

CHIN-HUI LEE
PROFESSOR
SCHOOL OF ELECTRICAL AND COMPUTER ENGINEERING
JANUARY 2009

I. EARNED DEGREES

- Ph.D. - Department of Electrical Engineering, University of Washington, Seattle, WA. 1981
- M.S. - Department of Engineering and Applied Science, Yale University, New Haven, CT. 1977
- B.S. - Department of Electrical Engineering, National Taiwan University, Taipei, Taiwan, 1973

II. EMPLOYMENT

- Professor, School of Electrical and Computer Engineering, Georgia Tech, 9/2002 – Present.
- Professor, School of Computing, National University of Singapore, 8/2001-8/2002
- Director, Dialogue Research, Lucent Technologies Bell Labs, Murray Hill, NJ., 1997-2001
- Member of Technical Staff and Distinguished MTS, AT&T Bell Labs, Murray Hill, NJ., 1986-1996
- DSP Group Manager, Digital Sound Corporation, Santa Barbara, CA., 1984-1986
- Senior Research Scientist, Verbex Corporation, Bedford, MA., 1981-1983

III. TEACHING

A. INDIVIDUAL STUDENT GUIDANCE

A1. Ph.D. Students

A1.1. Graduated Ph.D. Students

1. Qiang Huo, University of Science and Technology, Hefei, China, and The University of Hong Kong, CS Department, Ph.D. 1993, “Bayesian Learning of the Parameters of Hidden Markov Models” (Co-advisor, responsible for technical supervision)
2. Chih-Heng Lin, National Taiwan University, Taipei, Taiwan, EE Department, Ph.D. 1994, “Speaker Adaptation Based on Hidden Markov Models” (Co-advisor, responsible for technical supervision, most work done at Bell Labs, Murray Hill)
3. Chih-Shih Liu, National Tsing Hua University, Hsinchu, Taiwan, EE Department, Ph.D. 1995, “Discriminative Training for Speaker Verification” (Co-advisor, responsible for technical supervision, most work done at Bell Labs, Murray Hill)
4. Jen-Tzung Chien, National Tsing Hua University, Hsinchu, Taiwan, EE Department, Ph.D. 1997, “Speaker Adaptation Using MAP Transformation and Adaptation” (Co-advisor, responsible for technical supervision)
5. Arun C. Surendran, Rutgers University, EE Department, Ph.D. 1998, “Non-linear Maximum Likelihood Stochastic Matching for Robust Speech Recognition” (Co-advisor, responsible for technical supervision, most work done at Bell Labs, Murray Hill)
6. Cristina Chesta, Politecnico di Torino, Italy, Ph.D. 1999, “Joint Maximum A Posteriori Linear Regression for Robust Speech Recognition” (Co-advisor, responsible for technical supervision, most work done at Bell Labs, Murray Hill)
7. Koichi Shinoda, Tokyo Institute of Technology, CS Department, Ph.D. 2001, “A Structural Maximum A Posteriori (SMAP) Approach to Speech Recognition” (Co-advisor, responsible for technical supervision, most work done at Bell Labs, Murray Hill)
8. Tor Andre Myrvoll, Norwegian University of Science and Technology, Department of Telecommunications, Ph.D. 2002, “A Structural Maximum a Posteriori Linear Regression (SMAPLR) Approach to Speech Recognition” (Co-advisor, responsible for technical supervision, most work done at Bell Labs, Murray Hill)
9. Chao-Shih Huang, National Tsing Hua University, Hsinchu, Taiwan, EE, Ph.D. 2003, “Error Rate Reduction and Estimation for Robust Speech Recognition” (Co-advisor, responsible for technical

- supervision, most work done at Bell Labs, Murray Hill and National University of Singapore)
10. Namunu C. Maddage, National University of Singapore, CS Department, Ph.D. graduated Fall 2006 (Co-advisor, responsible for technical supervision, work done at National University of Singapore)
 11. Rui Shi, National University of Singapore, CS Department, Ph.D. Graduating in Fall 2008 (Co-advisor, responsible for technical supervision, most work done at National University of Singapore)
 12. Jinyu Li, Georgia Institute of Technology, School of ECE, Ph.D., Fall 2008, "Soft Margin Estimation for Automatic Speech Recognition"
 13. Sibel Yaman, MSR Fellow, Georgia Tech, School of ECE, Ph.D., Fall 2008, "A Multi-objective Programming Perspective to Statistical Learning Problems"
 14. Yu Tsao, Georgia Institute of Technology, School of ECE, Ph.D., Fall 2008, "An Ensemble Speaker and Speaking Environment Modeling Approach to Robust Speech Recognition"
 - 15.

A1.2. Current Ph.D. Students

1. Chengyuan Ma, Georgia Institute of Technology, ECE School, Ph.D. started in Spring 2004
2. Jeremy Reed, GRA, Georgia Tech, ECE, Ph.D., started Spring 2005
3. Byungki Byun, GRA, Georgia Tech, ECE, Ph.D., started Spring 2006
4. Ilseo Kim, GRA, Georgia Tech, ECE, Ph.D., started Spring 2008
5. Aleem Mushtaq, GRA, Georgia Tech, ECE, Ph.D., started Spring 2006

