

Curriculum Vitae

SETH SULLIVANT

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Education/Employment

2008 – Assistant Professor, North Carolina State University
2005 – 2008 Junior Fellow, Harvard University
2005 Ph.D. University of California, Berkeley, Mathematics (advisor: Bernd Sturmfels)
2002 M.A. San Francisco State University, Mathematics (advisor: Serkan Hoşten)
2000 B.A. University of California, Berkeley, Mathematics

Scientific/Academic honors and grants

2009 – 2010 NCSU Faculty Research and Professional Development Fund “Identifiability Problems in Algebraic Statistics” (\$4000)
2007 – 2010 National Science Foundation Grant “Algebraic Statistical Models” (\$ 106,457)
2005 National Science Foundation Postdoctoral Research Fellowship (declined)
2005 Bernard Friedman Memorial Prize (Berkeley Math Department)
2001 – 2005 National Science Foundation Graduate Research Fellowship
2004 Charles B. Morrey, Jr. Award (Berkeley Math Department)
2000 Dorothea Klumpke Roberts Prize (Berkeley Math Department)

Research interests

Algebraic statistics; applications to evolutionary biology and disclosure limitation; commutative, combinatorial, and computational algebra

Publications

Books

- 2009 1. (with M. Drton and B. Sturmfels) *Lectures on Algebraic Statistics*. Oberwolfach Seminar Series **39**, Birkhauser.
2008 2. (edited with M. Putinar) *Emerging Applications of Algebraic Geometry*. IMA Series **149**, Springer.

Articles in progress

3. (with A. Engström and T. Kahle) Toric fiber products, II.
4. Why does the shuttle algorithm work?

Submitted journal articles

5. (with E. Allman, S. Petrović, and J. Rhodes) Identifiability of two-tree mixtures for group-based phylogenetic models, 13 pages.
6. (with C. Hillar) Finite Gröbner bases in infinite dimensional polynomial rings and applications, 21 pages.
7. Normal binary graph models, 9 pages.
8. (with K. Talaska and J. Draisma) Trek separation for Gaussian graphical models, 23 pages.

Peer-reviewed journal articles

- 2009 9. (with N. Beerenwinkel) Markov models for accumulating mutations, *Biometrika* **96** no. 3 (2009) 645–661.
10. (with J. Sidman) Prolongations and computational algebra. *Canadian Journal of Mathematics*, **61** no. 4 (2009) 930–949.
11. A Gröbner basis for the secant ideal of the second hypersimplex, *Journal of Commutative Algebra*, **1** no. 2 (2009) 327–338.
12. Gaussian conditional independence relations have no finite complete characterization. *Journal of Pure and Applied Algebra*, **213** (2009) 1502–1506.
- 2008 13. (with B. Sturmfels) Toric geometry of cuts and splits. *Michigan Mathematical Journal*, **57** (2008) 689–709 (special issue in honor of Mel Hochster).
14. Algebraic geometry of Gaussian Bayesian networks. *Adv. in Appl. Math.* **40** (2008), no. 4, 482–513.
15. Combinatorial symbolic powers. *J. Algebra* **319** (2008), no. 1, 115–142.
- 2007 16. (with M. Drton) Algebraic statistical models. *Statist. Sinica* **17** (2007), no. 4, 1273–1297
17. Toric fiber products. *J. Algebra* **316** (2007), no. 2, 560–577.
18. (with S. Hoşten) A finiteness theorem for Markov bases of hierarchical models. *J. Combin. Theory Ser. A* **114** (2007), no. 2, 311–321.
19. (with M. Drton and B. Sturmfels) Algebraic factor analysis: tetrads, pentads, and beyond. *Probab. Theory Related Fields* **138** (2007), no. 3–4, 463–493.
- 2006 20. Compressed polytopes and statistical disclosure limitation. *Tohoku Mathematical Journal* **58** (2006), 433–445.
21. (with B. Sturmfels) Combinatorial secant varieties. *Quarterly Journal of Pure and Applied Mathematics* **2** (2006) 285–309.
22. (with Y. Chen and I. Dinwoodie) Sequential importance sampling for multiway tables. *Annals of Statistics*. **34** (2006) No. 1, 523–545
23. (with N. Eriksson, S. E. Fienberg, and A. Rinaldo) Polyhedral conditions for the nonexistence of the MLE for hierarchical log-linear models. *Journal of Symbolic Computation: special issue on Computational Algebraic Statistics*, **41** (2006), 222–233.
24. (with A. Slavkovic) The space of compatible full conditionals is a unimodular toric variety. *Journal of Symbolic Computation: special issue on Computational Algebraic Statistics*, **41** (2006), 196–209.
- 2005 25. Small contingency tables with large gaps. *SIAM Journal on Discrete Mathematics*. **18** (2005), no. 4, 787–793.
26. (with B. Sturmfels) Toric ideals of phylogenetic invariants. *Journal of Computational Biology*, **12** no. 2 (2005), 204–228.
- 2004 27. (with A. Dobra) A divide-and-conquer algorithm for generating Markov bases of multiway tables. *Computational Statistics* **19** (2004), 347–366.
28. (with S. Hoşten) Ideals of adjacent minors. *Journal of Algebra* **277** (2004), 615–642.
- 2003 29. (with M. Develin) Markov bases of binary graph models. *Annals of Combinatorics*, **7** (2003), 441–466.
- 2002 30. (with S. Hoşten) Gröbner bases and polyhedral geometry of reducible and cyclic models. *Journal of Combinatorial Theory: Series A* **100** (2002) no. 2, 277–301.

