

Brian Ruttenberg

Curriculum Vitae

Santa Barbara, CA

☎ (916) 276-9542

✉ ruttenberg@gmail.com

🌐 www.cs.ucsb.edu/~berutten

Research Interests

- Data mining using probabilistic models, graph theory and statistical testing
- Bio-imaging and bioinformatics
- Querying and mining of uncertain/probabilistic data

Education

2008–present **PhD (Expected June, 2012)**, *University of California*, Santa Barbara, CA.
PhD in Computer Science, GPA: 3.9/4.0

- Significant Courses: Bioinformatics, Computer Imaging, Experimental Cytology and Digital Imaging, Multimedia Index Structures, Parallel and Distributed Systems, Combinatorial Algorithms, Computer Architecture, Web Mining

2006–2008 **MS**, *University of California*, Santa Barbara, CA.
Masters in Computer Science

1996–2000 **BSE**, *University of Michigan*, Ann Arbor, MI.
Bachelors of Science in Computer Engineering, GPA: 3.52/4.0, *magna cum laude*

Experience

Research

2007–present **Graduate Student Researcher**, *Center for Bio-Image Informatics*, Santa Barbara, CA.
Knowledge discovery in biological and image data using novel computer science and statistical methods.

- *Community Detection on Spatially Embedded Networks*. (In progress).
- *Modeling cellular properties via probabilistic graph models*. Physical properties, such as size and shape, of a certain cell in the retina are highly influenced by and spatially correlated with the structure of the retinal vasculature. This project develops a Markov Random Field model of cell physical properties using cellular-vascular spatial interaction in the retina. Training of the model on healthy retinas reveals the structure of cellular-vascular interaction inherent the tissue. In addition, simulation and inference on detached retinas reveals the physical and spatial changes occurring in the retina after injury.
- *Improvement of K-NN queries on probability distributions using the Earth Mover's Distance*. K-NN queries that employ the Earth Mover's distance (EMD) are computationally complex. This project developed a new lower bound to the EMD and an accompanying low dimensional index that significantly improved query time. Multi-dimensional probability distributions were projected onto a vector, and each projected distribution is approximated by a normal distribution and an error term. A constant time lower bound is computed between distributions using the approximations. The approximated distributions are Hough transformed and embedded into a low dimensional index for efficient querying performance.

- *Statistical analysis of cellular and vascular spatial relationships in retinal tissue images.* This project analyzed the spatial distribution of glial cells in the retina relative to the vascular system, in response to retinal detachment. Cell and blood vessel features were extracted from whole tissue mosaics of the retina. A geodesic feature space based on the structure of the vasculature was developed and cell locations in the retina were embedded into the new vascular space. Histograms of the cell locations in vascular space were constructed, and a statistical test of similarity based on the Mallows distance was employed to show that the spatial relationship between glial cells and the vasculature does not change after detachment.
- *Investigation of opsin protein origin using novel sequence alignment algorithms.* Opsins are a transmembrane protein that had been hypothesized to originate via internal domain duplication. This theory was tested by a specifically designed sequence alignment algorithm that restricted valid alignments to those that could arise from internal duplication. Hundreds of opsin proteins were tested and compared with a random model, resulting in rejection of the duplication hypothesis for opsins.

2007–2007 **Intern, National Institutes of Health, Bethesda, MD.**
 Developed proteomics tools at National Heart, Lung and Blood Institute

- *Researched and designed PhosphoScore, a new algorithm to detect and score phosphorylation sites in mass spectrometry data.* Phosphorylation site assignment in mass spectrometry data is difficult due to the immense number of combinations and noisy data. This project developed a new scoring method for MS^n phosphorylation site assignment. A normal distribution cost function was designed to predict site assignment, and a search algorithm was employed to determine the optimal parameters of the cost function. A Java GUI was developed for ease of use, and the software released as an open source tool.