A2. Master Students

A2.1. Graduated Master Students

1. Jeff H.-K. Kuo, Massachusetts Institute of Technology, M.S. 1994, "Speaker Clustering for Talker Group Identification" (Co-advisor, responsible for technical supervision, most work done at Bell Labs, Murray Hill)
2. Jorge Alvarez-Cercardillo, Technical University of Madrid, Spain, M.S. 1996, "Acoustic Modeling of Context Dependent Units for Large Vocabulary Speech Recognition in Spanish" (Co-advisor, responsible for technical supervision, most work done at Bell Labs, Murray Hill)
3. J.J. Molina-Perez, Technical University of Madrid, Spain, M.S. 1998, "Task-Independent Subword Selection and Modeling for Speech Recognition" (Co-advisor, responsible for technical supervision, most work done at Bell Labs, Murray Hill)
4. Benoit Launay, Technical University of Munich, Germany, M.S. 2001, "Knowledge-Based Feature Extraction for Large Vocabulary Continuous Speech Recognition" (Co-advisor, responsible for technical supervision, most work done at Bell Labs, Murray Hill)
5. Wen Wu, National University of Singapore, CS Department, M.Sc. 2003, "A Maximal Figure-of-Merit Learning Approach to Text Categorization" (Co-advisor, responsible for technical supervision, most work done at National University of Singapore)
6. Namunu C. Maddage, National University of Singapore, CS Department, M.Sc. 2003, "Statistical Analysis of Musical Instruments" (Co-advisor, responsible for technical supervision, most work done at National University of Singapore)
7. Dominik Loefer, Georgia Institute of Technology, ECE Department, M.Sc. 2006, "Instrument Timbres and Pitch Estimation in Polyphonic Music"

A3. Undergraduate Students

1. Toma Ioan, National University of Singapore, CS Department, Intern from Romania, B.S. 2002, "Discriminative Semantic Models for Topic Spotting"
2. Vivien Chua, Georgia Tech, School of ECE, "Identification of Phonemes Using Neural Networks"
3. Vincent Lacey, Georgia Tech, School of ECE, Ongoing undergraduate research

B. OTHER TEACHING ACTIVITIES

- Developed Columbia University Course EE 6820: Fundamentals of Automatic Speech Recognition,

Fall Semester 1998 (following Rabiner's textbook)

- Developed National University of Singapore Course CS6212: Speech and Language Processing, Fall Semester 2001 (Fundamentals of Speech and Language Processing)
- Developed National University of Singapore Course CS3242: Hypermedia Information Processing, Spring Semester, 2002 (multimedia systems and technologies and applications on internet)
- Developed ECE6255 at <http://www.ece.gatech.edu/~chl/ECE6255.sp04> (Digital Speech Processing)
- Developed ECE3075 at <http://www.ece.gatech.edu/~chl/ECE3075.sum04> (Random Signals)
- Developed ECE8813 at <http://www.ece.gatech.edu/~chl/ECE8133.sp07> (Statistical NLP)
- Developed ECE7252 at <http://www.ece.gatech.edu/~chl/ECE7252.sp08> (Machine Learning for DSP)

IV. SCHOLARLY ACCOMPLISHMENTS

A. PUBLISHED BOOKS AND PARTS OF BOOKS

- [1] C.-H. Lee, F. K. Soong and K. K. Paliwal (eds), *Automatic Speech and Speaker Recognition: Advanced Topics*, Kluwer Academic Publishers, 1996.
- [2] Paul Dalsgaard, Chin-Hui Lee, Paul Heisterkamp, and Ron Cole (editors), *Proceedings ESCA Workshop on Interactive Dialogue in Multi-Modal Systems*, 1999.
- [3] C.-H. Lee, H. Li, L.-s. Lee, R.-H. Wang, and Q. Huo (eds), *Advances in Chinese Spoken Language Processing*, World Scientific Publishing Co., 2006.
- [4] C.-H. Lee (Part G Editor), "Language Identification," in *Springer Handbook on Speech Processing and Speech Communication*, J. Benesty, Y. Hunag. M. M. Sondhi, Editors, Springer-Verlag, 2008.
- [5] R. Pieraccini, C.-H. Lee, E. Giachin, and L. R. Rabiner, "An Efficient Structure for Continuous Speech Recognition," in *Speech Recognition and Understanding: Recent Advances, Trends and Applications*, NATO ASI Series F, P. Laface Editor, Springer-Verlag, 1991.
- [6] C.-H. Lee, L. R. Rabiner and R. Pieraccini, "Speaker-Independent Continuous Speech Recognition Using Continuous Density Hidden Markov Models," in *Speech Recognition and Understanding: Recent Advances, Trends and Applications*, NATO ASI Series F, P. Laface Editor, Springer-Verlag, 1991.
- [7] C.-H. Lee and J.-L. Gauvain, "Adaptive Learning in Acoustic and Language Modeling," in *New Advances and Trends in Speech Recognition and Coding*, NATO ASI Series F, A. Rubio Editor, Springer-Verlag, 1995.
- [8] B.-H. Juang, W. Chou, and C.-H. Lee, "Statistical and Discriminative Methods for Speech Recognition," in *New Advances and Trends in Speech Recognition and Coding*, NATO ASI Series F, A. Rubio Editor, Springer-Verlag, 1995.
- [9] C.-H. Lee and J.-L. Gauvain, "Bayesian Adaptive Learning and MAP Estimation of HMM," in *Automatic Speech and Speaker Recognition: Advanced Topics*, C.-H. Lee, F. K. Soong and K. K. Paliwal Editors, Kluwer Academic Publishers, 1996.
- [10] B.-H. Juang, W. Chou, and C.-H. Lee, "Statistical and Discriminative Methods for Speech Recognition," in *Automatic Speech and Speaker Recognition: Advanced Topics*, C.-H. Lee, F. K. Soong and K. K. Paliwal Editors, Kluwer Academic Publishers, 1996.
- [11] L. R. Rabiner, B.-H. Juang and C.-H. Lee, "An Overview of Automatic Speech Recognition," in *Automatic Speech and Speaker Recognition: Advanced Topics*, C.-H. Lee, F. K. Soong and K. K. Paliwal Editors, Kluwer Academic Publishers, 1996.
- [12] S. Katagiri, B.-H. Juang and C.-H. Lee, "Pattern Recognition Using A Family of Design Algorithms Based Upon Generalized Probability Descent Method," in *Intelligent Signal Processing*, S. Haykin and B. Kosko Editors, IEEE Press, 2001.

