

# STEVEN K. TJOA

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## Education

- Ph. D., Electrical Engineering** University of Maryland · College Park, MD · 1/2007–5/2011  
Advisor: Prof. K. J. Ray Liu (President, IEEE Signal Processing Society; IEEE Fellow; AAAS Fellow).  
Dissertation: “Sparse and Nonnegative Factorizations for Music Understanding”
- M. S., Electrical Engineering** University of Maryland · College Park, MD · 8/2004–12/2006  
Advisor: Prof. K. J. Ray Liu.  
Scholarly Paper: “Digital Image Source Coder Identification: A Non-Intrusive Forensic Methodology”
- B. S., Computer Engineering** University of Maryland · College Park, MD · 8/2000–5/2004  
University Honors Program. Citation in Music Performance. UM Symphony Orchestra.

## Honors and Awards

- NSF/ASEE Small Business Postdoctoral Research Fellowship*, 2011  
Quality Reviewer, IEEE Int. Conf. Multimedia Expo (ICME), 2011  
UMD Distinguished Teaching Assistant, 2007, 2011  
ECEGSA Best Student Speaker, 2010 (awarded to two ECE graduate students)  
ECE TA Training and Development Fellow, 2010  
ECE Graduate Student Service Award, 2008 (awarded to one ECE graduate student)  
UMD Graduate Student Summer Research Fellowship, 2008 (awarded to fifty-six UMD graduate students)  
Lilly Conference Travel Grant, 2008  
UMD Future Faculty Fellow, 2008 (awarded to twenty UMD engineering graduate students)  
ECE George Corcoran Memorial Award, 2007 (awarded to one ECE graduate student)  
UMD Dept. of Resident Life Community Assistant of the Year, 2002  
UMD Presidential Scholarship, 2000  
ECE Departmental Scholarship, 2000  
Edward J. Bloustein Distinguished Scholar, New Jersey, 2000  
New Jersey Governor’s School of the Arts, 1999  
MENC All-Eastern Orchestra, Carnegie Hall, New York, 1999

## Industry Experience

- Research Engineer** Imagine Research, Inc. · San Francisco, CA · 6/2011–present  
Produced software that can classify and search for sound objects in digital media.  
Implemented machine learning and signal processing algorithms.  
Received a *Small Business Postdoctoral Research Fellowship* from the U. S. National Science Foundation (NSF).

## Research Experience

**Research Assistant, Dept. of ECE** University of Maryland · College Park, MD · 6/2005–5/2011

Developed sparse and nonnegative factorization methods for music information retrieval (MIR) tasks such as transcription, instrument recognition, and more.

Developed forensic methods to detect and classify traces of compression in digital images based solely upon information intrinsic to the image such as artifacts caused by pre-processing, transformation, and quantization.

Received a *Graduate Student Summer Research Fellowship* from the Graduate School for 2008.

**Research Assistant, Dept. of ECE** University of Maryland · College Park, MD · 1/2003–8/2003

Implemented an indoor location system using a four-antenna array for synchronous data collection following the IEEE 802.11b standard.

Programmed FPGAs in VHDL. Wrote API programs in C. Applied frequency estimation algorithms in Matlab.

## Journal Publications

- [1] W. S. Lin, S. K. Tjoa, H. V. Zhao, and K. J. R. Liu, “Digital image source coder forensics via intrinsic fingerprints,” *IEEE Trans. Information Forensics and Security*, vol. 4, no. 3, pp. 460–475, Sep. 2009.
- [2] S. K. Tjoa and K. J. R. Liu, “Spectral-temporal musical instrument recognition using nonnegative matrix factorization,” *IEEE Trans. Audio, Speech, and Language Processing*, under review.

