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Education

Doctor of Philosophy in Electrical Engineering *May 1997*
University of Maryland, College Park, MD 20740
Dissertation Title: Model Selection and Universal Data Compression
Research Supervisor: Professor Prakash Narayan

Bachelor of Technology in Electrical Engineering *July 1988*
Indian Institute of Technology, Bombay 400 076, India
Project Title: Design and Implementation of an Ethernet Communications Controller
Research Supervisor: Professor Rajendra Lagu

Research Appointments

Associate Professor *Since July 2008*
Assistant Professor *July 2001 to June 2008*
Department of Electrical and Computer Engineering (Primary Appointment)
Department of Computer Science (Secondary Appointment)
Johns Hopkins University, Baltimore, MD

Investigating applications of Information Theory and Statistics to Automatic Speech Recognition, Natural Language Processing, Machine Translation and Information Retrieval.

Associate Research Scientist *January 1996 to June 2001*
Center for Language and Speech Processing
Johns Hopkins University, Baltimore, MD

Conducted research in all aspects of Automatic Speech Recognition and Understanding, including language modeling, pronunciation modeling, acoustic processing and natural language processing. Wrote proposals to secure research funding. Advised graduate and undergraduate students. Taught advanced graduate level seminars and courses. Organized guest lectures by external scholars and intensive summer research workshops.

Visitor *September to December 2000*
Institute for Mathematics and its Applications
University of Minnesota, Minneapolis, MN

Familiarized mathematicians with human language technology. Identified fundamental underlying problems. Studied recent advances in mathematics relevant to the speech and language processing community. Formulated specific mathematical problems whose solutions would advance the state of the art. Facilitated informal discussions, exchange of ideas and fostered collaboration between mathematicians and practitioners. *Organized 2 international workshops to promote these objectives.*

Graduate Research Assistant *January 1993 to December 1995*
Institute for Systems Research
University of Maryland, College Park, MD

Conducted research in statistical modeling based on information theoretic methods for lossy and lossless data compression and in system identification.

Summer Preprofessional

June to September 1994

Human Language Technology Group
IBM T. J. Watson Research Center, Yorktown Heights, NY

Designed special hidden Markov models for function words and other frequently occurring short lexemes in the Switchboard corpus and incorporated them with existing phone-based models in IBM's continuous speech recognition system. Studied various acoustic modeling and processing techniques.

Programmer Analyst

June to August 1990

LNK Corporation, 6811 Kenilworth Ave., Suite 306, Riverdale, MD

Designed and implemented a graphical user interface for the Acquisition Processing Expert System (APES), an application knowledgeable about Federal Acquisition Regulations (FAR) and operating in a Microsoft Windows environment.

Microsystems Trainee

May to July 1987

CMC Corporation, Worli, Bombay, India.

Designed and implemented an analog data acquisition system for use on offshore drilling platforms.

Teaching Appointments

Associate Professor

Since July 2008

Assistant Professor

July 2001 to June 2008

Department of Electrical and Computer Engineering (Primary Appointment)

Department of Computer Science (Secondary Appointment)

Johns Hopkins University, Baltimore, MD

520.447 *Information Theory and Coding* (Spring 2000, Fall 2001-2002)

520.651 *Random Signal Analysis* (Fall 2003-2011)

520.666 *Information Extraction from Speech and Text*[†] (Spring 2001, 2004-2006, 2008-2011)

520.674 *Information Theoretic Methods in Statistics* (Spring 1997-1999, 2002-2003, 2007)

520.701-702 *Current Topics in Language and Speech Processing*[‡] (Fall and Spring 2009-12)

Consistently excellent teaching evaluations (See <http://www.jhu.edu/merlin/>).

Lecturer

January 1997 to June 2001

Department of Electrical and Computer Engineering

Johns Hopkins University, Baltimore, MD

Taught regular undergraduate and advanced graduate courses in the fields of speech and language processing and information theory (see list above).

Instructor

August to December 1992

Department of Electrical Engineering

and June to August 1991

University of Maryland, College Park, MD

Taught a regular graduate course in Multiuser Communications (ENEE 625). Delivered lectures, prepared and graded examinations and homework on various aspects of data networks.

Taught an undergraduate (junior-level) laboratory course on Basic Electric Circuits (ENEE 305).

Delivered lectures on circuit design and supervised laboratory sessions.

Graduate Teaching Assistant

January 1989 to May 1992

Department of Electrical Engineering

University of Maryland, College Park, MD

[†] EN 520.666 is cross-listed with EN 600.666 and AS 050.666

[‡] EN 520.701 was cross-listed with EN 600.603, and EN 520.702 with EN 600.604 until Spring 2011.

Presented review sessions, prepared quizzes, homework and examinations, supervised laboratory sessions and conducted tutorials for various graduate and undergraduate courses.

Advised, mentored and tutored *African-American graduate students* as a part of a minority student-retention program named BEST, conducted by the University's Office of Graduate Minority Affairs.

Journal Articles

- [1] A. Kanlis, S. Khudanpur and P. Narayan, "Typicality of a Good Rate-Distortion Code," in *Problemy Peredachi Informatsii* (Problems of Information Transmission), **32**:96-103, Jan 1996.
- [2] M. Riley, W. Byrne, M. Finke, S. Khudanpur, A. Ljolje, J. McDonough, H. Nock, M. Saraçlar, C. Wooters and G. Zavaliagkos, "Stochastic Pronunciation Modeling Using Hand-Labeled Phonetic Corpora," in *Speech Communication*, **29**:209-224, Nov 1999.
- [3] M. Saraçlar, H. Nock and S. Khudanpur, "Pronunciation Modeling by Sharing Gaussian Densities Across Phonetic Models," in *Computer Speech and Language*, **14**:137-160, Apr 2000.
- [4] S. Khudanpur and J. Wu, "Maximum Entropy Techniques for Exploiting Syntactic, Semantic and Collocational Dependencies in Language Modeling," in *Computer Speech and Language*, **14**:355-372, Oct 2000.
- [5] S. Khudanpur and P. Narayan, "Order Estimation for a Special Class of Hidden Markov Sources and Binary Renewal Processes," in *IEEE Transactions on Information Theory*, **48**:1704-1713, Jun 2002.
- [6] D. He, D. Oard, J. Wang, J. Luo, D. Demner-Fushman, K. Darwish, P. Resnik, S. Khudanpur, M. Nossal, M. Subotin and A. Leuski, "Making MIRACLES: Interactive Translingual Search for Cebuano and Hindi," in *ACM Transactions on Asian Language Information Processing*, **2**:219-244, Sep 2003.
- [7] S. Khudanpur and W. Kim, "Contemporaneous Text as Side Information in Statistical Language Modeling," in *Computer Speech and Language*, **18**:143-162, Apr 2004.
- [8] H. Meng, B. Chen, S. Khudanpur, G. Levow, W. Lo, D. Oard, P. Schone, K. Tang, H. Wang and J. Wang, "Mandarin-English Information (MEI): Investigating Translingual Speech Retrieval," in *Computer Speech and Language*, **18**:163-169, Apr 2004.
- [9] W. Kim and S. Khudanpur, "Lexical Triggers and Latent Semantic Analysis for Cross-Lingual Language Model Adaptation," in *ACM Transactions on Asian Language Information Processing*, **3**:94-112, Jun 2004.
- [10] M. Saraçlar and S. Khudanpur, "Pronunciation Change in Conversational Speech and Its Implications for Automatic Speech Recognition," in *Computer Speech and Language*, **18**:375-395, Oct 2004.
- [11] B. Jedynek and S. Khudanpur, "Maximum Likelihood Set for Estimating a Probability Mass Function," in *Neural Computation*, **17**:1508-1530, Jul 2005.
- [12] D. Karakos, S. Khudanpur, C. Priebe and D. Marchette, "On Minimization of Concave Information Functionals for Unsupervised Classification via Decision Trees," in *Statistics and Probability Letters*, **78**(8):975-984, Jun 2008.
- [13] Z. Li, C. Callison-Burch, S. Khudanpur and W. Thornton, "Decoding in Joshua: Open Source, Parsing Based Machine Translation," in *The Pargue Bulletin of Mathematical Linguistics*, Special Issue: Open Source Tools for Machine Translation, **91**:47-56, Jan 2009.
- [14] J. Baker, L. Deng, J. Glass, S. Khudanpur, C. Lee, N. Morgan and D. O'Shaughnessy, "Research Developments and Directions in Speech Recognition and Understanding, Part 1," in the *IEEE Signal Processing Magazine*, **26**(3):75-80, May 2009.