- [13] L. Chaisorn, T.-S. Chua and C.-H. Lee, "News Video Segmentation," *Handbook of Video Database*, CRC Publications, pp. 1133-1148, 2003.
- [14] C.-H. Lee, "Back to Speech Science - Towards a Collaborative ASR Community of the 21st Century," *Dynamics in Speech Production and Perception*, P. Divenyi, S. Greenberg, and G. Meyer (eds), NATO Science Series, IOS Press, 2006.
- [15] H. Li, B. Ma and C.-H. Lee, "Vector Based Spoken Language Classification," in *Springer Handbook on Speech Processing and Speech Communication*, J. Benesty, Y. Hunag. M. M. Sondhi, Editors, Springer-Verlag, 2008.

B. REFEREED PUBLICATIONS

B1. Journal Publications:

- [1] C.-H. Lee and R. D. Martin, "Ordinary and Proper Location M-estimate for Autoregressive-Moving Average Models," *Biometrika*, Vol. 73, No. 3, pp. 679-686, December 1986.
- [2] C.-H. Lee, "On Robust Linear Prediction of Speech," *IEEE Trans. Acoustic, Speech and Signal Proc.*, Vol. ASSP-36, No.5, pp. 642-650, May 1988.
- [3] C.-H. Lee, "On the use of some robust modeling techniques for speech recognition," *Computer Speech and Language*, Vol.3, No.1, pp. 35-52, January 1989.
- [4] C.-H. Lee, "Applications of Dynamic Programming to Speech and Language Processing," *AT&T Technical Journal*, Special Issue on Optimization: Methodology, Algorithm and Applications, Vol. 68, No.3, pp. 114-130, May/June 1989.
- [5] C.-H. Lee and L. R. Rabiner, "A Frame-Synchronous Network Search Algorithm for Connected Word Recognition," *IEEE Trans. Acoustic, Speech and Signal Proc.*, Vol. ASSP-37, No. 11, pp. 1649-1658, Nov. 1989.
- [6] C.-H. Lee, L. R. Rabiner, R. Pieraccini and J. G. Wilpon, "Acoustic Modeling for Large Vocabulary Speech Recognition," *Computer, Speech and Language*, Vol. 4, No. 2, pp. 127-165, April 1990.
- [7] J. G. Wilpon, L. R. Rabiner, C.-H. Lee and E. R. Goldman, "Automatic Recognition of Keywords in Unconstrained Speech Using Hidden Markov Models," *IEEE Trans. Acoustic, Speech and Signal Proc.*, Vol. ASSP-38, pp. 1870-1878, Nov. 1990.
- [8] C.-H. Lee, C.-H. Lin and B.-H. Juang, "A Study on Speaker Adaptation of the Parameters of Continuous Density Hidden Markov Models," *IEEE Trans. Acoustic, Speech and Signal Proc.*, Vol. ASSP-39, No. 4, pp. 806-814, April 1991.
- [9] E. P. Giachin, C.-H. Lee and A. E. Rosenberg, "Word Juncture Modeling Using Phonological Rules for HMM-Based Continuous Speech Recognition," *Computer, Speech and Language*, Vol. 5, No. 2, pp. 155-168, April 1991.
- [10] C.-H. Lee, E. Giachin, L. R. Rabiner, R. Pieraccini and A. E. Rosenberg, "Improved Acoustic Modeling for Large Vocabulary Continuous Speech Recognition," *Computer, Speech and Language*, Vol. 6, No. 2, pp. 103-127, April 1992.
- [11] J.-L. Gauvain and C.-H. Lee, "Bayesian Learning for Hidden Markov Model with Gaussian Mixture State Observation Densities," *Speech Communication*, Vol. 11, Nos. 2-3, pp. 205-213, June 1992.
- [12] P. Ramesh, J. G. Wilpon, M. A. McGee, D. B. Roe, C.-H. Lee and L. R. Rabiner "Speaker-Independent Recognition of Spontaneously Spoken Connected Digits," *Speech Communication*, Vol. 11, Nos. 2-3, pp. 229-235, June 1992.