## Conference Publications

- [1] S. Tjoa, W. S. Lin, H. V. Zhao, and K. J. R. Liu, “Block size forensic analysis in digital images,” in *Proc. IEEE Int. Conf. Acoustics, Speech, and Signal Processing*, vol. 1, Honolulu, HI, Apr. 2007, pp. I-633–I-636.
- [2] W. S. Lin, S. Tjoa, H. V. Zhao, and K. J. R. Liu, “Image source coding forensics via intrinsic fingerprints,” in *Proc. IEEE Int. Conf. Multimedia and Expo*, Beijing, China, Jul. 2007, pp. 1127–1130.
- [3] S. Tjoa, W. S. Lin, and K. J. R. Liu, “Transform coder classification for digital image forensics,” in *Proc. IEEE Int. Conf. on Image Processing*, vol. 6, San Antonio, TX, Sep. 2007, pp. VI-105–VI-108.
- [4] S. K. Tjoa and K. J. R. Liu, “Multiplicative update rules for nonnegative matrix factorization with co-occurrence constraints,” in *Proc. IEEE Int. Conf. Acoustics, Speech, and Signal Processing*, Dallas, TX, Mar. 2010, pp. 449–452.
- [5] S. K. Tjoa, M. C. Stamm, W. S. Lin, and K. J. R. Liu, “Harmonic variable-size dictionary learning for music source separation,” in *Proc. IEEE Int. Conf. Acoustics, Speech, and Signal Processing*, Dallas, TX, Mar. 2010, pp. 413–416.
- [6] M. C. Stamm, S. K. Tjoa, W. S. Lin, and K. J. R. Liu, “Anti-forensics of JPEG compression,” in *Proc. IEEE Int. Conf. Acoustics, Speech, and Signal Processing*, Dallas, TX, Mar. 2010, pp. 1694–1697.
- [7] S. K. Tjoa and K. J. R. Liu, “Musical instrument recognition using biologically inspired filtering of temporal dictionary atoms,” in *Proc. Int. Soc. Music Information Retrieval Conf.*, Utrecht, Netherlands, Aug. 2010, pp. 435–440.
- [8] M. C. Stamm, S. K. Tjoa, W. S. Lin, and K. J. R. Liu, “Undetectable image tampering through JPEG compression anti-forensics,” in *Proc. IEEE Int. Conf. Image Processing*, Hong Kong, Sep. 2010, pp. 2109–2112.
- [9] B. P. Keegan, S. K. Tjoa, and K. J. R. Liu, “Super-resolution of musical signals using approximate matching pursuit,” in *Proc. IEEE Workshop on Applications of Signal Processing to Audio and Acoustics*, New Paltz, NY, Oct. 2011, pp. 81–84.
- [10] S. K. Tjoa and K. J. R. Liu, “Factorization of overlapping harmonic sounds using approximate matching pursuit,” in *Proc. Int. Soc. Music Information Retrieval Conf.*, Miami, FL, Oct. 2011, pp. 257–262.

## Service and Leadership Activities

**Program Committee** AdMIRe 2012

**Technical Program Committee** IEEE ICME 2011, 2012

**Reviewer** Fourteen journal and forty-seven conference paper submissions.

**Journals** IEEE Trans. Information Forensics and Security, IEEE J. Selected Topics in Signal Processing, IEEE Signal Processing Letters, SPIE J. Electronic Imaging, Elsevier J. Visual Comm. and Image Representation.

**Conferences** IEEE ICME (2011, 2012), Dagstuhl Seminar on Multimodal Music Processing 2011, IEEE ICASSP (2008, 2012), IEEE ISCAS 2012, ISMIR 2011, AES 42, IEEE ICIP (2008, 2010), IEEE ICCAS 2006.

*Quality Reviewer*, ICME 2011

**Conference Volunteer** Various international conferences

Helped grade the MIREX contests at ISMIR 2010 and 2011.

Performed administrative tasks at IEEE ICASSP 2007 and ISMIR 2008.

**Coordinator, Entrepreneurial Activities** U. of Maryland · College Park, MD · 9/2009–5/2011

Helped organize colloquia and social events related to entrepreneurship.

**Graduate Dean's Student Advisory Committee** U. of Maryland · College Park, MD · 1/2008–5/2011

Advised the Graduate Dean on graduate-level academic issues at the University of Maryland including assistantship policy, mentoring, entrepreneurship, ethics, career placement, inter-departmental collaboration, awards and recognition, revision of the UMD Strategic Plan, facility renovations, and more.

Was invited for membership by nomination.

**President, ECEGSA** University of Maryland · College Park, MD · 7/2007–6/2008

Led the Electrical and Computer Engineering Graduate Student Association (ECEGSA), an organization that unites the ECE graduate student body through social, academic, and professional activities.

Managed a board of nine graduate students. Communicated regularly with a graduate student body of over 400. Served as the primary interface between the graduate students and faculty, staff, industry, and professional organizations.

