

Curriculum Vitae for
Steven J. Rennie

Research Scholar
Human Language Technologies Department
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CURRENT RESEARCH

The invention and analysis of probabilistic learning and inference algorithms for information processing.

Ph.D. Thesis: *Graphical Models for Robust Speech Recognition in Adverse Environments.*

EDUCATION

Ph.D., Electrical and Computer Engineering (2003- 2008)

University of Toronto, Canada
Advisors: Parham Aarabi and Brendan J. Frey
External Appraiser: Li Deng

M.A.Sc., Electrical and Computer Engineering (2001-2003)

University of Toronto, Canada
Advisor: Parham Aarabi

B.A.Sc., Engineering Science (1994-1998)

University of Toronto, Canada
Thesis Advisor: Scott Bortoff

EXPERIENCE

Research Scholar, *IBM Research, Human Language Technology Department, T.J. Watson Research Center, NY, U.S.A.* (February 2007- present)

Projects: Efficient model-based speech separation and noise removal, HMM clustering, multi-talker speech recognition, hierarchical source reconstruction.

Research Assistant, *Artificial Perception Lab and Probabilistic and Statistical Inference Group, University of Toronto, Canada* (September 2001- February 2007)

Projects: Speech separation using microphone arrays; motion field analysis; fingerprint compression and recognition (in collaboration with Bioscrypt Inc.).

Research Intern, *IBM Research, Human Language Technology Department, T.J. Watson Research Center, NY, U.S.A.* (January- May 2006)

Project: Super-human multi-talker automatic speech recognition.

Research Intern, *IBM Research, Human Language Technology Department, T.J. Watson Research Center, NY, U.S.A.* (May- August 2005)

Project: Dynamic noise adaptation for robust ASR in car environments.

Teaching Assistant, *University of Toronto, Canada* (2001-present)

Courses taught:

ECE431: Digital Signal Processing

ECE356: Linear Systems and Control

ECE302: Probability and Applications (2X)

ECE299: Communication and Design II

ECE159: Fundamentals of Electricity (2X)

MAT298: Linear Algebra and DFQs (2X)

Software Designer, *MD Robotics, International Space Station Program (ISSP)* (2000-2001)

Designed and implemented an emulation of the Space Station Robotics Workstation in MS NT, capable of hosting the workstation kernel to support real-time testing, integration, and verification of the flight software, off-target; the first such tool of its kind in the ISSP.

Electrical Engineer, *MD Robotics, International Space Station Program (ISSP)* (1998-2000)

Managed a team of 5 electrical engineers as technical lead of the pre-flight Space Station CanadaArm Software Test Facility upgrades. Appointed onto the Space Station CanadaArm critical technical problems resolution consortium in 1999.

Research Assistant, *Institute of Biomedical Engineering, U of T, Canada* (1997)

Developed control experiments for a line-of-sight tracking system developed by El Mar Ltd. for military pilot training. Identified system limitations and sources of tracking error related to hardware and algorithm design.

Software Developer, *Array Systems Inc., Canada* (1997)

Developed image processing and video device driver software as a member of the Spotlight Synthetic Aperture Radar (SSAR) project development team.

ACADEMIC TALKS AND PRESENTATIONS

Oral Presentation: **Efficient Speech Separation and Denoising using Non-negative Subspace Analysis**, *IEEE Conference on Acoustics, Speech, and Signal Processing*, Las Vegas, USA, April 2008.

Invited talk: **Non-negative Subspace Analysis**. IBM T. J. Watson Research Center, NY, U.S.A., December 2007.

Invited talk: **Graphical Models for Robust Speech Recognition**. IBM T. J. Watson Research Center, NY, U.S.A., September 2006.

Invited talk: **Graphical Models for Robust Speech Recognition in Adverse Environments**. Multimodal, Pittsburgh, U.S.A., August 2006.

Poster Presentation: **Dynamic noise adaptation**. *IEEE Conference on Acoustics, Speech, and Signal Processing*, Toulouse, France, May 2006.

Invited talk: **Dynamic noise adaptation for robust ASR in car environments**. IBM T. J. Watson Research Center, NY, U.S.A., August 2005.

Poster Presentation: **Variational speech separation of more sources than mixtures**. *Tenth International Workshop on Artificial Intelligence and Statistics*, Barbados, January 2005.