- [13]E. Giachin, C.-H. Lee, L. R. Rabiner, A. E. Rosenberg, and R. Pieraccini, "On the Use of Inter-word Context Dependent Units for Word Juncture Modeling," *Computer, Speech and Language*, Vol. 6, No. 3, pp. 197-213, July 1992.
- [14]N. Merhav and C.-H. Lee, "A Minimax Classification Approach with Application to Robust Speech Recognition," *IEEE Trans. on Speech and Audio Proc.*, Vol. 1, No. 1, pp. 90-100, Jan. 1993.
- [15]J. G. Wilpon, C.-H. Lee and L. R. Rabiner, "Connected Digit Recognition Based on Improved Acoustic Resolution," *Computer, Speech and Language*, Vol. 7, No. 1, pp. 15-26, Jan. 1993.
- [16]N. Merhav and C.-H. Lee, "On the Asymptotic Statistical Behavior of Empirical Cepstral Coefficients," *IEEE Trans. on Signal Processing*, Vol. 41, No.5, pp. 1990-1993, May 1993.
- [17]C.-H. Lee and C.-H. Lin, "On the Use of A Family of Signal Limiters for Recognition of Noisy Speech," *Speech Communication*, Vol. 12, No. 4, pp. 383-392, August 1993.
- [18]S. Katagiri and C.-H. Lee, "A New Hybrid Algorithm for Speech Recognition Based on HMM Segmentation and Discriminative Classification," *IEEE Trans. on Speech and Audio Proc.*, Vol. 1, No. 4, pp. 421-430, Oct. 1993.
- [19]C.-H. Lee, J.-L. Gauvain, R. Pieraccini and L. R. Rabiner, "Large Vocabulary Speech Recognition Using Subword Units," *Speech Communication*, Vol. 13, Nos. 3-4, pp. 263-280, Nov. 1993.
- [20]C.-H. Lee, J.-L. Gauvain, R. Pieraccini and L. R. Rabiner, "Subword-Based Large Vocabulary Speech Recognition," *AT&T Technical Journal*, Vol. 72, No. 5, pp. 25-36, Sept./Oct. 1993.
- [21]K.-Y. Su and C.-H. Lee, "Speech Recognition using Weighted HMM and Subspace Projection Approaches," *IEEE Trans. on Speech and Audio Proc.*, Vol. 2, No. 1, pp. 69-79, Jan. 1994.
- [22]W. Chou, C.-H. Lee, B.-H. Juang and F. K. Soong, "A Minimum Error Rate Pattern Recognition Approach to Speech Recognition," *Journal of Pattern Recognition*, Vol. 8, No. 1, pp. 5-31, Feb. 1994.
- [23]J.-L. Gauvain and C.-H. Lee, "Maximum A Posteriori Estimation for Multivariate Gaussian Mixture Observations of Markov Chains," *IEEE Trans. on Speech and Audio Proc.*, Vol. 2, No. 2, pp. 291-298, April 1994.
- [24]A. Sankar and C.-H. Lee, "Stochastic Matching for Robust Speech Recognition," *IEEE Signal Processing Letters*, Vol. 1, No. 8, pp. 124-125, August 1994.
- [25]C.-H. Lee, "Stochastic Modeling in Spoken Dialogue System Design," *Speech Communication*, Vol. 15, pp. 311-322, Nov. 1994.
- [26]C.-S. Liu, C.-H. Lee, W. Chou, A. E. Rosenberg and B.-H. Juang, "A Study on Minimum Error Discriminative Training for Speaker Recognition," *Jour. Acoust. Soc. Am.*, Vol. 97, No. 1, pp. 637-648, Jan. 1995.
- [27]C.-H. Lee and L. R. Rabiner, "Directions in Automatic Speech Recognition," *NTT Review*, Vol. 7, No. 2, pp. 19-29, March 1995; also in *NTT R&D Journal* (Japanese), pp. 1069-1080, Vol. 43, No. 10, August 1994.
- [28]Q. Huo, C. Chan and C.-H. Lee, "Bayesian Adaptive Learning of the Parameters of Hidden Markov Model for Speech Recognition," *IEEE Trans. on Speech and Audio Proc.*, Vol. 3, No. 5, pp. 334-345, Sept. 1995.
- [29]C.-S. Liu, H.-C. Wang and C.-H. Lee, "Speaker Verification Using Normalized Log-Likelihood Score," *IEEE Trans. on Speech and Audio Proc.*, Vol. 4, No. 1, pp. 56-60, Jan. 1996.

- [30] Q. Huo, C. Chan and C.-H. Lee, "On-Line Adaptation of the SCHMM Parameters Based on the Segmental Quasi-Bayes Learning for Speech Recognition," *IEEE Trans. on Speech and Audio Proc.*, Vol. 4, No. 2, pp. 141-144, March 1996.
- [31] A. Sankar and C.-H. Lee, "A Maximum-Likelihood Approach to Stochastic Matching for Robust Speech Recognition," *IEEE Trans. on Speech and Audio Proc.*, Vol. 4, No. 3, pp. 190-202, May 1996.
- [32] C.-H. Lee and B.-H. Juang, "A Survey on Automatic Speech Recognition with an Illustrative Example on Continuous Speech Recognition of Mandarin," *International Journal of Computational Linguistics and Chinese Language Processing*, Vol. 1, No. 1, pp. 1-36, August 1996.
- [33] R. A. Sukkar and C.-H. Lee, "Vocabulary Independent Discriminative Utterance Verification for Non-Keyword Rejection in Subword Based Speech Recognition," *IEEE Trans. on Speech and Audio Proc.*, Vol. 4, No. 6, pp. 420-429, Nov. 1996.
- [34] K. Wang, C.-H. Lee and B.-H. Juang, "Selective Feature Extraction via Signal Decomposition," *IEEE Signal Processing Letters*, Vol. 5, No. 1, pp. 8-11, 1997.
- [35] Q. Huo and C.-H. Lee, "On-line Adaptive Learning of the Continuous Density Hidden Markov Model Based on Approximate Recursive Bayes Estimate," *IEEE Trans. on Speech and Audio Proc.*, Vol. 5, No. 2, pp. 161-172, March 1997.
- [36] M. Rahim and C.-H. Lee, "String-Based Minimum Verification Error (SB-MVE) Training for Speech Recognition," *Computer, Speech and Language*, Vol. 11, No. 2, pp. 147-160, April 1997.
- [37] B.-H. Juang, W. Chou and C.-H. Lee, "Discriminative Methods for Speech Recognition," *IEEE Trans. on Speech and Audio Proc.*, Vol. 5, No. 3, pp. 257-265, May 1997.
- [38] M. Rahim, C.-H. Lee and B.-H. Juang, "Discriminative Utterance Verification for Connected Digit Recognition," *IEEE Trans. on Speech and Audio Proc.*, Vol. 5, No. 3, pp. 266-277, May 1997.
- [39] M. Rahim, C.-H. Lee and B.-H. Juang, "Utterance Verification for Robust Connected Digit Recognition," *Jour. Acous. Soc. Am.*, Vol. 101, No. 5, pp. 2892-2902, May 1997.
- [40] J.-T. Chien, C.-H. Lee and H.-C. Wang, "A Hybrid Algorithm for Speaker Adaptation Using MAP Transformation and Adaptation," *IEEE Signal Processing Letters*, Vol. 4, No. 6, pp. 167-168, June 1997.
- [41] O. Siohan and C.-H. Lee, "Iterative Noise and Channel Estimation under the Stochastic Matching Algorithm Framework," *IEEE Signal Processing Letters*, Vol. 4, No. 11, pp. 304-306, Nov. 1997.
- [42] R. Sukkar, A. R. Setlur, C.-H. Lee and J. Jacob, "Verifying and Correcting String Hypotheses Using Discriminative Utterance Verification," *Speech Communication*, Vol. 22, pp. 333-342, 1997.
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- [44] C.-H. Lee, "On Stochastic Feature and Model Compensation Approaches to Robust Speech Recognition," *Speech Communication*, Vol. 25, pp. 29-47, 1998.
- [45] T. Kawahara, C.-H. Lee and B.-H. Juang, "Key-Phrase Detection and Verification for Flexible Speech Understanding," *IEEE Trans. on Speech and Audio Proc.*, Vol. 6, No. 6, pp. 558-568, Nov. 1998.
- [46] S. Katagiri, B.-H. Juang and C.-H. Lee, "Pattern Recognition Using A Generalized Probabilistic Descent Method," *Proceedings of the IEEE*, Vol. 86, No. 11, pp. 2345-2373, Nov. 1998.

