

# MATTHEW DOUGLAS HOFFMAN

Postdoctoral Researcher, Columbia University

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## EDUCATION:

Ph.D., Computer Science, Princeton University, November 2010.

M.A., Computer Science, Princeton University, September 2006.

B.A., Management-Engineering, Claremont McKenna College, December 2003.

B.S., Computer Science, School of Engineering and Applied Science, Columbia University, May 2003.

Thomas Jefferson High School Degree, Thomas Jefferson High School for Science and Technology, June 1999.

## TEACHING EXPERIENCE:

Spring 2009: Adjunct Professor, New York University. E85.2607: Advanced Digital Signal Theory.

Spring 2007: Teaching Assistant, Princeton University. Computer Science/Music 325: Transforming Reality By Computer (Digital Signal Processing for Music).

Spring 2006: Teaching Assistant, Princeton University. Computer Science 226: Algorithms and Data Structures.

Fall 2005: Teaching Assistant, Princeton University. Computer Science 109: Computers in Our World.

## WORK EXPERIENCE:

*September, 2010–Present:* Postdoctoral Researcher, Columbia University Department of Statistics.

Postdoctoral research fellowship under the supervision of Prof. Andrew Gelman, addressing computational issues associated with Bayesian inference in hierarchical probabilistic models.

*August, 2004–September, 2010:* Research Assistant, Princeton University Computer Science Department, Princeton, New Jersey.

Conducted research and wrote on online variational inference, nonparametric Bayesian models for latent source discovery and separation, automatic music annotation, content-based estimation of similarity for recorded music, automatic estimation of dissonance in recorded music, using global optimization heuristics and perceptual modeling to control complex musical synthesizers, content-based search of large speech audio corpora, and improving the auditory display of medical data obtained in real time.

*May–August, 2008:* Intern, Google, New York, New York.

Sped up core Google web search retrieval by 3% by further improving highly optimized C++ code.

*February–August, 2004:* Programmer, Bear, Stearns and Company, Inc, New York, New York.

Developed interfaces, analytics, and tools in C++ for mortgage trading desk.

*Summer, 2003:* Intern, Crushing Music, New York, New York.

Assisted with day-to-day operations of advertising music production house.

*Summers, 1998–2002:* Intern at Cincinnati Bell Information Systems/Convergys (Reston, VA), Global InfoTek Inc. (Reston, VA), Decisive Analytics Corporation (Arlington, VA).

Developed interfaces and implemented algorithms for various Java applications.

## GRANTS AWARDED:

2011–2012: Office of Naval Research, *Automated Audio Clustering*. Phase I SBIR grant. Consulting scientist to Decisive Analytics Corp., Arlington, VA.

#### AWARDS:

2nd place best student paper award, New York Academy of Sciences Machine Learning Symposium 2010 (for “Online Learning for Latent Dirichlet Allocation”).

Best student paper award, ISMIR 2009 (for “Easy as CBA: A Simple Probabilistic Model for Tagging Music”).

2nd place best student paper award, New York Academy of Sciences Machine Learning Symposium 2009 (for “Finding Latent Sources in Recorded Music With a Shift-Invariant HDP”).

#### INVITED TALKS:

“Probabilistic Graphical Models for the Analysis of Musical Audio,” New York Machine Learning Meetup, New York, New York, May 2011.

“Variational Bayesian Methods for Unsupervised Latent Factor Models of Text and Audio,” UCSD Computational Statistics and Machine Learning Group Colloquium, San Diego, California, February 2011.

“Variational Bayesian Methods for Unsupervised Latent Factor Models of Text and Audio,” I.B.M. T.J. Watson Research Center, Yorktown Heights, New York, November 2010.

“Online Learning for Latent Dirichlet Allocation,” Yahoo! Research, New York, New York, November 2010.

“Probabilistic Graphical Models for the Analysis of Musical Audio,” Columbia University Electrical Engineering Signal and Information Processing Seminar, New York, New York, October, 2010.

“Online Learning for Latent Dirichlet Allocation,” Columbia University Applied Mathematics Colloquium, New York, New York, October 2010.

“Probabilistic Graphical Models for the Analysis of Musical Audio,” Google, Mountain View, California, February, 2010.

“Probabilistic Graphical Models for the Analysis (and Synthesis) of Musical Audio,” New York University Computer Science Colloquium, New York, New York, November, 2009.

“Feature-Based Synthesis: When Machines Listen, What Do They Hear?” New York University Music and Audio Research Laboratory, October, 2008.

#### PROFESSIONAL ACTIVITIES:

Journal Reviewing: Journal of Machine Learning Research (JMLR); IEEE Transactions on Audio, Speech, and Language Processing (IEEE TASLP); IEEE Transactions on Neural Networks (IEEE TNN); Pattern Recognition Letters; IEEE Transactions on Pattern Analysis and Machine Intelligence (IEEE TPAMI); Statistics and Computing.