- [15] J. Baker, L. Deng, S. Khudanpur, C. Lee, J. Glass, N. Morgan and D. O’Shaughnessy, “Research Developments and Directions in Speech Recognition and Understanding, Part 2,” in the *IEEE Signal Processing Magazine*, **26**(4):78-85, Jul 2009.
- [16] C. White, S. Khudanpur and P. Wolfe, “Likelihood-Based Semi-Supervised Model Selection with Applications to Speech Processing,” in the *IEEE Journal of Selected Topics in Signal Processing*, **4**(6):1016-1026, Dec 2010.
- [17] B. Varadarajan, S. Khudanpur and T. Tran, “Stepwise Optimal Subspace Pursuit for Improving Sparse Recovery,” in the *IEEE Signal Processing Letters*, **18**(1):27-30, Jan 2011.

Book Chapters

- [1] W. Byrne, J. Hajic, P. Ircing, F. Jelinek, S. Khudanpur, J. McDonough, N. Peterek, and J. Psutka, “Large Vocabulary Speech Recognition for Read and Broadcast Czech,” in *Text, Speech and Dialog*, pp 235-240, V. Mátousek, P. Mautner, J. Ocelíková and P. Sojka (Editors), Springer-Verlag, 1999.
- [2] S. Khudanpur, “Multilingual Language Modeling,” in *Multilingual Speech Processing*, pp 169-205, K. Kirchhoff and T. Schultz (Editors), Elsevier, 2006.
- [3] Z. Li and S. Khudanpur, “Forest Reranking for Machine Translation Using the Direct Translation Model,” in *Handbook of Natural Language Processing and Machine Translation*, pp 226-236, J. Olive, C. Christianson and J. McCary (Editors), Springer, 2011.
- [4] A-V. I. Rosti, E. Matusov, J. Smith, N. F. Ayan, J. Eisner, D. Karakos, S. Khudanpur, G. Leusch, Z. Li, S. Matsoukas, H. Ney, R. Schwartz, B. Zhang and J. Zheng, “Confusion Network Decoding for MT System Combination,” in *Handbook of Natural Language Processing and Machine Translation*, pp 333-361, J. Olive, C. Christianson and J. McCary (Editors), Springer, 2011.

Edited Volumes

- [5] *Mathematical Foundations of Speech and Language Processing*, M. Johnson, S. Khudanpur, M. Ostendorf and R. Rosenfeld (Editors), IMA Volumes in Mathematics and Its Applications, Volume **138**, Springer-Verlag, New York, Jan 2004.
- [6] *Proceedings of the 39th Conference on Information Sciences and Systems*, F. M. Davidson, S. P. Khudanpur and A. B. Cooper (Editors), Johns Hopkins University, Baltimore, Mar 2005.

Refereed Conference Proceedings

- [1] E. Fosler, M. Weintraub, S. Galles, Y. Kao, S. Khudanpur, M. Saraçlar and S. Wegmann, “Automatic Learning of Word Pronunciation from Data,” in *Proceedings of the International Conference on Spoken Language Processing*, pages Addendum:28-29, Oct 1996.
- [2] C. Chelba, D. Engle, F. Jelinek, V. Jeminez, S. Khudanpur, L. Mangu, H. Printz, E. Ristad, R. Rosenfeld, A. Stolcke and D. Wu, “Structure and Performance of a Dependency Language Model,” in *Proceedings of the 5th European Conference on Speech Communication and Technology*, **5**:2775-2778, Sep 1997.
- [3] W. Byrne, M. Finke, S. Khudanpur, J. McDonough, H. Nock, M. Riley, M. Saraçlar, C. Wooters and G. Zavaliagos, “Pronunciation Modeling for Conversational Speech Recognition: A Status Report from WS97,” in *Proceedings of the IEEE Workshop on Automatic Speech Recognition and Understanding*, pages 26-33, Dec 1997.

- [4] W. Byrne, M. Finke, S. Khudanpur, A. Ljolje, J. McDonough, H. Nock, M. Riley, M. Saraçlar, C. Wooters and G. Zavaliagkos, "Pronunciation Modeling for Automatic Speech Recognition," in *Proceedings of the ESCA Pronunciation Modeling Workshop*, Kerkrade, The Netherlands, May 1998.
- [5] W. Byrne, M. Finke, S. Khudanpur, J. McDonough, H. Nock, M. Riley, M. Saraçlar, C. Wooters and G. Zavaliagkos, "Pronunciation Modeling Using a Hand-Labelled Corpus for Conversational Speech Recognition," in *Proceedings of the IEEE International Conference on Acoustics Speech and Signal Processing*, I:313-316, May 1998.
- [6] V. Goel, W. Byrne and S. Khudanpur "LVCSR Rescoring with Modified Loss Functions: A Decision Theoretic Perspective," in *Proceedings of the IEEE International Conference on Acoustics Speech and Signal Processing*, I:425-428, May 1998.
- [7] W. Byrne, E. Knodt, S. Khudanpur and J. Bernstein, "Is Automatic Speech Recognition Ready for Nonnative Speech? A Data Collection Effort and Initial Experiments in Modeling Conversational Hispanic English," in *Proceeding of the ESCA Workshop on Speech Technology in Language Learning*, Marholmen, Sweden, May 1998.
- [8] V. Digalakis, S. Berkowitz, E. Bocchieri, C. Boulis, W. Byrne, H. Collier, A. Corduneanu, A. Kannan, S. Khudanpur and A. Sankar, "Rapid Speech Recognizer Adaptation to New Speakers," in *Proceedings of the IEEE International Conference on Acoustics Speech and Signal Processing*, II:765-768, Mar 1999.
- [9] A. Kannan and S. Khudanpur, "Tree Structured Models of Parameter Dependence for Rapid Adaptation in Large Vocabulary Conversational Speech Recognition," in *Proceedings of the IEEE International Conference on Acoustics Speech and Signal Processing*, II:769-772, Mar 1999.
- [10] S. Khudanpur and J. Wu, "A Maximum Entropy Language Model Integrating N-Grams and Topic Dependencies for Conversational Speech Recognition," in *Proceedings of the IEEE International Conference on Acoustics Speech and Signal Processing*, I:553-556, Mar 1999.
- [11] M. Saraçlar, H. Nock and S. Khudanpur, "Pronunciation Modeling by Sharing Gaussian Densities Across Phonetic Models," in *Proceedings of the 6th European Conference on Speech Communication and Technology*, I:515-518, Sep 1999.
- [12] J. Wu and S. Khudanpur, "Combining Nonlocal Syntactic and N-gram Dependencies in Language Modeling," in *Proceedings of the 6th European Conference on Speech Communication and Technology*, 5:2179-2182, Sep 1999. (**ELSNET Best Student Paper Award.**)
- [13] P. Beyerlein, W. Byrne, J. Huerta, S. Khudanpur, B. Marathi, J. Morgan, N. Peterek, J. Picone and W. Wang, "Towards Language Independent Acoustic Modeling," in *Proceedings of the IEEE Workshop on Automatic Speech Recognition and Understanding*, Keystone, CO, Dec 1999.
- [14] H. Meng, S. Khudanpur, G. Levow, D. Oard and H. Wang, "Mandarin-English Information (MEI): Investigating Translingual Speech Retrieval," in *Proceedings of the Embedded Machine Translation Workshop*, North American Association for Computational Linguistics, Seattle, WA, May 2000.
- [15] W. Byrne, P. Beyerlein, J. Huerta, S. Khudanpur, B. Marathi, J. Morgan, N. Peterek, J. Picone, D. Vergyri and W. Wang, "Towards Language Independent Acoustic Modeling," in *Proceedings of the IEEE International Conference on Acoustics Speech and Signal Processing*, II:1029-1032, Jun 2000.
- [16] M. Saraçlar and S. Khudanpur, "Pronunciation Ambiguity vs Pronunciation Variability in Speech Recognition," in *Proceedings of the IEEE International Conference on Acoustics Speech and Signal Processing*, III:1679-1682, Jun 2000.
- [17] J. Wu and S. Khudanpur, "Syntactic Heads in Statistical Language Modeling," in *Proceedings of the IEEE International Conference on Acoustics Speech and Signal Processing*, III:1699-1702, Jun 2000.