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- [50] Q. Huo and C.-H. Lee, "A Bayesian Predictive Classification Approach to Robust Speech Recognition," *IEEE Trans. on Speech and Audio Proc.*, Vol. 8, No. 2, pp. 200-204, March 2000.
- [51] C.-H. Lee, R. Carpenter, W. Chou, J. Chu-Carroll, W. Reichl, A. Saad, and Q. Zhou, "On Natural Language Call Routing," *Speech Communication*, Vol. 31, pp. 309-320, 2000.
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- [53] C.-H. Lee and Q. Huo, "On Adaptive Decision Rules and Decision Parameter Adaptation for Automatic Speech Recognition," *Proceedings of the IEEE*, Vol. 88, No. 8, pp. 1241-1269, August 2000.
- [54] A. C. Surendran and C.-H. Lee, "Transformation Based Bayesian Prediction for Adaptation of HMMs," *Speech Communication*, Vol. 34, Nos. 1-2, pp. 159-174, 2001.
- [55] Q. Huo and C.-H. Lee, "Robust Speech Recognition Based on Adaptive Classification and Decision Strategies," *Speech Communication*, Vol. 34, Nos. 1-2, pp. 175-194, 2001.
- [56] K. Shinoda and C.-H. Lee, "A Structural Bayes Approach to Speaker Adaptation," *IEEE Trans. on Speech and Audio Proc.*, Vol. 9, No. 3, pp. 276-287, March 2001.
- [57] O. Siohan, C. Chesta and C.-H. Lee, "Joint Maximum a Posteriori Adaptation of Transformation and HMM Parameters," *IEEE Trans. on Speech and Audio Proc.*, Vol. 9, No. 4, pp. 417-428, May 2001.
- [58] M.-W. Koo, C.-H. Lee and B.-H. Juang, "Speech Recognition and Utterance Verification Based on a Generalized Confidence Score," *IEEE Trans. on Speech and Audio Proc.*, Vol. 9, No. 8, pp. 821-832, Nov. 2001.
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- [60] M. Affify, O. Siohan and C.-H. Lee, "Upper and Lower Bounds on the Mean of Speech: Application to Minimax Classification," *IEEE Trans. on Speech and Audio Proc.*, Vol. 10, No. 2, pp. 79-88, Jan. 2002.
- [61] O. Siohan, T. A. Myrvoll and C.-H. Lee, "Structural Maximum A Posteriori Linear Regression for HMM Adaptation," *Computer Speech and Language*, Jan. 2002.
- [62] L. Chaisorn, T.-S. Chua and C.-H. Lee, "A Multimodal Framework to Story Segmentation for News Video," to appear in *Journal of World Wide Web*, Kluwer Academic Publishers, 2003.
- [63] H.-K. J. Kuo and C.-H. Lee, "Discriminative Training for Robust Natural Language Call Routing," *IEEE Trans. on Speech and Audio Proc.*, Vol. 11, No.1, pp. 24-35, Jan. 2003.
- [64] C.-S. Huang, C.-H. Lee and H.-C. Wang, "A Decision Rule Based on Ordered-Nearest-Neighbor with Application to Utterance Verification," *IEE Electronics Letters*, Feb. 2003.

- [65] C.-H. Lee, "On Automatic Speech Recognition at the Dawn of the 21st Century," *IEICE Trans. on Information and Systems, Special Issue on Speech Information Processing*, Vol.E86-D, No. 3, pp. 377-396, March 2003.
- [66] S. Gao, W. Wu, C.-H. Lee and T.-S. Chua, "A Maximal Figure-of-Merit Learning Approach to Text Categorization," *2003 ACM SIGIR*, pp. 174-181, Toronto, Canada, July 2003.
- [67] H. Jiang and C.-H. Lee, "A New Approach to Utterance Verification Based on Neighborhood Information in Model Space," *IEEE Trans. on Speech and Audio Proc.*, Vol. 11, No. 5, pp. 425-435, 2003.
- [68] I. Zitouni, H.-K. J. Kuo and C.-H. Lee, "Boosting and Combination of Classifiers for Natural Language Call Routing Systems," *Speech Communication*, Vol. 41, No. 4, pp. 647-661, Nov. 2003.
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- [74] S. Gao, W. Wu, C.-H. Lee and T.-S. Chua, "A Maximal Figure-of-Merit (MFoM) Learning Approach to Robust Classifier Design for Text Categorization," *ACM Trans. on Information Systems*, pp. 190-216, Vol. 2.4, Issue 2, April 2006.
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- [16] C.-H. Lee, "A Detection Approach to Flexible Speech Recognition and Understanding," *invited talk at 1998 Johns Hopkins University Summer Research Workshop*, Baltimore, MD., July, 1998.
- [17] C.-H. Lee, "A Unified Testing Hypothesis Approach to Speaker and Utterance Verification, " invited talk at *Peiking University Information Technology Forum*, Beijing, China, July 1998.

