *ISBA Bulletin, Applications*; December 11(4), pp. 3–6

P. Ngan, D. Oliver, T. Smedes, R. Gramacy, C-K Wong. *Automatic Layout Based Verification of Electrostatic Discharge Paths*. (2001) *EOS/ESD Symposium, Portland OR* (pp. 96)

THESES

Ph.D. Thesis, Department of Applied Math & Statistics. *Bayesian treed Gaussian process models*. (2005) UC Santa Cruz; UCSC S&E Library: GRAD COMPSCI 2005 G73

Masters Thesis, Department of Computer Science. *Adaptive Caching by Experts*. (2003) UC Santa Cruz; UCSC S&E Library: Q325.5 .G73 2003

Honors Senior Thesis, Department of Computer Science. *Shortest paths and network flow algorithms for Electrostatic Discharge analysis* (2001) UC Santa Cruz

**TALKS &
SEMINARS**

Key: **IS** \equiv Invited Seminar < 60m; **IT** \equiv Invited Talk < 35m; **RT** \equiv Refereed Talk < 35m

Particle learning for sequential design and optimization

- IS Oct 2009 **UC Santa Cruz**, USA
- IT Oct 2009 **Design and Analysis of Experiments Conference**, Columbia, MO, USA
- IT Oct 2009 **INFORMS Conference**, San Diego, USA
- IS Oct 2009 **UC Santa Barbara**, USA
- IT June 2009 **BISP6**, Brixen, Italy

On estimating covariances between many assets with histories of highly variable length

- IT Aug 2009 **Joint Statistical Meetings**, Washington DC, USA
- IS Mar 2009 **University of Chicago** (Booth School of Business), USA
- IS Mar 2009 **University of Cambridge** (Engineering), UK
- IS Mar 2009 **University of Bath**, UK
- IS Mar 2009 **University College London**, UK
- IT Jun 2008 **Isaac Newton Institute**, Cambridge, UK
- IS Apr 2008 **INQUIRE Europe/UK Conference**, Zurich, Switzerland
- IS Dec 2007 **European Quantitative Forum**, State Street, London, UK

Importance Tempering

- IS Mar 2008 **University of Bristol**, UK
- IS Mar 2008 **University of Sheffield**, UK
- IS Jan 2008 **University of Warwick**, UK
- IT Jan 2008 **Joint Meeting of IMS & ISBA (MCMSki II)**, Bormio, Italy
- IS Dec 2007 **University of Southampton**, UK
- IS Mar 2007 **University of Nottingham**, UK

Bayesian treed Gaussian process models

- IS May 2009 **Tilburg University**, The Netherlands
- IS Apr 2009 **2nd OPUS Workshop**, CAE Paris, France
- IS Feb 2008 **RSS & S3RI joint meeting on computer experiments**, Southampton, UK
- RT Aug 2007 **SBSS Award talk, Joint Statistical Meetings**, Salt Lake City, UT, USA
- IS Dec 2006 **Fidelity Intl. Bank**, London, UK
- IT May 2006 **Statistical Society of Canada Meeting**, London, ON, Canada
- IS May 2006 **Acadia University**, Wolfville, NS, Canada
- IS Apr 2006 **University of Oxford**, UK
- IS Mar 2006 **Queen Mary, University of London**, UK
- IT Oct 2005 **Design and Analysis of Experiments Conference**, Santa Fe, NM
- IT June 2005 **Classification (CSNA) & Interface Meeting**, St. Louis, MO

Adaptive exploration of computer experiment parameter spaces

- RT Aug 2005 **Award talk, Joint Statistical Meetings**, Minneapolis, MN, USA
- RT July 2004 **Intl. Conf. on Machine Learning**, Banff, AB, Canada
- RT May 2004 **Meeting of the ISBA**, Viña del Mar, Chile