Organized and moderated weekly research seminars, panel discussions, and award ceremonies.

Organized such social events as hiking, skiing, barbecues, weekly coffee hours, and more.

Received the *Graduate Student Service Award* from the Department of Electrical and Computer Engineering for the 2007-2008 academic year.

**Lab Manager** University of Maryland · College Park, MD · 6/2007–5/2011

Handled everyday concerns related to the Multimedia Signal Processing Laboratory, including computer maintenance, item inventory, and lab organization.

Designed, created, and maintained the Signals and Information Group web site.

**Volunteer, Laboratory Demonstrations** University of Maryland · College Park, MD · 4/2006–4/2011

Volunteered during several demonstrations in the Multimedia Signal Processing Laboratory, including Maryland Day 2006-2011 and many others.

Spoke in front of general audiences. Assisted with hands-on demonstrations.

**Community Assistant, Dept. of Resident Life** Univ. of Maryland · College Park, MD · 8/2001–8/2002

Provided customer service to students, parents, staff, and faculty within the UMD community. Maintained security of keys and packages within North Hill resident halls.

Received an award for *Community Assistant of the Year* for the 2001-2002 academic year.

## Invited Talks

Two lecture and five poster presentations at international conferences.

“My First Four Months at a Tech Startup,” University of Maryland, College Park, MD, October 21, 2011. ECEGSA seminar.

“Music Information Retrieval in Polyphonic Mixtures,” Stanford University, CA, June 29, 2011. Center for Computer Research in Music and Acoustics (CCRMA) Workshop on MIR.

“L<sup>A</sup>T<sub>E</sub>X From Scratch,” University of Maryland, College Park, MD, February 8, 2011. Workshop for ECE students. Wrote [L<sup>A</sup>T<sub>E</sub>X At A Glance](#) for participants.

“Make It Stick: Get Students to Remember Your Message,” University of Maryland, College Park, MD, October 27, 2010. Workshop for graduate ECE teaching assistants. *Selected feedback*: “I like Steve’s workshops, he’s good.” “Very helpful.” “Really useful and interesting.” “Informative and very easy to listen to.” “That’s what every TA needs to know.”

“Factorizing Bach: Recent Convergences Between Music and Machines,” University of Maryland, College Park, MD, February 19, 2010. ECEGSA seminar on music information retrieval. Received an *ECEGSA Best Student Speaker Award* for 2009-10.

“Public Speaking: Conquering your fears through practice,” University of Maryland, College Park, MD, March 5, 2009. Workshop for graduate ECE teaching assistants.

“Time Management for Teaching Assistants: There is Not Enough Time in the Day,” University of Maryland, College Park, MD, October 16, 2008 and March 8, 2010. Workshop for graduate ECE teaching assistants.

## Teaching Experience

### Selected Student Feedback as TA

“Steve Tjoa - Best TA in the university.” “Steve was the best TA that I have ever had at UMD. Always had an answer to any question asked and used discussion time effectively.” “The TA Steve Tjoa, was the best TA I have ever had at Maryland” “he is absolutely the best TA I’ve ever had. His way of explaining things is really amazing.” “Best TA I’ve had in EE. Knows material well, explains concepts well.” “by far the best TA I ever had at UMD.” “great understanding of the subject.” “very friendly and approachable.” “offers insight and suggestions.” “always full of energy.” “enthusiastic.” “well organized, conveyed concepts clearly.” “understands student’s needs and difficulties.” “fair and sincere.” “communicates well.” “one of the most dedicated TAs I’ve had.” “one of the most helpful TAs I’ve come across.” “extremely helpful at all times and motivates you to do good work in lab.” “holds additional office hours and is very fair at grading reports.” “I hope you win the best TA award.”

### Teaching Assistant, ENEE324H University of Maryland · College Park, MD · Spring 2011

Taught one section (eighteen students) of ENEE324H: Engineering Probability (Honors section).

Held regular office hours. Graded homework assignments.

### Co-lecturer, ENEE322 University of Maryland · College Park, MD · Fall 2009

Lectured ENEE322: Signal and System Theory (forty-eight students) for 33% of the Fall 2009 semester. Designed lesson plans, homework assignments, and exams.

Mentored two teaching assistants. Held regular office hours and review sessions. Graded exams.