- [18] J. Wu and S. Khudanpur, "Efficient Training Methods for Maximum Entropy Language Modeling," in *Proceedings of the International Conference on Spoken Language Processing*, **3**:114-117, Oct 2000.
- [19] H. Meng, B. Chen, E. Grams, S. Khudanpur, G. Levow, W. Lo, D. Oard, P. Schone, K. Tang, H. Wang and J. Wang, "Mandarin-English Information (MEI): Investigating Translingual Speech Retrieval," in *Proceedings of the First International Conference on Human Language Technology Research*, pages 123-129, Mar 2001.
- [20] P. Ircing, P. Krbec, J. Hajic, J. Psutka, S. Khudanpur, F. Jelinek and W. Byrne, "On Large Vocabulary Continuous Speech Recognition of a Highly Inflectional Language – Czech," in *Proceedings of the 7th European Conference on Speech Communication and Technology*, **1**:487-489, Sep 2001.
- [21] W. Kim, S. Khudanpur and J. Wu, "Smoothing Issues in the Structured Language Model," in *Proceedings of the 7th European Conference on Speech Communication and Technology*, **1**:717-720, Sep 2001.
- [22] J. Wu and S. Khudanpur, "Building A Topic-Dependent Maximum Entropy Language Model for Very Large Corpora," in *Proceedings of the IEEE International Conference on Acoustics Speech and Signal Processing*, **1**:777-780, May 2002.
- [23] W. Kim and S. Khudanpur, "Using Cross-Language Cues for Story-Specific Language Modeling," in *Proceedings of the International Conference on Spoken Language Processing*, **1**:513-516, Sep 2002.
- [24] Y. Deng and S. Khudanpur, "Latent Semantic Information in Maximum Entropy Language Models for Conversational Speech Recognition," in *Human Language Technology Conference of the North American Chapter of the Association for Computational Linguistics: Proceedings of the Main Conference*, pages 56-63, Edmonton, Canada, May 2003.
- [25] D. Oard, D. Doermann, B. Dorr, D. He, P. Resnik, W. Byrne, S. Khudanpur, D. Yarowsky, A. Leuski, P. Koehn and K. Knight, "Desperately Seeking Cebuano," in *Human Language Technology Conference of the North American Chapter of the Association for Computational Linguistics: Companion Volume*, pages 76-78, Edmonton, Canada, May 2003.
- [26] W. Kim and S. Khudanpur, "Cross-Lingual Lexical Triggers in Statistical Language Modeling," in *Proceedings of the 2003 Conference on Empirical Methods in Natural Language Processing*, pages 17-24, Sapporo, Japan, Jul 2003. (Nominated for **Best Paper Award**.)
- [27] P. Virga and S. Khudanpur, "Transliteration of Proper Names in Cross-Lingual Information Retrieval," in *Proceedings of the ACL 2003 Workshop on Multilingual and Mixed-language Named Entity Recognition*, pages 57-64, Sapporo, Japan, Jul 2003.
- [28] P. Virga and S. Khudanpur, "Transliterating Proper Names in Cross-Language Applications," in *Proceedings of the 26th Annual International ACM SIGIR Conference on Research and Development in Information Retrieval*, pages 355-356 (Poster), Toronto, Canada, Jul-Aug 2003.
- [29] W. Kim and S. Khudanpur, "Language Model Adaptation Using Cross-Lingual Information," in *Proceedings of the 8th European Conference on Speech Communication and Technology*, **5**:3129-3132, Sep 2003.
- [30] W. Byrne, S. Khudanpur, W. Kim, S. Kumar, P. Pecina, P. Virga, P. Xu, and D. Yarowsky, "The Johns Hopkins University 2003 Chinese-English Machine Translation System," in *Proceedings of the Ninth Machine Translation Summit of the Association for Machine Translation in the Americas*, Sep 2003. (Available on-line at <http://www.amtaweb.org/summit/MTSummit/papers.html>)

- [31] W. Kim and S. Khudanpur, "Cross-lingual Latent Semantic Analysis for Language Modeling," in *Proceedings of the IEEE International Conference on Acoustics Speech and Signal Processing*, **I**:57-60, Mar 2004.
- [32] F. Och, D. Gildea, S. Khudanpur, A. Sarkar, K. Yamada, A. Fraser, S. Kumar, L. Shen, D. Smith, K. Eng, V. Jain, Z. Jin and D. Radev, "A Smorgasbord of Features for Statistical Machine Translation," in *Human Language Technology Conference of the North American Chapter of the Association for Computational Linguistics: Proceedings of the Main Conference*, pages 161-168, MA, May 2004.
- [33] D. Karakos, S. Khudanpur, J. Eisner and C. Priebe, "Unsupervised Classification via Decision Trees: An Information-Theoretic Perspective," in *Proceedings of the IEEE International Conference on Acoustics Speech and Signal Processing*, **V**:1081-1084, Mar 2005.
- [34] A. Ghoshal, P. Ircing and S. Khudanpur, "Hidden Markov Models for Automatic Annotation and Content-Based Retrieval of Images and Video," in *Proceedings of the 28th Annual International ACM SIGIR Conference on Research and Development in Information Retrieval*, pages 544-551, Salvador, Brazil, Aug 2005.
- [35] G. Iyengar, P. Duygulu, S. Feng, P. Ircing, S. Khudanpur, D. Klakow, M. Krause, R. Manmatha, H. Nock, D. Petkova, B. Pytlík and P. Virga, "Joint Visual-Text Modeling for Automatic Retrieval of Multimedia Documents," in *Proceedings of the 13th Annual ACM International Conference on Multimedia*, pages 21-30, Singapore, Nov 2005.
- [36] A. Ghoshal and S. Khudanpur, "Source Adaptation for Improved Content-Based Video Retrieval," in *Proceedings of the IEEE International Conference on Acoustics Speech and Signal Processing*, **II**:133-136, May 2006. (**ICASSP 2006 Best Student Paper Award.**)
- [37] J. Lin, D. Karakos, D. Demner-Fushman and S. Khudanpur, "Generative Content Models for Structural Analysis of Medical Abstracts," in *Proceedings of the BioNLP Workshop on Linking Natural Language Processing and Biology at HLT-NAACL'06*, pages 65-72, New York City, NY, Jun 2006.
- [38] D. Karakos and S. Khudanpur, "Language Modeling and the Maximum Likelihood Set: Complexity Issues and the Back-off Formula," in *Proceedings of the IEEE International Symposium on Information Theory*, pages 2814-2818, Seattle, WA, Jul 2006.
- [39] D. Karakos, S. Khudanpur, J. Eisner and C. Priebe, "Iterative Denoising Using Jensen-Renyi Divergences with an Application to Unsupervised Document Categorization," in *Proceedings of the IEEE International Conference on Acoustics Speech and Signal Processing*, **II**:509-512, Apr 2007.
- [40] D. Karakos, J. Eisner, S. Khudanpur and C. Priebe, "Cross-Instance Tuning of Unsupervised Document Clustering Algorithms," in *Human Language Technology Conference of the North American Chapter of the Association for Computational Linguistics: Proceedings of the Main Conference*, pages 252-259, NY, Apr 2007.
- [41] M. Dreyer, K. Hall and S. Khudanpur, "Comparing Reordering Constraints for SMT using Efficient BLEU Oracle Computation," in *Proceedings of the HLT-NAACL'07/AMTA Workshop on Syntax and Structure in Statistical Machine Translation*, pages 103-110, Rochester, NY, Apr 2007. (**AMTA Student Scholarship/Travel Award.**)
- [42] D. Karakos and S. Khudanpur, "Error Bounds and Improved Probability Estimation using the Maximum Likelihood Set," in *Proceedings of the IEEE International Symposium on Information Theory*, pages 1851-1855, Nice, France, Jun 2007.
- [43] Y. Su, F. Jelinek and S. Khudanpur, "Large-Scale Random Forest Language Models for Speech Recognition," in *Proceedings of the 10th European Conference on Speech Communication and Technology*, **1**:598-601, Antwerp, Belgium, Aug 2007.