Adaptive caching by refetching

- RT Dec 2002 **Poster Spotlight, NIPS Conference**, Vancouver, BC, Canada

OPEN SOURCE SOFTWARE

`tgp`: An R-package for Bayesian nonstationary, semiparametric nonlinear regression and design with treed Gaussian processes. <http://www.cran.r-project.org/web/packages/tgp/index.html>

`LogConcDEAD`: An R-package implementing a maximum likelihood estimator of nonparametric log-concave densities in arbitrary dimension; with M. Cule and R.J. Samworth. <http://www.cran.r-project.org/web/packages/LogConcDEAD/index.html>

`monomvn`: An R-package for shrinkage regression and estimation for multivariate normal and Student- t data with monotone missingness. <http://www.cran.r-project.org/web/packages/monomvn/index.html>

`amei`: An R-for the Adaptive Management of Epidemiological Interventions; with Dan Merl, Leah Johnson, and Marc Mangel. <http://www.cran.r-project.org/web/packages/amei/index.html>

`geometry`: An R-package for mesh generation and surface tessellation; with Raul Grassman. <http://www.cran.r-project.org/web/packages/geometry/index.html>

RESEARCH EXPERIENCE

FIDELITY INTERNATIONAL BANK. Contractor for Joo Hee Lee, portfolio manager, investment strategies group—Dec 2006 – July 2008. Projects include classification and regression trees (CART), estimating covariances with monotone missing data, and forecasting with the Kalman filter.

STATISTICAL LABORATORY, UNIVERSITY OF CAMBRIDGE. Postdoc under Steve Brooks. Studied approximations and automation of Reversible-Jump MCMC algorithms, with applications to problems in statistical ecology.

RAND CORPORATION. Summer Associate under John Shank. Joint High Speed Vessel Analysis of Alternatives and Logistics Analysis for the Littoral Combat Ship: data collection, analysis, model development, logistics & support, and optimal decisions; 2005

APPLIED MATH & STATISTICS, UC SANTA CRUZ. Graduate Student Researcher (GSR) under Herbie Lee. Developed R code for the text *Multiscale Modeling: A Bayesian Perspective* by Herbert K.H. Lee and Marco A.R. Ferreira; 2004

APPLIED MATH & STATISTICS, UC SANTA CRUZ in collaboration with NASA AMES RESEARCH CENTER. GSR under Herbie Lee. Adaptive exploration of computer experiment parameter spaces. 2003–2006

MACHINE LEARNING GROUP, UC SANTA CRUZ. GSR under Manfred K. Warmuth. On-line learning in the Expert Framework applied to caching and speech recognition. 2002–2003

GRANTS

INstitute for QUantitative Investment REsearch (INQUIRE) UK 2009/05 for *Fast, robust, and dynamic Bayesian updating of large scale between-asset covariances for balancing portfolios*
Awarded in October 2009 for 2 years. £8,190

UK Engineering and Physical Sciences Research Council (EPSRC) EP/D065704/1 for *Trans-dimensional Markov Chain Simulation for both Bayesian and Classical Model Determination*
Awarded in October 2006 for 3 years. £286,881

LECTURING

PSTAT 215A BAYESIAN INFERENCE, UC SANTA BARBARA: A graduate introduction to Bayesian methods and MCMC inference; 20 lectures: 2009

PART IIC STATISTICAL MODELLING, UNIVERSITY OF CAMBRIDGE: Undergraduate course in generalized linear models; 24 lectures: 2007, 2008, 2009

PART III/MPHIL MONTE CARLO INFERENCE, UNIVERSITY OF CAMBRIDGE: Graduate course in classical and Bayesian inference by simulation; 16 lectures: 2007, 2008, 2009, 2010

PART III/MPHIL TIME SERIES, UNIVERSITY OF CAMBRIDGE: Graduate course in time series theory and inference; 8 lectures: 2007, 2008, 2010