Selected Student Feedback: “The techniques used by Steve work very well for me.” “really great balance between theory and examples.” “good balance between theory and examples.” “extremely well-taught course.” “seemed genuinely interested in helping students.” “very approachable!” “has motivated me to branch into DSP.” “has been my best class this semester.” “Awesome class!!! my favorite this semester.”

### Teaching Assistant, ENEE408G University of Maryland · College Park, MD · 1/2006–5/2008

Taught ENEE408G: Multimedia Signal Processing over five semesters (fifty-seven students total). Administered four design projects per semester. Assisted with final semester projects, providing directions for research.

Also mentored four groups (twenty students total) in Spring 2010 on final semester projects related to music information retrieval.

Coauthored various assignments and programming guides. Held regular office hours and graded lab reports.

Received the *George Corcoran Memorial Award* from the Department of Electrical and Computer Engineering for the 2006-2007 academic year.

Received a *Distinguished Teaching Assistant Award* from the Center for Teaching Excellence.

Received a travel grant to the *Lilly-East Conference on College and University Teaching*.

**Teaching Assistant, ENEE241** University of Maryland · College Park, MD · Fall 2007, Fall 2010

Taught ENEE241: Numerical Techniques in Engineering over two semesters (thirty-seven students total).

Held regular office hours. Helped design exams. Graded homework assignments and exams.

**Teaching Assistant, ENEE428** University of Maryland · College Park, MD · Fall 2005

Taught one section (four students) of ENEE428: Communications Design Laboratory. Assisted students with DSP programming of the TI TMS320C6701. Administered lab assignments.

Held office hours and graded lab reports for both sections (sixteen students).

**Honors 100 Section Leader** University of Maryland · College Park, MD · Fall 2002

Taught a weekly honors seminar (fourteen students), HONR100, as part of the University Honors Program. Introduced college freshmen to the qualities of a liberal education (e.g., diversity, current events, community service, arts), and helped them facilitate the transition from high school to college (e.g., academic planning, campus resources).

## Internships

**Intern, Satellite Management Systems** Intelsat · Washington, DC · 6/2004–8/2004

Performed software tests on telemetry and flight dynamic commanding for Loral Ground Network Systems integration. Assisted with maintenance of software documentation.

**Intern, Satellite Engineering** Intelsat · Washington, DC · 6/2002–11/2002

Performed software and database testing for the IS-X satellite series. Revised acceptance test plans and software requirement specifications.

## Graduate Coursework

**Signal Processing** Advanced Digital Signal Processing, Digital Image Processing, Space-Time Signal Processing (A+), Auditory Scene Analysis (A+)

**Machine Learning** Statistical Pattern Recognition (A+), Pattern Recognition in Temporal Data

**Communications** Random Processes, Information Theory, Estimation and Detection Theory, Random Graphs

**Optimization and Controls** System Theory, Optimal Control, Advanced Numerical Optimization, Convex Optimization (A+), Networked Control Systems, Foundations of Optimization

**Computing** Numerical Analysis, Digital Computer Design, Real-Time Collision Detection

**Miscellaneous** Future Faculty Program Seminar I/II/III, Teaching Practicum (A+), Technology Law (A+)

## Computer Skills

**Languages** Python, C, Java, Matlab/Octave, Perl, PHP, HTML/XML

**OSs, Servers, Databases, etc.** Unix/Linux, Mac OS X, Windows, Apache, Cherokee, MySQL, SQLite, Amazon Web Services EC2/S3

**Hardware** TI TMS320C6701 EVM

## Web Site Development

Signals and Information Group, 8/2005 – 5/2011 (<http://sig.umd.edu/>)

ENEE408G, Spring 2006 – Spring 2007 (<http://www.ece.umd.edu/class/enee408g.S2007/>)

IEEE Journal on Selected Areas in Communications, special issue on Cooperative Communications and Networking, 9/2005 – 8/2006 (<http://dsplab.eng.umd.edu/jsac-ccn/>)

Language Media Services, 9/2004 – 8/2005 (<http://www.languages.umd.edu/langctr/lms/>)

## Miscellaneous

Born in New Jersey, USA. United States citizen.

Studied violin under Ms. Ayako Hosoi (formerly w/ New Jersey SO) and Dr. James Stern (U. Maryland).