Conference Reviewing: Advances in Neural Information Processing Systems (NIPS), International Conference on Artificial Intelligence and Statistics (AISTATS), Conference on Artificial Intelligence (AAAI), IEEE Conference on Audio, Speech, and Signal Processing (ICASSP), International Society for Music Information Retrieval conference (ISMIR), International Computer Music Conference (ICMC).

Consulting: Decisive Analytics, Inc.; Imagine Research, Inc.

#### PUBLICATIONS (most available online at <http://www.cs.princeton.edu/~mdhoffma/publications>):

M. Hoffman, A. Gelman, “The No-U-Turn Sampler: Adaptively Setting Path Lengths in Hamiltonian Monte Carlo,” submitted.

M. Hoffman, “Poisson-Uniform Nonnegative Matrix Factorization,” submitted to *Proceedings of the IEEE Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, Kyoto, 2012.

M. Hoffman, D. Blei, F. Bach, “Online Learning for Latent Dirichlet Allocation,” in *Advances in Neural Information Processing Systems (NIPS)*, Vancouver, 2010. (Selected for spotlight presentation.)

(2nd place Best Student Paper Award, New York Academy of Sciences Machine Learning Symposium 2010)

M. Hoffman, “Probabilistic Graphical Models for the Analysis and Synthesis of Musical Audio,” Ph.D. Thesis,

Princeton University, 2010.

- M. Hoffman, D. Blei, P. Cook, “Bayesian Nonparametric Matrix Factorization for Recorded Music,” in *Proceedings of the International Conference on Machine Learning (ICML)*, Haifa, 2010.
- M. Hoffman, D. Blei, P. Cook, “Easy as CBA: A Simple Probabilistic Model for Tagging Music,” in *Proceedings of the 10th International Conference on Music Information Retrieval (ISMIR)*, Kobe, 2009. (Selected for oral presentation.) (Winner, Best Student Paper Award, ISMIR 2009)
- M. Hoffman, D. Blei, P. Cook, “Finding Latent Sources in Recorded Music With a Shift-Invariant HDP,” in *Proceedings of the 12th International Conference on Digital Audio Effects*, Como, 2009. (2nd place Best Student Paper Award, New York Academy of Sciences Machine Learning Symposium 2009)
- M. Hoffman, P. Cook, D. Blei, “Bayesian Spectral Matching: Turning Young MC into MC Hammer via MCMC Sampling,” in *Proceedings of the 2009 International Computer Music Conference*, Montreal, 2009.
- M. Hoffman, D. Blei, P. Cook, “Content-Based Musical Similarity Computation Using the Hierarchical Dirichlet Process,” in *Proceedings of the 9th International Conference on Music Information Retrieval*, Philadelphia, 2008. (Selected for oral presentation.)
- M. Hoffman, P. Cook, “Real-Time Dissonancizers: Two Dissonance-Augmenting Audio Effects,” in *Proceedings of the 11th International Conference on Digital Audio Effects*, Espoo, 2008.
- M. Hoffman, P. Cook, D. Blei, “Data-driven recomposition using the hierarchical Dirichlet process hidden Markov model,” in *Proceedings of the 2008 International Computer Music Conference*, Belfast, 2008.
- M. Hoffman, P. Cook, “The FeatSynth Framework for Feature-Based Synthesis: Design and Applications,” in *Proceedings of the 2007 International Computer Music Conference*, Copenhagen, 2007.
- M. Hoffman, P. Cook, “Real-time Feature-Based Synthesis for Live Musical Performance,” in *Proceedings of the 2007 International Conference on New Interfaces for Musical Expression*, New York, 2007.
- M. Hoffman and P. Cook, “Feature-Based Synthesis: Mapping from Acoustic and Perceptual Features to Synthesis Parameters,” in *Proceedings of the International Computer Music Conference*, New Orleans, 2006.
- Z. Wang, M. Hoffman, P. Cook, K. Li, “VFerret: Content-Based Similarity Tool for Continuous Archived Video,” in *Proceedings of the 3rd ACM Workshop on Continuous Archival and Retrieval of Personal Experiences*, Santa Barbara, 2006.
- M. Hoffman, P. Cook, “Feature-Based Synthesis: A Tool for Evaluating, Designing, and Interacting with Music-IR Systems,” in *Proceedings of the 7th International Conference on Music Information Retrieval*, Victoria, 2006.
- M. Hoffman, P. Cook, D. Vilkomerson, “Staining Doppler Audio,” in *Proceedings of the IEEE International Ultrasonics Symposium*, Vancouver, 2006.
- M. Hoffman, P. Cook, “Feature-Based Synthesis for Sonification and Psychoacoustic Research,” in *Proceedings of the International Conference on Auditory Display*, London, 2006.

Selected conference acceptance rates:

NIPS 2010, spotlight presentations: 6%.

ICML 2010: 26%

ISMIR 2009, oral presentations: 18%.

ISMIR 2008, oral presentations: 14%.