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- [45] L. Burget, P. Schwarz, P. Matejka, M. Hanneman, A. Rastrow, C. White, S. Khudanpur, H. Hermansky, J. Cernocky, "Combination of Strongly and Weakly Constrained Recognizers for Reliable Detection of OOVs," in *Proceedings of the IEEE International Conference on Acoustics Speech and Signal Processing*, pages 4081-4084, Las Vegas, NV, Apr 2008.
- [46] D. Farris, C. White and S. Khudanpur, "Sample Selection for Automatic Language Identification," in *Proceedings of the IEEE International Conference on Acoustics Speech and Signal Processing*, pages 4225-4228, Las Vegas, NV, Apr 2008.
- [47] B. Varadarajan, S. Khudanpur and E. Dupoux, "Unsupervised Learning of Acoustic Subword Units," in *Proceedings of the 46th Annual Meeting of the Association for Computational Linguistics*, Short Papers (Companion Volume), pages 165-168, Columbus, OH, Jun 2008.
- [48] D. Karakos, J. Eisner, S. Khudanpur and M. Dreyer, "Machine Translation System Combination using ITG-based Alignments," in *Proceedings of the 46th Annual Meeting of the Association for Computational Linguistics*, Short Papers (Companion Volume), pages 81-84, Columbus, OH, Jun 2008.
- [49] Z. Li and S. Khudanpur, "A Scalable Decoder for Parsing-based Machine Translation with Equivalent Language Model State Maintenance," in *Proceedings of the Second ACL Workshop on Syntax and Structure in Statistical Machine Translation*, pages 10-18, Columbus, OH, Jun 2008.
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- [51] B. Varadarajan and S. Khudanpur, "Automatically Learning Speaker-independent Acoustic Subword Units," in *Proceedings of the International Conference on Spoken Language Processing*, pages 1333-1336, Sep 2008.
- [52] C. White, S. Khudanpur and J. Baker, "An Investigation of Acoustic Models for Multilingual Code-Switching," in *Proceedings of the International Conference on Spoken Language Processing*, pages 2691-2694, Sep 2008.
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- [62] P. Xu, D. Karakos and S. Khudanpur, “Self-supervised Discriminative Training of Statistical Language Models,” in *Proceedings of the IEEE Workshop on Automatic Speech Recognition and Understanding*, Merano, Italy, Dec 2009.
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- [67] B. Varadarajan, S. Garimella, S. Khudanpur, “Dirichlet Mixtures to Model Neural Network Posteriors in the HMM Framework,” in *Proceedings of the IEEE International Conference on Acoustics Speech and Signal Processing*, pages 5028-5031, Prague, Czech Republic, May 2011.
- [68] Balakrishnan Varadarajan, Sanjeev Khudanpur, “Learning and Inference Algorithms for Partially-Observed Structured Switching Vector Autoregressive Models,” in *Proceedings of the IEEE International Conference on Acoustics Speech and Signal Processing*, pages 1281-1284, Prague, Czech Republic, May 2011.
- [69] Ariya Rastrow, Markus Dreyer, Abhinav Sethy, Sanjeev Khudanpur, Bhuvana Ramabhadran, Mark Dredze, “Hill Climbing on Speech Lattices: A New Rescoring Framework,” in *Proceedings of the IEEE International Conference on Acoustics Speech and Signal Processing*, pages 5032-5035, Prague, Czech Republic, May 2011.

- [70] Tomas Mikolov, Stefan Kombrink, Lukas Burget, Jan Cernocky, Sanjeev Khudanpur, “Extensions of Recurrent Neural Network Language Model,” in *Proceedings of the IEEE International Conference on Acoustics Speech and Signal Processing*, pages 5528-5531, Prague, Czech Republic, May 2011.
- [71] Anoop Deoras, Tomáš Mikolov, Stefan Kombrink, Martin Karafiát, Sanjeev Khudanpur, “Variational Approximation of Long-Span Language Models for LVCSR,” in *Proceedings of the IEEE International Conference on Acoustics Speech and Signal Processing*, pages 5532-5535, Prague, Czech Republic, May 2011.
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- [74] Scott Novotney, Rich Schwartz and Sanjeev Khudanpur, “Unsupervised Arabic Dialect Adaptation with Self-Training,” in *Proceedings of the 12th Annual Conference of the International Speech Communication Association*, pp 541-544, Florence, Italy, Aug 2011.
- [75] Ariya Rastrow, Mark Dredze and Sanjeev Khudanpur, “Efficient Discriminative Training of Long-span Language Models,” in *Proceedings of the 2011 IEEE Workshop on Automatic Speech Recognition and Understanding*, pp 214-219, Waikoloa Beach, HI, Dec 2011.
- [76] Ariya Rastrow, Mark Dredze and Sanjeev Khudanpur, “Adapting n -gram Maximum Entropy Language Models with Conditional Entropy Regularization,” in *Proceedings of the 2011 IEEE Workshop on Automatic Speech Recognition and Understanding*, pp 220-225, Waikoloa Beach, HI, Dec 2011.
- [77] Puyang Xu, Sanjeev Khudanpur and Asela Gunawardana, “Randomized Maximum Entropy Language Models,” in *Proceedings of the 2011 IEEE Workshop on Automatic Speech Recognition and Understanding*, pp 226-230, Waikoloa Beach, HI, Dec 2011.
- [78] Damianos Karakos, Mark Drzede, Kenneth Church, Aren Jansen and Sanjeev Khudanpur, “Estimating Document Frequencies in a Speech Corpus,” in *Proceedings of the 2011 IEEE Workshop on Automatic Speech Recognition and Understanding*, pp 407-412, Waikoloa Beach, HI, Dec 2011.
- [79] P. Xu, S. Khudanpur, M. Lehr, E. Prud’hommeaux, N. Glenn, D. Karakos, B. Roark, K. Sagae, M. Saraclar, I. Shafran, D. Bikel, C. Callison-Burch, Y. Cao, K. Hall, E. Hasler, P. Koehn, A. Lopez, M. Post, D. Riley, “Continuous Space Discriminative Language Modeling,” *Proceedings of the 2012 IEEE International Conference on Acoustics Speech and Signal Processing*, pp 2129-2132, Kyoto, Japan, Mar 2012.
- [80] K. Sagae, M. Lehr, E. Prud’hommeaux, P. Xu, N. Glenn, D. Karakos, S. Khudanpur, B. Roark, M. Saraclar, I. Shafran, D. Bikel, C. Callison-Burch, Y. Cao, K. Hall, E. Hasler, P. Koehn, A. Lopez, M. Post, D. Riley, “Hallucinated n -best Lists for Discriminative Language Modeling,” *Proceedings of the 2012 IEEE International Conference on Acoustics Speech and Signal Processing*, pp 5001-5004, Kyoto, Japan, Mar 2012.
- [81] A. Celebi, H. Sak, E. Dikici, M. Saraclar, M. Lehr, E. Prud’hommeaux, P. Xu, N. Glenn, D. Karakos, S. Khudanpur, B. Roark, K. Sagae, I. Shafran, D. Bikel, C. Callison-Burch, Y. Cao, K. Hall, E. Hasler, P. Koehn, A. Lopez, M. Post, D. Riley, “Unsupervised Discriminative Language Modeling for Turkish,” *Proceedings of the 2012 IEEE International Conference on Acoustics Speech and Signal Processing*, pp 5025-5028, Kyoto, Japan, Mar 2012.

- [82] Ariya Rastrow, Sanjeev Khudanpur and Mark Dredze, “Revisiting the Case for Explicit Syntactic Information in Language Models,” in *Proceedings of the NAACL-HLT 2012 Workshop: Will We Ever Really Replace the N-gram Model? On the Future of Language Modeling for HLT*, pp 50-58, Montreal, Canada, Jun 2012.
- [83] Ariya Rastrow, Mark Dredze and Sanjeev Khudanpur, “Fast Syntactic Analysis for Statistical Language Modeling via Substructure Sharing and Up-training,” in *Proceedings of the 50th Annual Meeting of the Association for Computational Linguistics (Volume 1: Long Papers)*, pp 175-183, Jeju Island, Korea, Jul 2012.
- [84] D. Karakos, B. Roark, I. Shafran, K. Sagae, M. Lehr, E. Prud’hommeaux, P. Xu, N. Glenn, S. Khudanpur, M. Saraclar, D. Bikel, M. Dredze, C. Callison-Burch, Y. Cao, K. Hall, E. Hasler, P. Koehn, A. Lopez, M. Post, D. Riley, “Deriving Conversation-based Features from Unlabeled Speech for Discriminative Language Modeling,” in *Proceedings of the 13th Annual Conference of the International Speech Communication Association*, pp xxx-xxx, Portland, OR, Sep 2012.
- [85] Puyang Xu, Brian Roark and Sanjeev Khudanpur, “Phrasal Cohort Based Unsupervised Discriminative Language Modeling,” in *Proceedings of the 13th Annual Conference of the International Speech Communication Association*, pp xxx-xxx, Portland, OR, Sep 2012.
- [86] Scott Novotney, Ivan Bulykov, Rich Schwartz, Sanjeev Khudanpur and Owen Kimball, “Semi-supervised Methods for Improving Keyword Search of Unseen Terms,” in *Proceedings of the 13th Annual Conference of the International Speech Communication Association*, pp xxx-xxx, Portland, OR, Sep 2012.
- [87] Ariya Rastrow, Mark Dredze and Sanjeev Khudanpur, “Efficient Structured Language Modeling for Speech Recognition,” in *Proceedings of the 13th Annual Conference of the International Speech Communication Association*, pp xxx-xxx, Portland, OR, Sep 2012.
- [88] Yuan Cao and Sanjeev Khudanpur, “Sample Selection for Large-Scale MT Discriminative Training,” in *Proceedings of the Tenth Conference of the Association for Machine Translation in the Americas*, pp xxx-xxx, San Diego, CA, Oct 2012.