Invited talk: **Probabilistic speech separation using microphone arrays.** *Symposium on Information Processing*, University of McMaster, Canada, September 2004.

Poster Presentation: **Robust variational speech separation using fewer microphones than speakers.** *IEEE Conference on Multimedia and Expo*, Baltimore, U.S.A., July 2003.

Invited talk: **A new generative model for probabilistic speech separation using microphone arrays.** *Symposium on Information Processing*, University of Toronto, Canada, September 2003.

ACTIVITIES AND AWARDS

Selected to review numerous top international conferences and journals including the *IEEE Transactions on Speech and Audio Processing*, *IEEE Signal Processing Letters*, *Pattern Recognition Letters*, *International Conference on Computer Graphics and Interactive Techniques (SIGGRAPH)*, *Journal of Information Fusion*, and the *IEEE Transactions on Systems, Man, and Cybernetics, Part B*.

IBM Exploratory Research Funding Competition Finalist in 2008.

Sir Edward S. Rogers Sr. Scholarship Recipient from 2001-2003.

Dean's Honors Graduate in Engineering Science at the University of Toronto in 1998.

PUBLICATIONS

Refereed Publications

Rennie, S., Dognin, P., **Beyond MLLTs: efficient nonlinear dynamic feature adaptation for noise robust speech recognition.** *INTERSPEECH, 2008 (submitted)*.

Hershey, J., Rennie, S., Olsen, P., Kristjansson, T., **Super-human single channel multi-talker speech recognition using graphical models.** *Journal of Computer Speech and Language, Special Issue on the Pascal Speech Separation Challenge, Elsevier (to appear)*.

Rennie, S., Hershey, J., Olsen, P., **Efficient speech separation and de-noising using Non-negative Subspace Analysis.** *IEEE Conference on Acoustic, Speech, and Signal Processing, 2008*.

Hershey, J., Olsen, P., Rennie, S., **Variational Kullback-Leibler divergence for Hidden Markov Models.** *IEEE Workshop on Automatic Speech Recognition & Understanding, 2007*.

Rennie, S., Aarabi, P., Frey, B., **Variational probabilistic speech separation using microphone arrays.** *IEEE Transactions on Speech and Audio Processing, 2007*.

Hershey, J., Kristjansson, T., Rennie, S., Olsen, P., **Single channel speech separation using Factorial Dynamics.** *Advances in Neural Information Processing Systems, 2006*.

Rennie, S., Olsen, P., Hershey, J., Kristjansson, T., **Separating multiple speakers using temporal constraints.** *ISCA Workshop on Statistical and Perceptual Audition, 2006*.

Kristjansson, T., Hershey, J., Olsen, P., Rennie, S., Gopinath, R., **Super-human multi-talker speech recognition: The IBM 2006 Speech Separation Challenge System.** *International Conference on Spoken Language Processing*, 2006.

Rennie, S., Kristjansson, T., Olsen, P., Gopinath, R., **Dynamic noise adaptation.** *Proceedings of the 2006 IEEE Conference on Acoustics, Speech, and Signal Processing*, 2006.

Rennie, S., Achan, K., Aarabi, P., Frey, B., Achan, K., **Variational speech separation of more sources than mixtures.** *Tenth International Workshop on Artificial Intelligence and Statistics*, 2005.

Rennie, S., Aarabi, P., Kristjansson, T., Frey, B., Achan, K., **Robust variational speech separation using fewer microphones than speakers.** *Proceedings of the 2003 IEEE Conference on Acoustics, Speech, and Signal Processing*, 2003.

Academic Theses

Rennie, S., **Graphical models for robust speech separation and recognition in adverse environments.** *Ph.D. Thesis, University of Toronto, Canada*, 2008.

Rennie, S., **Variational probabilistic speech separation using microphone arrays.** *M.A.Sc. Thesis, University of Toronto, Canada*, 2003.

Rennie, S., Resnick, J., **Real-time tracking of the position and orientation of an autonomous helicopter.** *B.A.Sc. Thesis, University of Toronto, Canada*, 1998.

Technical Reports

Rennie, S., **Robust motion field estimation and segmentation via appearance model-free, aperture-free coherence propagation.** *PSI-TR-2005-012, Feb. 2005.*

Rennie, S., **Robust probabilistic TDOA estimation in reverberant environments.** *PSI-TR-2005-011, Feb. 2005.*

REFERENCES

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Additional references available upon request