Conference publications and book chapters (peer-reviewed and/or invited)

- 2008 31. (with S. Hoşten) *Algebraic complexity of maximum likelihood estimation for bivariate missing data.*, Special Volume in Honor of Giovanni Pistone, 15 pages. arXiv:0709.0935
- 2005 32. (with N. Eriksson, K. Ranestad, and B. Sturmfels) Phylogenetic algebraic geometry. In *Projective Varieties with Unexpected Properties*, edited by C. Ciliberto, et al., Walter de Gruyter, Berlin
33. (with M. Casanellas) The strand symmetric model. Chapter in *Algebraic Statistics for Computational Biology*, (eds. L. Pachter and B. Sturmfels) 2005.
34. (with M. Casanellas and L. Garcia) Catalog of small trees. Chapter in *Algebraic Statistics for Computational Biology* (eds. L. Pachter and B. Sturmfels), 2005.

Lecture series, lectures, and presentations

Lecture series

- 2008 May MFO, Oberwolfach, Germany: Algebraic Statistics [4 lectures]
- 2007 Aug. Texas A & M, College Station, TX: Applicable Algebraic Geometry [5 lectures]
 June TU Eindhoven, The Netherlands: Algebraic Statistics [15 lectures]
- 2006 July Universidad de Buenos Aires, Argentina: Algebraic Statistics [6 lectures]
 June Nordfjordeid, Norway: Algebraic Statistics, Computational Biology, and Tropical Geometry [6 lectures]

Invited Conference Talks

- 2010 Aug. Special Session on Graphical Models, *IMS Annual Meeting*, Göteborg, Sweden.
 Mar. Special Session on Combinatorial Algebra, *AMS Southeastern Sectional Meeting*, Lexington, KY.
 Mar. Special Session on Advances in Algebraic Statistics, *AMS Southeastern Sectional Meeting*, Lexington, KY.
 Jan. Commutative Algebra Meetings in the Southeast, UCF, Orlando, FL.
 Jan. AMS-SIAM Special Session on Applications of Algebraic Geometry, *Joint Mathematics Meetings*, San Francisco, CA.
- 2009 Oct. Special Session on Applicable Algebraic Geometry, *AMS Central Sectional Meeting*, Waco, TX.
 Aug. Session on Algebraic Methods in Systems Biology and Statistics, *Joint Statistics Meeting*, Washington D.C.
 May Texas Algebraic Geometry Seminar, Texas A & M, College Station, TX.
 Apr. Evolutionary Biology and Phylogenetics, SAMSI, Research Triangle Park, NC.
 Mar. Special Session on Algebraic Methods in Statistics and Probability, *AMS Central Sectional Meeting*, Urbana, IL.
- 2008 Dec. Algebraic Statistics Workshop, MSRI, Berkeley, CA.
 Nov. GSU-USC Commutative Algebra Seminar (National Meeting), Columbia, SC.
 Oct. Special Session on Applications of Algebraic Geometry. *AMS Western Sectional Meeting*, Vancouver, BC.
 July Mathematical Aspects of Graphical Models, Durham, UK.
 May Mathematical Explorations in Contemporary Statistics, Sestri Levante, Italy.
 Mar. Special Session on Toric Varieties. *SIAM Southeastern sectional meeting*, Orlando, FL.
 Jan. Special Session on Secant Varieties and Related Topics, *Joint Mathematics Meeting*, San Diego, CA.

- 2007 Nov. Special Session on Combinatorial Enumeration, Optimization, Geometry and Statistics
AMS Southeastern Sectional, Murfreesboro, TN.
- Oct. Multivariate Interpolation– Its Relation to Algebraic Statistics, Classical Algebraic Geometry, and Computational Complexity Theory, Sestri Levante, Italy.
- June Commutative Algebra and Its Interaction with Algebraic Geometry, *BIRS*, Banff, Canada.
- Jan. International Conference on Theoretical and Practical Effectivity of Gröbner Bases, *RIMS*, Kyoto, Japan.
- 2006 Nov. New England Discrete Math Day, College of the Holy Cross, Worcester, MA.
- Aug. Computational and Combinatorial Commutative Algebra, *Fields Institute*, Toronto.
- July Special Session on Graphical and Algebraic Statistical Models, *European Meeting of Statisticians*, Torun, Poland.
- 2004 Jan. Special Session on Geometry and Combinatorics, *Joint Math Meeting*, Phoenix, AZ.
- 2003 Dec. Computational Algebraic Statistics, *American Institute of Math*, Palo Alto, CA.
- July Commutative Algebra: Presentations by Young Researchers, *AMS-IMS-SIAM Summer Research Conference*, Snowbird, UT.
- July Lattice Points in Polyhedra, *AMS-IMS-SIAM Summer Research Conf.*, Snowbird, UT.
- June Workshop on Stochastic Computation, *SAMSI*, Research Triangle Park, NC.
- May Special Session on Combinatorial Commutative Algebra and Algebraic Geometry, *AMS Western Section Meeting*, San Francisco, CA.
- 2002 Nov. Combinatorics and Integer Programming of Multidimensional Tables, *INFORMS*, San Jose, CA.
- June Symbolic Computational Algebra 2002, *ORCCA*, University of Western Ontario, London, Ontario, Canada.
- Feb. Multidimensional Tables: Statistics, Optimization and Gröbner bases, Davis, CA.

