Ruchira S. Datta

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Research Interests

Mathematics of community interactions

dynamics of populations of interacting agents in communities, considering their shared and competing interests and varying power, information, and resources.

Education

University of California at Berkeley, Ph.D., Mathematics, December 2003,
Algebraic Methods in Game Theory. Supervisor: Bernd Sturmfels.

University of California at Berkeley, M.S., Computer Science, December 2002,
Using Computer Algebra To Compute Nash Equilibria. Supervisor: Richard Fateman.

California Institute of Technology, B.S., Mathematics, June 1991.

Recent Research Experience

Mathematical Biosciences Institute; Postdoctoral Fellow; September 2014–.
Modelling the human organism as an evolving ecological community. Studying the interaction between cancer and its microenvironment, specifically the immune system. Developing the mathematics of mutualism.

UCSF: Center for Evolution and Cancer; Research Specialist; October 2011–October 2014; Postdoctoral supervisor: Carlo C. Maley. Applying ecological and evolutionary theory to cancer progression and development of therapeutic resistance.

UC Berkeley: QB3 Institute; Postdoctoral Researcher; July 2007–September 2011; Postdoctoral supervisor: Kimmen Sjölander. Developing novel computational methods in protein informatics for inferring orthology, predicting structure, annotating function, and predicting interactions.

Google Inc.; Software Engineer; 2004-2006. **International Search Quality**. Creating and implementing novel algorithms for diacritical insensitivity, transliteration, and stemming. **Google Book Search**. Statistically analyzing user behavior. Supervising Ph.D student intern in classification/clustering project.

Select Publications

Ruchira S. Datta, Alice Gutteridge, Charles Swanton, Carlo C. Maley, Trevor A. Graham, "Modelling the evolution of genetic instability during tumour progression", in *Evolutionary Applications* Volume 6, Issue 1, 20–33, January 2013

Ruchira S. Datta, "Finding all Nash equilibria of a finite game using polynomial algebra", in *Economic Theory*, Volume 42, No. 1, January 2010, 55–96

Ruchira S. Datta, Christopher Meacham, Bushra Samad, Christoph Neyer, and Kimmen Sjölander, "Berkeley PHOG: PhyloFacts orthology group prediction web server", in *Nucleic Acids Research* 2009, 37(suppl 2): W84–W89. doi:10.1093/nar/gkp373

Ruchira S. Datta, "Universality of Nash Equilibria", in *Mathematics of Operations Research*, Vol. 28, No. 3, August 2003, pp. 424–432.

Other Publications

Kimmen Sjölander, **Ruchira S. Datta**, Yaoqing Shen, and Grant M. Shoffner, "Ortholog identification in the presence of domain architecture arrangement", in *Briefings in Bioinformatics* 2011, September; 12(5): 413–422.

Raffi Hagopian, John R. Davidson, **Ruchira S. Datta**, Bushra Samad, Glen R. Jarvis and Kimmen Sjölander, "SATCHMO-JS: a webserver for simultaneous protein multiple sequence alignment and phylogenetic tree construction", in *Nucleic Acids Research* 2010, 38(suppl 2): W23–W28. doi:10.1093/nar/gkq298
Featured article (top 5%).

Ursula Pieper, Benjamin M. Webb, David T. Barkan, Dina Schneidman-Duhovny, Avner Schlessinger, Hannes Braberg, Zheng Yang, Elaine C. Meng, Eric F. Pettersen, Conrad C. Huang, **Ruchira S. Datta**, Parthasarathy Sampathkumar, Mallur S. Madhusudhan, Kimmen Sjölander, Thomas E. Ferrin, Stephen K. Burley and Andrej Sali, "ModBase, a database of annotated comparative protein structure models, and associated resources", in *Nucleic Acids Research* 2011, 39(suppl 1): D465–D474. doi:10.1093/nar/gkq1091 *Featured article (top 5%).*

Ruchira S. Datta, Matthew W. Lux, Philip E. Bourne, "PLoS Computational Biology Conference Postcards from PSB 2010", in *PLoS Computational Biology* 2010, 6(4):e1000746. doi:10.1371/journal.pcbi.1000746

Allyson L. Lister, **Ruchira S. Datta**, Oliver Hoffman, Roland Krause, Michael Kuhn, Bettina Roth, Reinhard Schneider, "Live Coverage of Intelligent Systems for Molecular Biology/European Conference on Computational Biology (ISMB/ECCB) 2009", in *PLoS Computational Biology* 2009, 6(1): e1000640.

Allyson L. Lister, **Ruchira S. Datta**, Oliver Hoffman, Roland Krause, Michael Kuhn, Bettina Roth, Reinhard Schneider, "Live Coverage of Scientific Conferences Using Web Technologies", in *PLoS Computational Biology* 2009, 6(1): e1000563.