Other Publications

- [1] S. Khudanpur, “Design and Implementation of an Ethernet Communications Controller for IBM-Compatible Personal Computers,” *Bachelor of Technology Project*, Department of Electrical Engineering, Indian Institute of Technology, Bombay, India, Apr 1988.
- [2] S. Khudanpur, S. Dharanipragada and F. Jelinek, “Language Model Adaptation Using the Minimum Divergence Principle,” in *Proceedings of the Summer Research Workshop on Language Modeling*, Johns Hopkins University, Baltimore, MD, Sept 1995.
- [3] M. Weintraub, E. Fosler, S. Galles, Y. Kao, S. Khudanpur, M. Saraclar and S. Wegmann, “Automatic Learning of Word Pronunciation from Data,” in *Proceedings of the Summer Research Workshop on Large Vocabulary Conversational Speech Recognition*, Johns Hopkins University, Baltimore, MD, Sep 1996.
- [4] A. Stolcke, C. Chelba, D. Engle, V. Jeminez, L. Mangu, H. Printz, E. Ristad, R. Rosenfeld, D. Wu, F. Jelinek and S. Khudanpur, “Dependency Language Modeling,” in *Proceedings of the Summer Research Workshop on Large Vocabulary Conversational Speech Recognition*, Johns Hopkins University, Baltimore, MD, Sep 1996.
- [5] S. Khudanpur, “Model Selection and Universal Data Compression,” *Doctoral Dissertation*, Department of Electrical Engineering, University of Maryland, College Park, MD, Jan 1997.

- [6] M. Riley, W. Byrne, M. Finke, S. Khudanpur, J. McDonough, H. Nock, M. Saraçlar, C. Wooters and G. Zavaliagos, "Pronunciation Modeling," in *Proceedings of the Summer Research Workshop on Innovative Techniques for Large Vocabulary Conversational Speech Recognition*, Johns Hopkins University, Baltimore, MD, Nov 1997.
- [7] V. Digalakis, E. Bocchieri, C. Boulis, W. Byrne, H. Collier, A. Corduneanu, A. Kannan, S. Khudanpur and A. Sankar, "Rapid Speech Recognizer Adaptation to New Speakers," in *Proceedings and Final Team Technical Reports of the Language Engineering Workshop for Students and Professionals: Integrating Research and Education*, Johns Hopkins University, Baltimore, MD, Dec 1998.
- [8] W. Byrne, P. Beyerlein, J. Huerta, S. Khudanpur, B. Marathi, J. Morgan, N. Peterek, J. Picone and W. Wang, "Towards Language Independent Acoustic Modeling," in *Proceedings and Final Team Technical Reports of the Language Engineering Workshop for Students and Professionals: Integrating Research and Education*, Johns Hopkins University, Baltimore, MD, Nov 1999.
- [9] H. Meng, S. Khudanpur, G. Levow, D. Oard and H. Wang, "Mandarin-English Information (MEI)," in *Proceedings of the NIST Topic Detection and Tracking Workshop*, Tysons Corner, VA, Feb 2000.
- [10] H. Meng, B. Chen, E. Grams, S. Khudanpur, G. Levow, W. Lo, D. Oard, P. Schone, K. Tang, H. Wang and J. Wang, "Mandarin-English Information (MEI): Investigating Translingual Speech Retrieval," in *Proceedings and Final Team Technical Reports of the 2000 Language Engineering Workshop for Students and Professionals: Integrating Research and Education*, Johns Hopkins University, Baltimore, MD, Dec 2000.
- [11] F. Jelinek, W. Byrne, S. Khudanpur, B. Hladka, H. Ney, F. Och, J. Curin and J. Psutka, "Robust Knowledge Discovery from Parallel Text and Speech Sources," in *Proceedings of the First International Conference on Human Language Technology Research*, pages 191-195 (Poster), San Diego, CA, Mar 2001.
- [12] S. Khudanpur, "Hindi 101," in *Team TIDES: Quarterly Newsletter of the DARPA TIDES Program*, D. Oard and A. Powell (Editors), pages 2-3, Oct 2003.
- [13] D. He, D. Demner Fushman, D. Oard, D. Karakos and S. Khudanpur, "Improving Passage Revrieval Using Passage Retrieval and Statistical Modeling," in *Proceedings of the 2004 NIST Text Retrieval Conference (TREC)*, Gaithersburg, MD, Nov 2004.
- [14] B. Jedynek, S. Khudanpur and A. Yazgan, "Estimating Probabilities from Small Samples," in the Section on Nonparametric Statistics in the *CDROM Proceedings of the Joint Statistical Meeting of the American Statistical Association*, Minneapolis, MN, Aug 2005.
- [15] B. Pytlik, A. Ghoshal, D. Karakos and S. Khudanpur, "TRECVID 2005 Experiments at Johns Hopkins Univeristy: Using Hidden Markov Models for Video Retrieval," in *Proceedings of the 2005 TREC Video Retrieval Evaluation Workshop*, Gaithersburg, MD, Nov 2005. Available via the Internet at <http://www.nlpir.nist.gov/projects/tvpubs/tv.pubs.org.html>
- [16] D. Karakos and S. Khudanpur, "Estimating Conditional Densities from Sparse Data for Statistical Language Modeling," in *Proceedings of the Information Theory and Applications – Inaugural Workshop*, San Diego, CA, Feb 2006. (Available through the IEEE at <http://ieeexplore.ieee.org>)
- [17] H. Zhou, D. Karakos, S. Khudanpur, A. Andreou and C. Priebe, "On Projections of Gaussian Distributions using Maximum Likelihood Criteria," in *Proceedings of the 2009 Information Theory and Applications Workshop*, pages 431-438, San Diego, CA, Feb 2009. (Available through the IEEE at <http://ieeexplore.ieee.org>)
- [18] Z. Li, C. Callison-Burch, C. Dyer, J. Ganitkevitch, S. Khudanpur, L. Schwartz, W. Thornton, J. Weese and O. Zaidan, "Demonstration of Joshua: An Open Source Toolkit for Parsing-based

Machine Translation,” in *Proceedings of the ACL-IJCNLP Software Demonstrations*, pages 25-28, Suntec, Singapore, Aug 2009.