- [18] C.-H. Lee, "Robust Speech Recognition: An Adaptation and Compensation Perspective," invited talk at *Tsinghua University Information Technology Forum*, Beijing, China, July 1998.
- [19] C.-H. Lee, "A Detection Approach to Flexible Speech Recognition and Understanding: Perspectives for Spoken Dialogue Processing," *Chinese Academy of Sciences Speech Technology Forum*, Beijing, China, July 1998.
- [20] C.-H. Lee, "Spoken Dialogue Processing towards Telecommunication Applications" invited talk at *1998 ISSD Workshop*, Sydney, Australia, Dec. 1998.
- [21] C.-H. Lee, "Robust speech recognition -- overview of statistical pattern recognition approach and the implied robustness problems and solutions," *TMH Special Speech Seminar* at KTH, Stockholm, Sweden, April 1999.
- [22] C.-H. Lee, "Speaker and speech verification -- overview of statistical pattern verification approach and applications to speaker and speech verification," *TMH Special Speech Seminar* at KTH, Stockholm, Sweden, April 1999.
- [23] C.-H. Lee, "A detection approach to speech recognition and understanding -- a paradigm to combine feature-based detection and state-of-the-art recognition to open up new possibilities," *TMH Special Speech Seminar* at KTH, Stockholm, Sweden, April 1999.
- [24] C.-H. Lee, "Voice User Interface (VUI) to Multimedia Services over Networks," *Multimedia and Internet Technologies Summer School Lecture Notes*, Taipei, Taiwan, August 2000.
- [25] C.-H. Lee, "Voice User Interface (VUI): Technology Dimensions and Applications," Plenary Talk at *International Conference on Signal Processing Plenary Talk*, Beijing, China, August 2000.
- [26] C.-H. Lee, "Parameter Adaptation and Compensation in Designing Maximum A Posteriori Decision Rules for Automatic Speech Recognition," *IMA Workshop on Mathematical Foundations on Speech Processing and Recognition*, Minneapolis, MN., Nov. 2000.
- [27] C.-H. Lee, "Voice User Interface (VUI) for New Services over Internet and Wireless Communication," *Korea Telecom International Symposium - Cyber World's Technologies for the New Millennium*, Seoul, South Korea, Oct. 2000.
- [28] C.-H. Lee, "Adaptation and Compensation for Automatic Speech Recognition," invited lecture at *ETRI*, Daejeon, South Korea, August 2001.
- [29] C.-H. Lee, "Voice User Interface Technologies and Applications," invited keynote at *NCSEC-2001*, Chiang Mai, Thailand, Nov. 2001.
- [30] C.-H. Lee, "Fundamentals of Speech and Audio Coding," invited lecture at *Tamkang University International Lecture Series on Signal Processing*, Taipei Taiwan, April 2002.
- [31] C.-H. Lee, "Fundamentals of Speech and Speaker Recognition," invited lecture at *Tamkang University International Lecture Series on Signal Processing*, Taipei Taiwan, April 2002.
- [32] C.-H. Lee, "Voice User Interface Technologies and Their Applications," invited lecture at *Tamkang University International Lecture Series on Signal Processing*, Taipei Taiwan, April 2002.
- [33] C.-H. Lee, "Advances in Speech and Audio Technologies," invited lecture at *2002 IDA Distinguished Professor Symposium*, Singapore, May 2002.
- [34] C.-H. Lee, "Future of Speech and Media Technologies," invited lecture at *2002 IDA Distinguished Professor Symposium*, Singapore, May 2002.

- [35] C.-H. Lee, "Back to Speech Science: A Bottom-Up Approach to Automatic Speech Recognition," invited lecture at *2002 NATO-ASI Series on Speech Production*, Il Ciocco, Italy, July 2002.
- [36] C.-H. Lee, "A Machine Learning Approach to Generalized Call Routing," presented at *Microsoft Research*, Redmond, WA., Nov. 2002.
- [37] C.-H. Lee, "Infocomm Research at Georgia Tech," presented at *A*Star and Georgia Tech Joint Seminar*, Singapore, Dec. 2002.
- [38] C.-H. Lee, "Knowledge-Based Features for Automatic Speech Recognition," presented at *Rutgers University CAIP Colloquium*, New Brunswick, NJ., May 2003.
- [39] C.-H. Lee, "Novel Approaches to ASR: How Far can we Push?," presented at *DARPA EARS PI Meeting*, Boston, MA., May 2003.
- [40] C.-H. Lee, "Human and Media Communication at the Dawn of the 21st Century," invited lecture at Department of Information Science and Engineering, *Nagoya University*, Nagoya, Japan, June 2003.
- [41] C.-H. Lee, "Human Language Engineering: Research and Challenges?," invited talk at *IEEE Kansai Section Meeting*, Kyoto, Japan., June 2003.
- [42] C.-H. Lee, "A Neural-Perception Approach to Automatic Speech Recognition" invited talk at *SMA Lecture Series*, National University of Singapore, September 2003.
- [43] C.-H. Lee and B.-H. Juang, "A New Detection Paradigm for Collaborative Automatic Speech Recognition and Understanding," *Lectures by Masters in Speech Processing*, Maui, Hawaii, January 2004.
- [44] C.-H. Lee, "Advances in Voice User Interface Technologies," Acer Research Forum at Acer Aspire Park, Longtan, Taiwan, March 2004.
- [45] C.-H. Lee, "From Knowledge-Ignorant to Knowledge-Rich Modeling: A New Speech Research Paradigm for Next Generation Automatic Speech Recognition," *International Conference on Spoken Language Processing (ICSLP2004)*, Jeju, South Korea, Oct. 2004.
- [46] C.-H. Lee, "Discovering Knowledge in and Extracting Information from Multimedia Patterns," *International Symposium on Intelligent Multimedia, Video and Speech Processing (ISIMP2004)*, Hong Kong., Oct. 2004.
- [47] C.-H. Lee, "A Decision-Feedback Approach to Text Categorization," *Microsoft Faculty Summit*, July 2005.
- [48] C.-H. Lee, "Speech Recognition Based on Attribute Detection and Knowledge Integration," *2005 Symposium on Next Generation Automatic Speech Recognition*, Academia Sinica, Taipei, Taiwan, Septemeber 2005.