Professional

2004–2006 **Senior Engineer, Qualcomm, Inc, San Diego, CA.**
 Mobile 3-D graphics hardware group

- Responsible for the entire architecture of the 3D front end in graphics shader core
- Designed and implemented rasterization, triangle setup and blending for mobile chipsets

2000–2004 **Senior Component Design Engineer, Intel Corp, Folsom, CA.**
 Integrated 3-D graphics hardware group

- Architected and implemented memory and caching systems for three different graphics cores used in eight of Intel's chipsets
- Successfully designed a new feature on Intel's 3D graphics core that resulted in 10–15% speedup on 3D applications

Teaching

2008–2008 **Graduate Teaching Assistant, University of California, Santa Barbara, CA.**
 Introduction to C, C++ and Unix

Doctoral Dissertation

title *Mining and Modeling of Biological Images, (Expected)*
 advisor Ambuj K. Singh, University of California, Santa Barbara

Awards

2009–2010 **Dean's Fellowship, University of California, Santa Barbara, CA.**

Publications

Journals and Conferences

B. Rutenber and A. Singh, "Indexing the earth mover's distance using normal distributions," *Proceedings of the VLDB Endowment*, vol. 5, no. 3, 2011.

P. Suwannat, G. Luna, B. Rutenber, R. Raviv, G. Lewis, S. Fisher, and T. Hollerer, "Interactive visualization of retinal astrocyte images," in *IEEE International Symposium on Biomedical Imaging*, 2011, pp. 242–245.

B. E. Rutenber, T. Pisitkun, M. A. Knepper, and J. D. Hoffert, "PhosphoScore: An Open-Source Phosphorylation Site Assignment Tool for MSn Data," *Journal of Proteome Research*, vol. 7, no. 7, pp. 3054–3059, 2008.

N. D. Larusso, B. E. Rutenber, A. K. Singh, and T. H. Oakley, "Type II Opsins: Evolutionary Origin by Internal Domain Duplication?" *Journal of Molecular Evolution*, vol. 66, no. 5, pp. 417–423, 2008.

P. Uawithya, T. Pisitkun, B. E. Rutenber, and M. A. Knepper, "Transcriptional Profiling of Native Inner Medullary Collecting Duct Cells From Rat Kidney," *Physiol. Genomics*, vol. 32, no. 2, pp. 229–253, 2008.

Posters and Talks

B. E. Rutenber, N. Larusso, and A. K. Singh, "Spatial Modularity in Biological Networks," in *Automated Imaging and High Throughput Phenotyping, Cold Spring Harbor Lab*, 2012, Selected Talk.

B. E. Rutenber and A. K. Singh, "Spatial Modeling and Mining of the Retina," in *Workshop on Bio-Image Informatics: Biological Imaging, Computer Vision and Data Mining*, 2010.

N. Larusso, B. E. Rutenber, and A. K. Singh, "Probabilistic Analysis of Retinal Neuron Morphology," in *Workshop on Bio-Image Informatics: Biological Imaging, Computer Vision and Data Mining*, 2008.

—, "Probabilistic Analysis of Ganglion Cell Morphology," in *UCSB Graduate Student Workshop on Computing*, 2007.

Patents

G. Jiao, B. Rutenber, C. Yu, and Y. Du, "Graphics Processing Unit With Shared Arithmetic Logic Unit," U.S. Patent #8,009,172, 2011.

—, "Graphics Processing Unit With Extended Vertex Cache," U.S. Patent #7,952,588, 2011.

G. Jiao, W. Torzewski, C. Yu, and B. Rutenber, "Universal Rasterization of graphic primitives," U.S. Patent #7,791,605, 2010.

B. Rutenber and P. Surti, "Efficient Use of a Render Cache," U.S. Patent #7,760,804, 2010.

P. Surti, B. Rutenber, and A. Navale, "Banking Render Cache for Multiple Access," U.S. Patent #7,320,053, 2008.

Technical Skills

Languages	C/C++, Java, Perl, Bash, L ^A T _E X	Packages	OpenCV, Boost, MPI
Platforms	Linux, Windows	Scientific	Matlab

Professional Activities

External Reviewer

2011 ICDM, Proceedings of VLDB, ICDE, International Workshop on Graph Data Management

2010 ICDE, PAKDD, SIGMID, The VLDB Journal

2009 ICDE, KDD, SDM

2008 Proceedings of VLDB, KDD

Mentoring

2008–2009 Apprentice Researchers Summer Mentorship Program