P. Gaudet, L. Lane, P. Fey, A. Bridge, S. Poux, A. Auchincloss, K. Axelsen, S. Braconi Quintaje, E. Boutet, P. Brown, E. Coudert, **R.S. Datta**, W.C. de Lima, T. de Oliveira Lima, S. Duvaud, N. Farriol-Mathis, S. Ferro Rojas, M. Feuermann, A. Gateau, U. Hinz, C. Hulo, J. James, S. Jimenez, F. Jungo, G. Keller, P. Lemercier, D. Lieberherr, M. Moinat, A. Nikolskaya, I. Pedruzzi, C. Rivoire, B. Roechert, M. Schneider, E. Stanley, M. Tognolli, K. Sjölander, L. Bougueleret, R.L. Chisholm, and A. Bairoch, "Collaborative annotation of genes and proteins between UniProtKB/Swiss-Prot and dictyBase", in *Database* 2009:bap016, doi:10.1093/database/bap016

Ruchira S. Datta, "Polynomial Graphs With Applications To Graphical Games, Extensive-Form Games, and Games With Emergent Node Tree Structures", `arXiv.org:math.AC/0612463`.

Ruchira S. Datta, "Using Computer Algebra to Compute Nash Equilibria", in the (refereed) *Proceedings of the 2003 International Symposium on Symbolic and Algebraic Computation*, August 2003, pp. 74–79.

Mustafa Ergen, Duke Lee, **Ruchira Datta**, Jeff Ko, Anuj Puri, Raja Sengupta, and Pravin Varaiya, "Comparison of Wireless Token Ring Protocol with IEEE 802.11", in *Journal of Internet Technology*, Vol. 4, No. 4.

Teaching Experience

Ohio State: Mathematics; Mentor; Fall 2014; Mentored forty calculus students in six small group projects.

UC Davis: Mathematics; Lecturer; Winter 2004; Teaching two large calculus lecture courses (two preps).

UC Berkeley: Mathematics; Graduate Student Researcher; Fall 2002–Fall 2003; Coordinating seminar on Mathematics of Phylogenetic Trees, Fall 2003.

UC Berkeley: Mathematics; Technical Assistant; Summer 2002; Editing, indexing, and contributing to the book *Solving Systems of Polynomial Equations*.

UC Berkeley: Mathematics; Graduate Student Instructor; Spring 1994–Fall 1995; teaching two discussion sections of 40 students each; in three semesters, linear algebra and differential equations; in one semester, multivariable calculus.

Patents

Inventors: **Datta, Ruchira S.**, and Lopiano, Fabio. *Query language determination using query terms and interface language*, U.S. Patent 8,762,358.

Inventor: **Datta, Ruchira S.** *Augmenting queries with synonyms from synonyms map*, U.S. Patent 8,255,376.

Inventor: **Datta, Ruchira S.** *Simplifying query terms with transliteration*, U.S. Patent 7,835,903.

Inventors: **Datta, Ruchira S.**, and Lopiano, Fabio. *Augmenting queries with synonyms selected using language statistics*, U.S. Patent 7,475,063.

Invited Talks

Ecology and Evolution of Cancer, MBI, September 2014
Workshop on Game Theory and Cancer, Johns Hopkins, August 2013
Integrative Cancer Biology Program, Webinar, May 2013
rEvolution Symposium, Stanford, California, March 2012
Princeton Physical Science of Cancer, Webinar, November 2011
WTGC, Hinxton, Cambridge, UK, The Quest for Orthologs, July 2011
Los Cabos, México, World Molecular Engineering Network, May 2010
Bay Area Bioinformatics Meetup, Berkeley, California, April 2010
Plant & Animal Genome, Phylogenomics Workshop, January 2010
Western Evolutionary Biology Meeting, Berkeley, California, December 2009
ISMP, Chicago, Illinois, August 2009
WTGC, Hinxton, Cambridge, UK, The Quest for Orthologs, July 2009
Vrije Universiteit Amsterdam, Netherlands, IBIVU Seminar, June 2009
Cloudera Inc., Technical Talk, June 2009
Plant & Animal Genome, Phylogenomics Workshop, January 2009
BiCi, Italy, Biological Networks, September 2008
CGS, UNAM, México, Workshop on Phylogenomics, August 2008
DoE MAGGIE Review Meeting, Lawrence Berkeley Laboratory, November 2007
UC Berkeley, Student Algebraic Statistics Seminar, May 2007
UC Davis Genome Center, Evolution Discussion Group Seminar, May 2007
Virginia Bioinformatics Institute, Research Seminar, April 2007
IBM Almaden Research, Technical Talk Series, March 2007
Stanford, Seminar Series in BioMathematical Methodology, March 2007
IMA, Industrial Problems Seminar, February 2006