E. OTHER SCHOLARLY ACCOMPLISHMENTS (PATENT)

- [1] C.-H. Lee and D. Y. Wong, U. S. Patent No. 4,689,760, "Digital Tone Decoder and Method of Decoding Tones Using Linear Predictive Coding," August 25, 1987.
- [2] J.W. Klovstad, K. Ganesan and C.-H. Lee, U. S. Patent No. 4,713,777, "Speech Recognition Method Having Noise Immunity," Dec. 15, 1987.
- [3] J. K. Baker, J.W. Klovstad, K. Ganesan and C.-H. Lee, U. S. Patent No. 4,718,088, "Speech Recognition Training Method," Jan. 5, 1988.
- [4] C.-H. Lee, L. R. Rabiner and J. G. Wilpon, U. S. Patent No. 5,509,104, "Application of Hidden Markov Models for Recognition of a Limited Set of Words in Unconstrained Speech - Word Spotting," April 16, 1996.

- [5] W. Chou, B.-H. Juang and C.-H. Lee, U. S. Patent No. 5,579,436, "Recognition Unit Model Training Based on Competing Words and Word String Models," Nov. 26, 1996.
- [6] W. Chou, B.-H. Juang and C.-H. Lee, U. S. Patent No. 5,606,644, "Minimum Error Rate Training of Combined String Models," Feb. 25, 1997.
- [7] C.-H. Lee, L. R. Rabiner and J. G. Wilpon, U. S. Patent No. 5,649,057, "Speech Recognition Employing Key Word Modeling and Non-Key Word Modeling," July 17, 1997.
- [8] B.-H. Juang, C.-H. Lee, A.E. Rosenberg, F.K. Soong, U.S. Patent No. 5,675,704, "Speaker Verification with Cohort Normalized Scoring," Oct. 7, 1997.
- [9] C.-H. Lee and R. Sukkar, U.S. Patent No. 5,675,706, "Vocabulary Independent Discriminative Utterance Verification for Non-Keyword Rejection in Subword Based Speech Recognition," Oct. 7, 1997.
- [10] B.-H. Juang, C.-H. Lee and R. Rose, U.S. Patent No. 5,710,864, "Systems, Methods And Articles Of Manufacture For Improving Recognition Confidence," Jan. 20, 1998.
- [11] C.-H. Lee and A. Sankar, U.S. Patent No., 5,724,124, "Method Of And Apparatus For Signal Recognition That Compensates For Mismatch," March 10, 1998.
- [12] W. Chou, B.-H. Juang, C.-H. Lee and M. Rahim, U.S. Patent No. 5,737,489, "Discriminative Utterance Verification for Connected Digit Recognition," April 7, 1998.
- [13] W. Chou, B.-H. Juang, T. Kawahara, and C.-H. Lee, U.S. Patent No. 5,797,123, "Method of Key-Phrase Detection and Verification for Flexible Speech Understanding," August 18, 1998.
- [14] W. Chou, B.-H. Juang, C.-H. Lee, and T. Matsuoka, U.S. Patent No. 5,805,772, "Systems, Methods, and Articles of Manufacture for Performing High Resolution N-Best String Hypothesization," Sept. 8, 1998.
- [15] C.-H. Lee and K. Shinoda, U.S. Patent No. 6151574, "Techniques for Adaptation of Hidden Markov Models for Speech Recognition," Nov. 21, 2000.
- [16] H.-K. Kuo, C.-H. Lee and A. Pargellis, U.S. Patent No. 6418440, "System and Method for Performing Automated Dynamic Dialogue Generation," July 7, 2002.
- [17] C.-H. Lee, P. Q. Li, O. Siohan and A. C. Surendran, U.S. Patent No. 6519563, "Background Model Design for Flexible and Portable Speaker Verification," Feb. 11, 2003.
- [18] C.-H. Lee, P. Q. Li, J. Zheng and Q. Zhou, U.S. Patent No. 6782363, "Method and Apparatus for Performing Real-Time Endpoint Detection in Automatic Speech Recognition," August 24, 2004.
- [19] H.-K. Kuo and C.-H. Lee, U.S. Patent No. 6925432, "Methods and Apparatus Using Discriminative Training in Natural Language Call Routing and Document Retrieval," August 2, 2005.
- [20] B.-H. Juang, C.-H. Lee, P. Q. Li and Q. Zhou, "Method and Apparatus for Providing Speaker Authentication by Verbal Information Verification," filed July 1997.
- [21] B.-H. Juang, C.-H. Lee, P. Q. Li and Q. Zhou, "Method and Apparatus for Providing Speaker Authentication by Verbal Information Verification Using Forced Decoding," filed July 1997.
- [22] C.-H. Lee and P. Ramesh, "Voice Message Filtering for Classification of Voice Messages According to Caller," filed June 1999.
- [23] C.-H. Lee and P. Ramesh, "Key Segment Spotting in Voice Messages," filed June 1999.

- [24] C.-H. Lee, P. Q. Li, J. Zheng and Q. Zhou, "A Robust, Real-Time Endpoint Detector with Energy Normalization for ASR in Adverse Environment," filed September 2000.
- [25] E. Fosler-Lussier, C.-H. Lee, A. Pargellis, and A. Potamianos, "Automatic Derivation and Extraction of Semantic Classes across Domains," filed June 2001.