Colloquia and Seminars

- 2009 U. Pennsylvania.
- 2008 U. Toronto, U. Massachusetts– Amherst, Georgia Tech, North Carolina State U., U. Kansas, U. Oregon, U. California– Davis, Boston U., U. Minnesota, Colorado State U., Wellesley College
- 2007 Massachusetts Institute of Technology, Harvard U., U. Chicago, U. Warwick, U. Minnesota, IMA, Colorado State U., Ohio State U., U. Wisconsin– Madison, McGill U., U. Illinois– Chicago
- 2006 Harvard U., U. Pennsylvania, San Francisco State U., U. California–Berkeley, Massachusetts Institute of Technology
- 2005 Harvard U., Queen’s U., Duke U., U. Chicago, U. Massachusetts–Amherst, San Francisco State U., U. Barcelona
- 2004 U. Massachusetts–Amherst, Pennsylvania State U., Carnegie Mellon U., U. California–Berkeley, Duke U., North Carolina State U., Harvard U.
- 2003 U. California–Berkeley, U. Washington, Stanford U., MSRI
- 2002 MSRI, U. California–Berkeley

Organizing activities for conferences, meetings, etc.

- 2009 – 2011 Secretary, SIAM Activity Group in Algebraic Geometry.
- 2009 Apr. with Carla Savage, organized Special Session on Applications of Algebraic and Geometric Combinatorics, *AMS Southeastern Section Meeting*, Raleigh, NC.

- 2008 – 2009 Organizing Committee Member, SAMSI yearlong program on Algebraic Methods in Systems Biology and Statistics. Organizing yearlong activities for the program including Opening and Closing workshop, 3 midterm workshops, and a course for graduate students.
- 2007 Mar. with Serkan Hoşten and Lior Pachter organized IMA midprogram workshop on Applications in Biology, Dynamics, and Statistics.
- 2006 Jan. with Elizabeth Allman organized an AMS special session on Algebraic Statistics: Theory and Practice. Joint Mathematics Meeting, San Antonio, TX
- 2005 Nov. with Lior Pachter, Bernd Sturmfels, and Jim Carlsson, organized a workshop Algebraic Statistics and Computational Biology. Clay Mathematics Institute, Cambridge, MA

Editorial activities

- 2006 Guest Associate Editor, *Statistica Sinica*, for Theme Topic on Algebraic Statistics and Computational Biology

Referee and review activities

Journals refereed

Advances in Applied Mathematics
Advances in Geometry
Algorithms for Molecular Biology
Annals of Combinatorics
Annals of Statistics
Australian and New Zealand Journal of Statistics
Discrete Mathematics
Experimental Mathematics
IEEE/ACM Transactions on Computational Biology and Bioinformatics
Journal of Algebra
Journal of Algebraic Combinatorics
Journal of Combinatorial Theory: Series A
Journal of Commutative Algebra
Journal of the European Mathematical Society
Journal of Multivariate Analysis
Journal of Pure and Applied Algebra
Journal of Statistical Planning and Inference
Journal of Symbolic Computation
Mathematical Research Letters
Mathematics of Computation
Math Reviews
Proceedings of the AMS
Transactions of the AMS

Conferences refereed

- 2010 Program Committee Member, Artificial Intelligence and Statistics (AISTATS), Sardinia, Italy.

- 2009 Program Committee Member, Uncertainty and Artificial Intelligence (UAI), McGill University, Montreal, Canada.
- 2008 Program Committee Member, Algebraic Biology 2008, RISC, Linz, Austria.

Granting agencies refereed

- 2006–2009 NSF, Two panels and other individual refereeing

Teaching activities

Courses taught

- 2009 Fall Abstract Algebra I (Math 521)
- 2008 Fall (with R. Laubenbacher) Algebraic Methods in Systems Biology and Statistics (Math 810E) SAMSI special topics course
- 2004 Spring Calculus for Business Majors (Math 16B) TA, UC Berkeley
- 2001 Spring Precalculus (Math 109) SFSU
- 2000 Fall Algebra (Math 59) SFSU
- 1999–2000 Calculus for Scientists and Engineers (Math 1B) TA, UC Berkeley

Postdocs mentored

- 2008–2010 Megan Owen