Invited Talks

- [1] “Interacting with Computers via Natural Language,” at the *Society of Industrial and Applied Mathematics* chapter meeting, George Washington University, Washington D.C., Apr 30, 1998.
- [2] “An Insider’s View of Automatic Speech Recognition,” at Sigma Xi chapter meeting, *Naval Research Laboratory*, Washington D.C., Nov 5, 1998.
- [3] “Statistical Language Modeling: A Critical Review of Papers by R. Rosenfeld and J. Bellagarda,” at the *DARPA-Lucent Workshop on Spoken Language Understanding*, Summit, NJ, Feb 6-9, 2000.
- [4] “Maximum Entropy Methods in Statistical Language Modeling,” at the Department of Electrical and Computer Engineering, *Johns Hopkins University*, Baltimore, MD, Oct 5, 2000.
- [5] “The Basic Mathematics of Automatic Speech Recognition,” at the Mathematics Department Probability Seminar, *University of Minnesota*, Minneapolis, MN, Oct 13, 2000.
- [6] “Parsing for the Sake of Language Modeling and Understanding,” at the *IEEE Automatic Speech Recognition and Understanding Workshop*, Madonna di Campiglio, Italy, Dec 9-13, 2001.
- [7] “The Basic Mathematics of Automatic Speech Recognition,” at the Department of Electrical Engineering, *Indian Institute of Technology*, Mumbai, India, Jan 7, 2002.
- [8] “Information Theoretic Techniques in Large Deviations: Order Estimation for a Class of Hidden Markov Sources,” at the Department of Electrical and Computer Engineering, *University of Maryland, Baltimore County*, Catonsville, MD, May 6, 2003.
- [9] “Impressions from RT03-S: What I did for Two Beautiful Spring Days in Downtown Boston,” at the *DARPA 2003 Rich Transcription Workshop*, Boston, MA, May 19-20, 2003.
- [10] “Hindi 101,” at the *DARPA Translingual Information Detection, Extraction and Summarization: Principal Investigators’ Meeting*, Harriman, NY, Aug 4-7, 2003.
- [11] “Lexical Triggers and Latent Semantic Analysis for Language Model Adaptation,” at the Computer Science and Artificial Intelligence Laboratory, *Massachusetts Institute of Technology*, Boston, MA, Nov 17, 2003.
- [12] “What Could EARS Do to Help Machine Translation?” at the *DARPA EARS Spring 2004 Principal Investigators’ Meeting*, Tysons Corner, VA, Feb 5, 2004.
- [13] “On Estimation of Discrete Probability Mass Functions,” at the *Joint Annual Meeting of the Interface Foundation and Classification Society of America*, St. Louis, MO, June 10, 2005.
- [14] “Probability Estimation in Statistical Natural Language Processing,” at the 5th Annual Meeting of the International Post-Graduate College of *Saarland University* and the *University of Edinburgh*, Schloss Dagstuhl, Germany, Jul 14, 2005.
- [15] “On Estimating Probability Mass Functions from Small Samples,” *Plenary Lecture* at the *Human Language Technology Conference and Conference on Empirical Methods in Natural Language Processing*, Vancouver, B.C., Canada, Oct 7, 2005.
- [16] “On Estimating Probability Mass Functions from Small Samples,” at the Computational Linguistics Group & Information Engineering Department, *University of Oxford*, Oxford, England, Jan 20, 2006.
- [17] “Document Representations for Topic-Adaptation in Statistical Language Modeling,” at the Institute for Pure and Applied Mathematics, *University of California, Los Angeles*, CA, Jan 23, 2006.
- [18] “Content-Based Image and Video Retrieval Using HMMs,” at Google Research, *Google Inc.*, Mountain View, CA, Jan 31, 2006.
- [19] “Ideas in Probability Estimation from Small Samples: Theoretical Claims, Algorithmic Issues and Empirical Results,” at the *Tata Institute of Fundamental Research*, Mumbai, India, Jan 2, 2007.
- [20] “On Estimating Probability Mass Functions from Small Samples,” *Plenary Lecture* at *ICON’07, the Sixth International Conference on Natural Language Processing*, Hyderabad, India, Jan 5, 2007.
- [21] “On Estimating Probability Mass Functions from Small Samples,” at *Microsoft Research (India)*, Bangalore, India, Jan 12, 2007.

- [22] “Error Bounds and Improved Probability Estimation using the Maximum Likelihood Set,” at ITA 2007, the Information Theory and Applications Workshop, *University of California*, San Diego, CA, Feb 1, 2007.
- [23] “On Estimating Probability Mass Functions from Small Samples,” at the Center for Spoken Language Research, *University of Colorado*, Boulder, CO, Mar 19, 2007.
- [24] “Recognize speech v/s Wreck a nice beach: The Mathematics of Automatic Speech Recognition,” at the *IEEE Signal Processing Society* (Baltimore Chapter), Linthicum, MD, May 23, 2007.
- [25] “Content-Based Image and Video Retrieval Using HMMs,” at *StreamSage, Inc.*, a subsidiary of *Comcast Cable Communications*, Washington, DC, May 24, 2007.
- [26] “Perspectives in Statistical Language Modeling,” *Plenary Lecture* at the *IEEE Workshop on Spoken Language Technology*, Goa, India, Dec 2008.
- [27] “Discovering the Language of Surgery: Automatic Gesture Induction for Manipulative Tasks,” in the Control and Dynamical Systems Invited Lecture Series of the *Institute for Systems Research*, *University of Maryland*, College Park, MD, Feb 4, 2009.
- [28] “On Estimating Probability Mass Functions from Small Samples,” at the *Permanents and Modeling Probability Distributions Workshop*, organized by the *American Institute of Mathematics*, Palo Alto, CA, Aug 31-Sep 4, 2009.
- [29] “Discovering the Language of Surgery,” at the Language Technology Institute of *Carnegie Mellon University*, Pittsburgh, PA, Mar 26, 2010.

Refereeing Activities

- [1] *Grant proposal reviewer*: National Science Foundation: Intelligent Robotic and Interactive Systems (IRIS) panel, January 1998, Human Computer Interaction (HCI) panel, April 1998, Information Technology Research (ITR) panel, May 2002 and May 2003, Human Language and Communication (HLC) program, March 2004, Advanced Learning Technology (ALT) program, June-July 2005, Computing Research Infrastructure (CRI) program, December 2006, October 2007, 2009 and 2010, Robust Intelligence (RI) program, March 2009, Cyber-Enabled Discovery and Innovation (CDI) program, March 2010.
- [2] *Journal paper reviewer*: IEEE Transactions on Information Theory, Pattern Analysis and Machine Intelligence, Computer Speech and Language, Speech Communication, Journal of Machine Learning Research.
- [3] *Associate Editor*: ACM Transactions of Speech and Language Processing, 2004-2006.
- [4] *Conference paper reviewer*: IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), IEEE International Symposium on Information Theory (ISIT), Conference of the North American Association for Computational Linguistics (NAACL), Applied Natural Language Processing (ANLP), Conference on Empirical Methods in Natural Language Processing (EMNLP), Conference on Computational Language Learning (CoNLL), IEEE Workshop on Automatic Speech Recognition and Understanding (ASRU), International Conference on Spoken Language Processing (ICSLP), International Conference on Very Large Corpora in Natural Language Processing, European Conference on Speech Communication and Technology (EUROSPEECH), Frontiers of Massively Parallel Computation, Conference on Information Sciences and Systems (CISS).
- [5] *Dissertation Reader* (excluding own advisees): Served as an examiner on many Electrical and Computer Engineering doctoral dissertations, and on the Graduate Board Oral examination of several Cognitive Science doctoral dissertations.

Mentoring and Research Supervision

Postdoctoral Fellows

- [1] *Seth Cameron*, May 1996 to Jan 1997. Developed telephone-based dialog systems. Subsequently went to Fonix Corp. Salt Lake City, UT, a speech recognition company.
- [2] *Barbora Hladka*, Oct 2000 to Sep 2001. Investigated Cross-Lingual Language Modeling. Subsequently joined Charles University, Prague, as research staff.
- [3] *Damianos Karakos*, Sep 2003 to Feb 2007. Developed novel *information theoretic* methods to solve problems in human language technology. Subsequently appointed Assistant Research Professor in Electrical and Computer Engineering, Johns Hopkins University, Baltimore.

Graduate Students

[4] *PhD advisees graduated: 9*

Murat Saraclar (2000): Now Associate Professor, Bogazici University, Istanbul, Turkey.
Jun Wu (2002): Now Senior Research Scientist, Google Inc., Mountain View, CA.
Woosung Kim (2004): Now at Nuance Communications Inc., Burlington, MA.
Arnab Ghoshal (2009): Now Research Manager, University of Edinburgh, Edinburgh, UK.
Christopher White (2009): Now Program Manager at DARPA, Arlington, VA.
Zhifei Li (2010): Now Research Scientist, Google Inc., Mountain View, CA.
Balakrishnan Varadarajan (2011): Now Research Scientist, Google Inc., Mountain View, CA.
Ariya Rastrow (2012): Now Research Scientist at Amazon.com, Seattle, WA.
Puyang Xu (2012): Now Scientist at Microsoft Corp., Redmond, WA.

[5] *Current PhD advisees: 8*

Scott Novotney (4th year, CS)
Yuan Cao (4th year, ECE)
Jonathan Wintrobe (3rd year, CS, part-time)
Guoguo Chen (3rd year, ECE)
Yixin Gao (3rd year, CS)
Oguz Yilmaz (2nd year, ECE)
Xiaohui Zhang (1st year, ECE, Fellow)
Chunxi Liu (1st year, ECE)

[6] *MSE advisees graduated: 19*

ECE Research advisees (year of graduation), and where they went after graduation:

Yan Huang (2000), Panasonic Research Laboratory, Santa Barbara, CA.
Geetu Ambwani (2003), M*Modal Inc., Pittsburgh, PA.
Sourin Das (2004), Constellation Energy, Baltimore, MD.
Srividya Mohan (2005), M*Modal Inc., Pittsburgh, PA.
Srihari Reddy (2005), Yahoo! Mountainview, CA.
David Farris (2007), Department of Defense, Ft. Meade, MD.
Lisa Yung (2007), US Patent Office, Alexandria, VA.
Binit Mohanty (2008), Epic Systems, Madison, WI.
Brian Kjersten (2012), Ratheon BBN Corp., Cambridge, MA.