V. SERVICE

A. PROFESSIONAL CONTRIBUTIONS

A1. Memberships

- Member, ARPA Spoken Language Coordination Committee (1991-95)
- Member, IEEE Signal Processing Society Speech Technical Committee (1994-96)
- Member, SPS Multimedia Signal Processing Technical Committee (1996-2004)
- Member, Advisory Board, Telecommunication Labs, Taiwan (1992-present)
- Member, Advisory Council, International Speech Communication Association (2004-present)
- Member, Advisory Board, European Union FP7 ACORNS project (2007-2009)

A2. Editorial/Review Activities

- Associate Editor, IEEE Transactions on Signal Processing (1991-93)
- Associate Editor, IEEE Transactions on Speech and Audio Processing (1993-95)
- Editor, Inter Journal of Computational Linguistics and Chinese Language Processing (1997-present)
- International Editorial Board, Communications of COLIPS (1998-present)
- Editorial Board, European Journal on Applied Signal Processing (2001-2007)
- Editorial Board, IEEE Signal Processing Magazine (2009-present)
- Paper Reviewers for many journals, conferences and workshops of IEEE, ESCA and ACM
- Proposal Reviewers for many funding agencies from US, Canada, Europe, and Asia

A3. Conference Leadership Positions

- Steering Committee Chair, International Symposium on Chinese Spoken Language Processing
- Member, Scientific Review Committee, HLT-NAACL'03, May 2003.
- Member, Scientific Review Committee, EuroSpeech 2003, Geneva, Switzerland, Sept. 2003.
- Special Session Chair, 2004 International Conference on Image Processing, Dec. 2004
- Member, Scientific Committee, 2003 International Conference on WWW, Budapest, Hungary
- Member, Scientific Committee, 2004 IEEE Workshop on Automatic Speech Recognition and Understanding, St. Thomas, Virgin Islands, Dec. 2003.
- Organizer and Lecturer, 2000 Multimedia and Internet Technology Summer School, Taipei, Taiwan
- Program Chair, 1996 International Symposium on Multi-Technology Information Processing
- General Chair, 1997 International Symposium on Multi-Technology Information Processing
- General Chair, 1998 International Symposium on Chinese Spoken Language Processing, Singapore
- General Co-Chair, 1999 IEEE Workshop on Automatic Speech Recognition and Understanding
- General Co-Chair, 1999 International Workshop on Spoken Dialogue Processing
- General Co-Chair, 2002 International Symposium on Chinese Spoken Language Processing, Taipei, Taiwan
- Technical Co-Chair, 2003 International Conference on Multimedia Modeling, Taipei, Taiwan
- Session Chair at many international conferences and workshops

A4. Invited Speakers/Lecturers

- Keynote Speaker, 1995 International Symposium on Multi-Technology Information Processing
- Keynote Speaker, 1996 International Conf. of Computational Linguistics & Chinese Language Proc.
- Plenary Speaker, 1999 International Conference of Speech Processing

- Keynote Speaker, 2000 International Symposium on Chinese Spoken Language Processing
- Plenary Speaker, 2000 Korean Telecom International Symposium,
- Plenary Speaker, 2000 World Congress on Computers
- Keynote Speaker, 2000 IEEE Pacific Rim Conference on Multimedia
- Keynote Speaker, 2001 Turkish Signal Processing and Applications Conference
- Keynote Speaker, 2004 International Conference on Spoken Language Processing
- Keynote Speaker, 2004 International Symposium on Intelligent Multimedia Processing
- Keynote Speaker, 2007 National Conference on Man-Machine Speech Communication
- Invited Speaker, 2007 European Science Foundation Workshop
- Keynote Speaker, 2007 International Conference on Speech and Computer
- Keynote Speaker, 2008 Chinese Conference on Pattern Recognition
- Plenary Speaker, 2008 International Conference on Signal Processing
- Keynote Speaker, 2009 NTNU Advanced Learning Workshop
- Keynote Speaker, 2009 ROCLING
- Invited Lecturer, NATO Advanced Study Institute (1990, 1993, 2002)
- Invited Speaker at many international societies, workshops and universities

A5. Professional Society Leadership

- Chairman, IEEE Signal Processing Society Speech Technical Committee (1996-98)
- Founding Chair, International Symposium on Chinese Spoken Language Processing (1998)
- Member, Advisory Committee, HK PolyTechnic University Area of Strategic Development in Multimedia (2001- Present)
- Member, Academic Advisory Board, Institute of Information Science, Academia Sinica (1998-2004)

B. CAMPUS CONTRIBUTIONS

- Establish the Joint Laboratory program between School of Computing at National University of Singapore and Institute of Infocomm Research at A*Star in Singapore, 2001-2002
- Organize the IDA Symposium on Advanced Speech and Media Technologies and Applications, National University of Singapore, 2002.
- Organize the 2002 Summer School of Media and Information Processing, Singapore
- Member, SIG-GT Steering Committee, Tech's Singapore outreach possibilities
- Champion, Feasibility Study on Georgia Tech Singapore Institute

VI. HONORS AND AWARDS

- 1994 IEEE Signal Processing Society Senior Award
- 1995 AT&T Bell Laboratories Distinguished Member of Technical Staff
- 1997 IEEE Fellow
- 1997 Bell Labs President's Gold Award
- 1997 Lucent Network System TSVS (Toll Switching, Voice & Signaling) Award
- 1997 IEEE Signal Processing Society Best Paper Award
- 1999 IEEE Signal Processing Society Best Paper Award
- 2000 IEEE Signal Processing Society Distinguished Lecturer
- 2002 Top Teacher Award, National University of Singapore, CS Department
- 2002 Singapore IDA Distinguished Visiting Professor Award
- 2006 IEEE Signal Processing Society Technical Achievement Award
- 2007-2008 International Speech Communication Association Distinguished Lecturer