San Francisco State, Algebra-Geometry-Combinatorics Seminar, December 2005
Google Inc., Zürich Tech Talk Series, May 2005
Santa Clara University, Math Colloquium, April 2005
Bay Area Discrete Mathematics Day, San José State University, April 2005
Computational Real Algebraic Geometry Workshop, MSRI, April 2004
UC Berkeley, Microeconomic Theory Seminar, February 2004
UC Davis, Discrete Math & Representation Theory Seminar, February 2004
Tulane University, Math Colloquium, February 2004
University of Arizona, Special Mathematics Colloquium, January 2004
Georgia Tech, Informal Geometry Seminar, November 2003
Lockheed Martin, Modelling, Simulation & Information Sciences, August 2003
Lawrence Berkeley Laboratory, Arkin Lab Systems Biology, July 2003
NSF/DARPA CARGO Review Meeting, Santa Rosa, California, May 2003
Microsoft Research, Theory Group Seminar, March 2003
University of Minnesota, Combinatorics Seminar, September 2002
UC Davis, Informal Optimization Seminar, May 2002
UC Berkeley, Research Seminar in Computational Biology, April 2001
UIUC, Wireless Networks and Convergence, October 2001

Conference Talks

ISSAC, Drexel University, August 2003
MTNS, Notre Dame University, August 2002
Symbolic Computational Algebra, University of Western Ontario, July 2002

Posters

Ruchira S. Datta and Carlo C. Maley "Modelling the dynamics of tumor heterogeneity", *Ecological and evolutionary perspectives in cancer*, Roscoff, France, November 2013

Ruchira S. Datta, Alice Gutteridge, Charles Swanton, Carlo C. Maley, Trevor A. Graham, "Modelling the evolution of genetic instability during tumour progression", *Biology and Mathematics in the Bay Area*, Berkeley, California, November 2012

R.S. Datta, U. Pieper, A. Sali, and K. Sjölander, "Phylogenomic Inference for Functional Annotation of a Bacterial Genome: *Helicobacter pylori*", *Meeting in Microbial Genomics*, Lake Arrowhead, California, September 2010 **Ruchira Datta** and Kimmen Sjölander, "Phylogenomic Inference for Large Scale Microbial Functional Annotation", *Human Microbiome Research Conference*, St. Louis, Missouri,

August–September 2010

Ruchira S. Datta and Kimmen Sjölander, "Berkeley PHOG: Phylogenomic Orthology Prediction, With Applications to Inferring Interactions", *Computational Systems Bioinformatics (CSB)*, Stanford, August 2010

Ruchira S. Datta, Sriram Sankararaman, Bryan Kolaczkowski, Dean Starrett, Chris Meacham, and Kimmen Sjölander, "New Methods from the Berkeley Phylogenomics Group", *Intelligent Systems for Molecular Biology (ISMB)*, Stockholm, July 2009

Ruchira S. Datta, Terry Farrah, Sriram Sankararaman, David Eramian, Eswar Narayanan, Andrej Šali, and Kimmen Sjölander, "Matchmaker: Improving alignment accuracy through phylogenomics", *Protein Modeling Workshop*, UCSF, July 2008

Kimmen Sjölander, Duncan Brown, Nandini Krishnamurthy, and **Ruchira S. Datta**, "Automated Protein Subfamily Identification : PhyloFacts Phylogenomics Encyclopedias", *Intelligent Systems for Molecular Biology (ISMB)*, Toronto, July 2008

Grant Submissions Completed

K99 to NIGMS of NIH, February 2011.

Journals Refereed

Comparative and Functional Genomics; PLoS ONE.

Organizing Committees

Bay Area Discrete Mathematics Day, 2006–2009.

Previous Employment Experience

Lockheed Martin; Technical Associate; Summer 2003; Implementing A* algorithm for integer programming with Lagrangian heuristic.

UC Berkeley: Electronics Research Lab & Institute for Transporation Studies; Graduate Student Researcher; Summer 2001–Summer 2002. Implementing Wireless Token Ring Protocol; researching ad-hoc service networks.

SRC Systems Inc.; Thermal Analysis; Software Engineer; 1996–1998. Primarily responsible for maintaining and adding functionality to commercial software application for thermal analysis of buildings.

Hewlett-Packard Laboratories: 3D Modeling; Technical Associate; 1995. Designing and implementing spreadsheet interface for 3D modelling.

Lawrence Berkeley Laboratory: Earth Sciences; Staff Scientist; 1994. Interactively generating 2-dimensional Voronoi diagrams.

Lockheed Martin: Tomography; Programmer/Analyst; 1993. Implementing the Feldkamp algorithm for 3-D reconstruction from X-ray images.

UC Berkeley: Materials Science & Mineral Engineering; Graduate Student Researcher; 1992. Randomly generating tangent discs under constraint.

Woodward-Clyde Consultants: Seismology; Programmer/Analyst; 1991. Calculating theoretical seismograms.

AT&T Bell Labs; Technical Associate; 1990. Generating conformance tests of a PBX switch to the ASAI protocol.

AT&T Bell Labs; Technical Associate; 1989. Developing software for generating conformance tests of boundary-scan hardware implementations, later marketed by AT&T as TAPDANCE.

AT&T Bell Labs; Technical Associate; 1988. Developing software to decode several OSI layers of communication protocols for a passive protocol monitor.

AT&T Information Systems; Technical Associate; 1987. Developing software to audit a database.

Professional Society Memberships

AMS (American Mathematical Society)

SMB (Society for Mathematical Biology)

SIAM (Society for Industrial and Applied Mathematics)

References

Upon request.