CS Research advisees (year of graduation), and where they went after graduation:

Paola Virga (2005), IBM Corp, Yorktown, NY.
Benjamin Klein-Fignier (2005), Exchange student from France.
Eui-Jung Jung (2006), Unknown.
Wei-Wei Chen (2007), Carnegie Mellon University, Pittsburgh, PA.
Scott Novotney (2008), BBN Technologies, Columbia, MD.
Helmut Radrich (2008), Exchange student from Germany.

ECE Academic advisees (year of graduation):

Amita Agarwal (2002).
Shay-Jian Wong (2003).
Srinvas Vijayaragavan (2005).
Blake Caldwell (2007).

[7] *Current MSE advisees: 2*

ECE Academic advisees (expected year of graduation):

Zengwei Cheng (2013).
Yinan Zhao (2013).

Undergraduate Students

[8] *BS advisees graduated: 13* (Computer Engineering & Electrical Engineering)

[9] *Current BS advisees: 0* (Computer Engineering) plus **1** (Computer Science)

Sponsored Research Activities and Awards

Grant titles are in **bold face**; Co-investigators are listed in alphabetical order with (PI) designating the *Principal Investigator*; Award amounts include all indirect costs.

Exploiting Nonlocal and Syntactic Word Relationships in Language Models for Conversational Speech Recognition

National Science Foundation, STIMULATE Grant No IRI-9618874

E. Brill, F. Jelinek (PI), S. Khudanpur and D. Yarowsky

March 1997 – February 2001 (\$749,994)

3 months FTE/year. 1 graduate student/year. 25% admin responsibility.

Pronunciation Modeling for Conversational Speech Recognition

National Science Foundation, SGER Grant No IRI-9714169

S. Khudanpur (PI)

October 1997 – September 1998 (\$49,998)

1 month FTE. 1 graduate student. 100% admin responsibility.

Dynamic Pronunciation Modeling Using Acoustic, Linguistic and Speaker Dependent Information

Department of Defense, Contract No MDA904-99-C-3525

W. Byrne, F. Jelinek and S. Khudanpur (PI)

October 1998 – September 2001 (\$474,000)

4 months FTE/year. 1 graduate student/year. 33% admin responsibility.

WS99: A Language Engineering Workshop for Students and Professionals – Integrating Research and Education.

National Science Foundation, Grant No IIS-9820687

W. Byrne, F. Jelinek (PI) and S. Khudanpur

April 1999 – March 2001 (\$882,000)

2 months FTE/year. 33% admin plus *Summer School organization*.

WS00: A Language Engineering Workshop for Students and Professionals – Integrating Research and Education.

National Science Foundation, Grant No IIS-0071215

W. Byrne, F. Jelinek (PI) and S. Khudanpur

June 2000 – June 2002 (\$797,953)

2 months FTE/year. 33% admin plus *Summer School organization*.

Translingual Information Access: Rapidly Retargetable Approaches to Text, Speech and Document Images

University of Maryland (DARPA, Contract No N66001-00-2-8910)

W. Byrne (PI) and S. Khudanpur

May 2000 – April 2003 (\$473,000)

1.5 months FTE/year. 1 graduate student/year. 50% admin responsibility.

Mathematics in Multimedia: Speech Vision and Language

University of Minnesota (NSF Grant)

S. Khudanpur (PI)

September 2000 – December 2000 (\$18,070)

3 months of residence at the Institute for Mathematics and its Applications

Integrating Prosody, Speech Recognition and Parsing in Spoken-Language Information Retrieval

Mississippi State University (NSF, ITR Grant No IIS-0085940)

W. Byrne, F. Jelinek (PI) and S. Khudanpur

September 2000 – August 2004 (\$405,000)

1 month FTE/year. 33% admin responsibility.

Robust Knowledge Discovery from Parallel Speech and Text Sources

National Science Foundation, MLIAM Grant No IIS-9982329

W. Byrne, F. Jelinek (PI) and S. Khudanpur

March 2001 – December 2005 (\$748,719)

2 months FTE/year. 1 graduate student/year. 33% admin responsibility.

WS01: A Language Engineering Workshop for Students and Professionals – Integrating Research and Education.

National Science Foundation, Grant No IIS-0097467

W. Byrne, F. Jelinek (PI) and S. Khudanpur

June 2001 – May 2003 (\$583,047)

2 months FTE/year. 50% admin plus *Summer School organization.*

Improving Statistical Machine Translation Models via Text Analyzers Trained from Parallel Corpora

Office of Naval Research, MURI Grant No N00014-01-1-0685

W. Byrne, J. Eisner, F. Jelinek, S. Khudanpur and D. Yarowsky (PI)

May 2001 – April 2006 (\$4,334,000)

2 months FTE/year. 1 graduate student/year. 20% admin responsibility.

Integrated Cross-Language Spoken Document Retrieval

Johns Hopkins University, WSE-APL Partnership Fund

W. Byrne, L. Duong, S. Khudanpur, J. Mayfield (PI), P. McNamee

July 2001 – June 2003 (\$333,000)

No salary. 10% admin responsibility. Collaboration with APL staff.

Language Engineering Workshops for Students and Professionals: Integrating Research and Education

National Science Foundation, ITR Grant No IIS-0121285

W. Byrne, J. Eisner, F. Jelinek (PI), S. Khudanpur and D. Yarowsky

October 2001 – September 2007 (\$3,767,053)

2 months FTE/year. 20% admin plus *Summer School organization*.

Multilingual Access to Large Spoken Archives from the Holocaust

Shoah Visual History Foundation (NSF, ITR Grant No IIS-0122466)

W. Byrne (PI)

October 2001 – September 2006 (\$1,810,000)

0.5 months FTE/year.

A University Center for Language and Speech Processing

Department of Defense, Contract No MDA904-01-C-1005

W. Byrne, J. Eisner, F. Jelinek (PI), S. Khudanpur and D. Yarowsky

October 2001 – September 2005 (\$3,450,000)

1 month FTE/year. 2 graduate students/year. 20% admin responsibility.

Quantitative Electrical Measure of Brain Injury

National Institutes of Health, Grant No 1R21NS/MH42690-01A1

S. Khudanpur and N. Thakor (PI)

September 2002 – August 2004 (\$388,000)

1 month FTE (*budgeted but declined*). Interaction with post-doctoral fellow.

Computational Learning and Discovery in Biological Sequences

Carnegie Mellon University (NSF ITR Grant No IIS-0225656)

W. Byrne, J. Eisner, F. Jelinek (PI), S. Khudanpur and D. Yarowsky

September 2002 – August 2004 (\$180,000)

1 month FTE/year. 9 months graduate student. 20% admin responsibility.

Multimodal Collaboration Across Wired and Wireless Networks

Rutgers University (NSF KDI Grant No IIS-9872995)

D. Geman, F. Jelinek (PI) and M. Miller

October 2002 – September 2003 (\$180,000)

No salary. 2 months graduate student support. 25% admin responsibility

Automated Serendipity

AlgoTek Inc. (DARPA Contract)

S. Khudanpur, C. Priebe (PI) and A. Szalay

February 2003 – February 2004 (\$173,000)

No salary. \$40K salary plus F&A costs for 1 post-doctoral fellow.

Collaborative Investigation of Meaning Representations in Language Understanding for Machine Translation Systems

National Science Foundation, PIRE Grant No OISE-0530118

E. Charniak, J. Eisner, F. Jelinek (PI), M. Johnson and S. Khudanpur

October 2005 – September 2010 (\$2,498,407)

No salary. 1 graduate student/year. 33% admin responsibility

Structure Induction for Manipulative and Interactive Tasks

National Science Foundation, Grant No IIS-0534359

G. Hager (PI), S. Khudanpur and I. Shafran

February 2006 – January 2010 (\$491,598)

1 month FTE/year. 1 graduate student/year. 50% admin responsibility

Rosetta: An Analyst Co-Pilot

IBM Inc. (DARPA Contract No HR0011-06-2-0001)

F. Jelinek, S. Khudanpur (PI) and D. Yarowsky

October 2005 – September 2010 (\$3,276,465)

2 months FTE/year. 1 graduate student/year. 33% admin responsibility

Human Language Technology Center of Excellence

Department of Defense, Contract No H98230-07-C-0365

K. Johnson and J. Bagger (ex officio PIs)

January 2007 – September 2016 (Minimum \$5M/year, Maximum \$20M/year, WSE ~ \$1M/year)

Affiliate: 0-3 months FTE/year. 0-2 graduate student/year. (depending on evolving, mutual needs).

