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Current Position (2014):

Senior Research Scientist, Spoken Language Systems Group,
MIT Computer Science and Artificial Intelligence Laboratory

Brief Biography

Stephanie Seneff is a Senior Research Scientist at MIT's Computer Science and Artificial Intelligence Laboratory. She has a Bachelor's degree from MIT in biology with a minor in food and nutrition, and a PhD in Electrical Engineering and Computer Science, also from MIT. Throughout her career, Dr. Seneff has conducted research in diverse areas, including human auditory modeling, spoken dialogue systems, natural language processing, information retrieval and summarization, and computational biology. She has published over 200 refereed articles in technical journals and conferences on these subjects, and has been invited to give several keynote speeches. Dr. Seneff has recently become interested in the effect of drugs and diet on health and nutrition, and she has presented talks on these subjects at various workshops and written several essays on the web articulating her view. She is currently developing spoken dialogue systems to support intelligent search and summarization of user-provided reviews in the medical domain. She has authored over a dozen recently published papers on theories proposing that a low-micronutrient, high-carbohydrate diet contributes to the metabolic syndrome and to Alzheimer's disease, and that sulfur deficiency, environmental toxicants, and insufficient sunlight exposure to the skin and eyes play an important role in many modern conditions and diseases, including heart disease, diabetes, gastrointestinal problems, Alzheimer's disease and autism.

Education:

School	Department	Degrees Received
MIT	Biology	B.S. (Biophysics), 1968
MIT	EECS	S.M., E.E., 1980
MIT	EECS	Ph.D., 1985

S.M. Thesis: Speech Transformation System (Spectrum and/or Excitation) without Pitch Extraction

Supervisor: Kenneth Stevens

Summary: An extension of the phase vocoder to applications that allow for independent transformations of the spectrum, the excitation, and temporal aspects of the speech signal.

Ph.D. Thesis: Pitch and Spectral Analysis of Speech based on an Auditory Synchrony model

Supervisor: Kenneth Stevens

Summary: A model for extracting a spectral representation for speech that enhances spec-

tral peaks and normalizes for energy, by exploiting timing information available in auditory nerve fiber responses.

Awards:

Sophomore Chemistry Award (1967), given by the American Chemical Society to the sophomore most likely to succeed in a career in Chemistry.

Junior Scholastic Award (1968), given by the Alumnae Association to the woman student in her third year with the best academic record.

Prior Work Experience:

1993-2010: Principal Research Scientist, Spoken Language Systems Group
MIT Computer Science and Artificial Intelligence Laboratory
(formerly Laboratory for Computer Science).

1989-1993: Research Scientist, Spoken Language Systems Group
MIT Laboratory for Computer Science

Developed computational models for speech understanding systems, including speech recognition, syntax, semantics, discourse, and dialogue components. Designed a trainable, probabilistic graph-based parsing framework to robustly capture the meaning of spoken utterances. Developed interactive spoken dialogue systems for a number of different realistic applications. Developed models for context resolution and response planning with the goal of domain independence and portability. Developed a natural language generation framework that combines linguistic formalisms with the more intuitive template-based approaches.

1985-1989: Research Scientist, Speech Communication Group,
MIT Research Laboratory of Electronics

Developed several components of a speech understanding system as part of a large effort funded by the Defense Advance Research Projects agency (DARPA). At the acoustic phonetic level, developed an improved version of the auditory model proposed in the doctoral thesis, which has been used extensively by other members of the speech group and by others in the research community outside of MIT. Borrowing from vision research, the idea of a skeleton sketch of a speech spectrogram led to a representation of formant trajectories by frequency/slope probability fields.

1968-1978: Research Staff, MIT Lincoln Laboratory

Worked on several topics related to computer speech processing, including synthesis, vocoders, and speech recognition. Implemented real-time vocoder algorithms including Adaptive Predictive Coding (APC) and cepstral vocoders on specialized microprocessors built in house. As part of the ARPA Speech Understanding Project, developed new algorithms for extracting formants and fundamental frequency from the speech signal. Also worked on issues

related to speech transmission over digital networks, and digital processing of seismic signals (surface wave data).

Professional Activities

I have been or continue to be a member of the Acoustical Society of America, the Association of Computational Linguistics, the American Geophysical Union, and the IEEE Signal Processing Society, for which I served as a member of the Speech Technical Committee from 1987 to 1992. I am a member of the organizing committee for the Special Interest Group on Speech and Language Technology in Education (SIGSLaTE). I have served as a member of the Permanent Council for the International Conference on Spoken Language Systems (ICSLP), and as a member of the Editorial Board for the journal *Speech Communication*. I am a Fellow of the International Speech Communication Association.

I have reviewed papers for the Human Language Technology (HLT) conference and Interspeech, multiple times, and I also frequently review papers for many other conferences and workshops, including SIGSLaTE (Special Interest Group on Speech and Language Technology in Education), SIGDial (Special Interest Group on Dialogue Modelling), SLT (Spoken Language Technology), Eurospeech, COLING (Computational Linguistics), EMNLP (Empirical Methods in Natural Language Processing), ASRU (Automatic Speech Recognition and Understanding), and ACL (Association for Computational Linguistics). I was a member of the organizing committee for the AAI workshop on Machine Learning in Dialogue Systems. I have served twice on the review board of NSF ITR proposals. I was a joint editor of a special issue of ACM's Transactions on Computer-Human Interaction, on "Mobile and Adaptive Conversational Interfaces."