**OTHER
TEACHING
EXPERIENCE**

JESUS COLLEGE DIRECTOR OF STUDIES (DOS) IN PART II MATHEMATICS: 2008, 2009, 2010

CAMBRIDGE MATHEMATICAL TRIPOS TUTORIALS/SUPERVISIONS: Part 1A Probability, 2007, 2008, 2009, 2010; Part 1B Markov chains, 2007, 2008; Part 1B Statistics, 2008, 2009, 2010

APPLIED MATH & STATISTICS 131, UC SANTA CRUZ: Undergraduate introduction to Probability Theory (with calculus). Teaching Assistant under Raquel Prado; Spring 2005

APPLIED MATH & STATISTICS 007, UC SANTA CRUZ: Undergraduate course in biostatistics. Teaching Assistant under Raquel Prado; Winter 2005

COMPUTER SCIENCE 201, UC SANTA CRUZ: Graduate course in analysis of algorithms. Teaching Assistant under Allen van Gelder; Winter 2002

COMPUTER SCIENCE 102, UC SANTA CRUZ: Undergraduate course in analysis of algorithms. Teaching Assistant under Suresh Lodha; Fall 2001, & Course Assistant under David Helmbold; Fall 2000; *Course Assistant is the undergraduate equivalent of a Teaching Assistant.*

TUTOR, UC SANTA CRUZ: courses in Mathematics and Engineering. Founded a tutoring service aimed specifically at students who are ethnically underrepresented in Engineering.

**OTHER
EMPLOYMENT**

ANTRIM DESIGN SYSTEMS: Contractor. Scripting support for database migration; April 2002

PHILIPS SEMICONDUCTORS: Software & CAD Engineer. Summer internship led to senior thesis and extended position; June 1999 – September 2002

UC SANTA CRUZ: Chancellors Undergraduate Intern: Multicultural Engineering Participation (MEP) Student Coordinator; 1999–2000

MENTORSHIP

	<u>Field</u>	<u>Location</u>	<u>Date(s)</u>
Postdocs			
Ioana Cosma	Stats	U. of Cambridge	2009–
Ricardo Silva	Stats	U. of Cambridge	2007–2008
Ph.D. Students			
Adam Bull	Stats	U. of Cambridge	2009–
Timothy Graves	Stats	U. of Cambridge	2009–
James Lawrence	Stats	U. of Cambridge	2008–
Masters–level Students			
Timothy Graves	Mphil Stats	U. of Cambridge	2008–2009
Tamara Broderick	Part III Maths	U. of Cambridge	2007–2008
James Keough	Mphil Stats	U. of Cambridge	2007–2008
Donal Moore	Mphil Stats	U. of Cambridge	2006–2007
Ph.D. Viva/Committee			
Paul Birrell	Stats	U. of Cambridge	expected 2009
Richard Wilkinson	Comp Bio	U. of Cambridge	2007

PROFESSIONAL SERVICE

Associate Editor, Technometrics; December 2008–Present
 Associate Editor, ISBA Bulletin Student Corner; January 2005–June 2006

In addition to AE services I **referee** 10 papers/year for:

Technometrics, Journal of the American Statistical Association, Journal of the Royal Statistical Society, Journal of Statistical Planning and Inference, Statistics and Computing, Communications in Statistics, Journal of Machine Learning Research, Machine Learning, IEEE Transactions on Knowledge and Data Engineering, Institute of Industrial Engineers (IIE) Transactions, Bioinformatics, Oecologia, Artificial Intelligence in Medicine, Books/Chapters for Princeton University Press, Books/Chapters for Springer

Project management committee member, National Centre for Statistical Ecology, 2007–present
 Secretary, IEEE UCSC Student Branch, elected position; 2000–2001
 UCSC Student Leadership, Chancellors Undergrad Internship Program; 1999–2000.
 Webmaster, Intl. Workshop on Bayesian Data Analysis, UC Santa Cruz, CA; 2003

PROFESSIONAL MEMBERSHIP

American Statistical Association (ASA)
 International Society for Bayesian Analysis (ISBA)
 Institute of Mathematical Statistics (IMS)
 Royal Statistical Society (RSS)