Novel Approaches to Unsupervised Classification via ISPDTs

National Science Foundation, Grant No CCF-0728931

D. Karakos (PI), S. Khudanpur and C. Priebe

September 2007 – August 2010 (\$299,996)

0.33 month FTE/year. 1 graduate student/year. 33% admin responsibility

Cross-Cutting Research Workshops in Intelligent Information Systems

National Science Foundation, Grant No IIS-0705708

J. Eisner, D. Geman, G. Hager, F. Jelinek (PI) and S. Khudanpur

September 2007 – August 2010 (\$646,913)

0.5 month FTE/year. 50% admin responsibility

Cross-Cutting Research Workshops in Intelligent Information Systems

Google Inc., Unrestricted gift to supplement NSF Grant No IIS-0705708

F. Jelinek and S. Khudanpur

Received March 12, 2008 (\$150,000)

1 month FTE/year. 50% admin responsibility

SGER: Self-supervised Discriminative Training of Statistical Language Models

National Science Foundation, Grant No IIS-0840112

D. Karakos and S. Khudanpur (PI)

September 2008 – August 2009 (\$137,464)

1 month FTE/year. 1.5 graduate student/year. 50% admin responsibility

Cross-Cutting Research Workshops in Intelligent Information Systems

National Science Foundation, Grant No IIS-0833652

J. Eisner, D. Geman, G. Hager, F. Jelinek (PI) and S. Khudanpur

February 2009 – January 2010 (\$280,480)

0.5 month FTE/year. 50% admin responsibility

Cross-Cutting Research Workshops in Intelligent Information Systems

Google Inc., Unrestricted gift to supplement NSF Grant No IIS-0833652

F. Jelinek (PI) and S. Khudanpur

Received March 2009 (\$120,000)

0.5 month FTE/year. 50% admin responsibility

CPS: Medium: Hybrid Systems for Modeling and Teaching the Language of Surgery

National Science Foundation, Grant No CNS-0931805

G. Hager (PI), S. Khudanpur, R. Kumar and Rene Vidal

September 1 2009 – August 2012 (\$1,499,828)
1 month FTE/year. 1 graduate student/year. 25% admin responsibility

CDI Type II: Language Models for Human Dexterity

National Science Foundation, Grant No OIA-0941362
G. Hager (PI), S. Khudanpur, R. Kumar and Rene Vidal
September 1 2009 – August 2013 (\$1,809,437)
1 month FTE/year. 1 graduate student/year. 25% admin responsibility

Unsupervised and Semi-supervised Methods for Training Automatic Speech Recognition

BBN Technologies, Corp., (DoD Contract No H98230-06-C-0482)
S. Khudanpur (PI) and Scott Novotney
September 1 2009 – October 2011 (\$200,000)
1 graduate student/year. 50% admin responsibility

Cross-Cutting Research Workshops in Intelligent Information Systems

Google Inc., Unrestricted gift to supplement NSF Grant No IIS-0833652
F. Jelinek and S. Khudanpur
Received February, 2010 (\$150,000)
0.5 month FTE/year. 50% admin responsibility (now 100%)

Semi-supervised Discriminative Training of Language Models

National Science Foundation, Grant No IIS-0963898
C. Callison-Burch, D. Karakos and S. Khudanpur (PI)
June 2010 – May 2013 (\$500,000)
0.25 month FTE/year. 3 graduate student/year. 100% admin responsibility

Cross-Cutting Research Workshops in Intelligent Information Systems

National Science Foundation, Grant No IIS-1005411
G. Hager, ~~F. Jelinek (PI)~~, S. Khudanpur (PI), R. Vidal, D. Yarowsky
September 2010 – August 2013 (\$439,651)
0.5 month FTE/year. 100% admin responsibility

Query-Directed Transcription and Translation for Cross-Language Information Retrieval

IBM Corporation (via DARPA Contract No HR0011-12-C-0015)
S. Khudanpur (PI)
October 2011 – September 2016 (\$1,603,852)
0.5 month FTE/year. 100% admin responsibility

Rapidly Deployable Information Capture Across Languages (RADICAL)

Carnegie Mellon University (via IARPA Contract No W911NF-12-C-0015)
Aren Jansen, S. Khudanpur (PI), Daniel Povey and David Yarowsky
March 2012 – June 2016 (\$800,000/year, renewable annually for a total of 4 years)
20% FTE/year. 100% admin responsibility

Administrative Service

Center for Language and Speech Processing (CLSP)

1. Day-to-day CLSP administration (ongoing),
particularly in the CLSP Director's absence, e.g. on sabbatical leave Jan-Dec 2001.

2. Organization of the annual Summer School on Human Language Technology (ongoing), an annual activity that brings high visibility to the Center among prospective students.
3. Coordination of the weekly CLSP external seminar (1997-2004) and the student seminar (ongoing).
4. Training and mentoring the CLSP administrator, Laura Graham (Jan-Dec 2001).
5. CLSP space renovation (Oct-Dec 2001), and space planning in CSEB (Apr-Aug 2007).
6. CLSP liaison to the WSE Communications Office (ongoing).
7. Acting Director of CLSP, Aug 2008 to Jan 2009.

Department of Electrical and Computer Engineering (ECE)

8. Committee Membership:
 - a. Strategic Planning Committee (2003-2008).
 - b. Graduate Admissions and Fellowships Committee (2001-2004).
 - c. Space Committee (2001-2004).
 - d. Computer Engineering Program Committee (2001-present).
 - e. Ad hoc Committee on Undergraduate Curriculum Review (Jul 2008-present).
 - f. Ad hoc Committee to Review ECE Fellowship Procedures (Oct 2012-present)
9. Supervisor and mentor of all ECE Teaching Assistants (2001-2008):
 - a. Department TA orientation, ESL evaluation, review of teaching evaluation, ABET support.
10. Coordinator of the weekly ECE Department Seminar (2001-2008).
11. Presenter of Speech and Language research to ECE visitors, external advisory committee, etc.
12. Program Director, 39th Conference on Information Sciences and Systems (2005).

Whiting School of Engineering (WSE)

13. Supervised a substantial and significant WSE-internal audit of CLSP finances (Jan-Dec 2001).
14. Assisted in the drafting of a section of the *WSE-APL Task-Force* report (Jan-Feb 2003).
15. Met with visitors (*trustees*) invited by the Associate Dean for Development and Alumni Relations.
16. Presented the EE and CE program at *WSE Open-House* to prospective students & parents (2003).
17. Member of the WSE *International Affairs Advisory Committee* (Aug 2006-present).
 - a. Facilitated MOU with the Indian Institute of Technology, Bombay, India (Jun 2009).
18. Member of the WSE *Communications Committee* (Aug 2007-present).
19. Participating faculty member in the *WISE program* with Garrison Forest School (Jan-May 2009).
20. Member of the WSE *Information Technology Faculty Advisor Committee* (Jun 2010-present).
21. Principal organizer of the Frederick Jelinek Memorial Service (Nov 2010).

Johns Hopkins University

22. Member of the Provost's Advisory Committee (Apr 2008-Mar 2010).
23. Member of the President's *Science of Learning* Steering Committee (Sep 2012-present).

Speech and Language Research Community

24. *Mentor and host* at the annual JHU Summer School on Human Language Technology, 1998-present.
25. *Publications Chair*, IEEE International Symposium on Information Theory, Washington DC, 2001.
26. *Member of the Advisory Board*, for the Human Language Technology Conference, 2003–present.
27. *Publications Chair*, Human Language Technology Conference of the North American Chapter of the Association for Computational Linguistics, New York City, NY, 2006.
28. *Chair of the Data Committee*, DARPA GALE Program, 2006-2008.
29. *Area Chair* for Language Modeling and Speech, Conference on Empirical Methods in Natural Language Processing and Conference on Computational Natural Language Learning, 2007.