Teaching Experience

I have been a guest lecturer in several graduate level courses at MIT, including 6.343, Digital Speech Processing, 6.345, Automatic Speech Recognition, 6.892 Computational Models of Discourse, speaking on topics ranging from auditory modelling, to vocoders, signal processing, subword linguistic modelling, prosodic modelling, natural language understanding, and dialogue systems. In addition, I have participated as a lecturer and teaching assistant in the Speech Spectrogram Reading Summer Course and the Speech Processing Summer Course both at MIT and at several sites elsewhere within the United States and abroad (e.g., Japan and Scotland).

I have been a major contributor to short courses offered to members of the SLS Affiliates program, having developed lectures and on-line laboratory exercises for three topics: natural language understanding and generation, designing and configuring Galaxy spoken dialogue systems, and multimodality in dialogue systems.

I gave a half-day lecture on spoken language processing at a two-week Advanced Summer Institute sponsored by NATO held at Cetraro, Italy in July, 1990. The proceedings of this

special course were published in a book in the NATO ASI Series: Speech Recognition and Understanding, Recent Advances, Trends and Applications.

Together with Grace Chung of CNRI, I taught a one-day seminar on spoken dialogue systems to the Johns Hopkins Summer School program in July, 2003.

Together with Victor Zue, I gave a two-day short course on spoken dialogue systems at Microsoft Research, China.

Invited Talks

I have given numerous invited talks on my research at companies such as IBM, Apple Computer, NASA, ITRI, Delta Electronics, and Microsoft, as well as at universities such as Johns Hopkins, Boston University, the University of Maryland, Rochester University, Cornell University, Cambridge University, U.K., and Chinese University of Hong Kong.

I have given three invited keynotes at conferences and workshops: one on linguistic hierarchies at ICSLP in 1998, and two on computer aids for language learning, at ISCSLP in 2006 and at SIGSLaTe in 2007.

My most recent work in biology has led to several presentations in various conferences sponsored by organizations such as the Weston Price Foundation, the American College for the Advancement of Medicine, and Unite for Sight, related to nutrition, pharmaceutical drugs, environmental toxicants and health.

Publications of Stephanie Seneff

Papers in Refereed Journals

1. S. Seneff McCandless, “An Algorithm for Automatic Formant Extraction using Linear Prediction Spectra,” *IEEE Transactions on Acoustics, Speech, and Signal Processing*, Vol. 22, No. 2, pp. 135–141, 1974.
2. C.J. Weinstein, S. Seneff McCandless, L.F. Mondschein and V.W. Zue , “A System for Acoustic-Phonetic Analysis of Continuous Speech,” *IEEE Transactions on Acoustics, Speech, and Signal Processing*, Vol 23, No. 1, pp. 54–67, 1975.
3. S. Seneff, “Real Time Harmonic Pitch Detector,” *IEEE Transactions on Acoustics, Speech and Signal Processing*, Vol. 26, No. 4, pp. 358–364, 1978.
4. S. Seneff (1978) “A Fast New Method for Frequency Filter Analysis of Surface Waves: Application in the West Pacific,” *Bulletin of Seismological Society of America*, Vol. 68, No. 4, pp. 1031–1048, 1978.
5. T. Bially, B. Gold, and S. Seneff, “A Technique for Adaptive Voice Flow Control in Integrated Packet Networks,” *IEEE Transactions on Communication*, Vol. 28, No. 3, pp. 325–333, 1980.
6. S. Seneff, “System to Independently Modify Excitation and/or Spectrum of Speech Waveform without Explicit Pitch Extraction,” *IEEE Transactions on Acoustics, Speech and Signal Processing*, Vol. 30, No. 4, pp. 566–577, 1982.
7. S. Seneff, “A Joint Synchrony/Mean-rate Model of Auditory Speech Processing,” *Journal of Phonetics*, Vol. 16, pp. 55–76, 1988.
8. Zue, V.W., S. Seneff, and J. Glass, “Speech Database Development at MIT: TIMIT and Beyond,” *Speech Communication*, Vol. 9, pp. 351–356, 1990.
9. S. Seneff, “TINA: A Natural Language System for Spoken Language Applications,” *Computational Linguistics*, Vol. 18, No. 1, pp. 61–86, 1992.
10. J. Glass, G. Flammia, D. Goodine, M. Phillips, J. Polifroni, S. Sakai, S. Seneff, and V. Zue, “Multilingual Spoken-language Understanding in the MIT Voyager System,” *Speech Communication*, Vol. 17, Nos. 1-2, pp. 1-18, 1995.
11. H. Meng, S. Hunnicut, S. Seneff, and V. Zue, “Reversible Letter-to-sound / Sound-to-letter Generation Based on Parsing Word Morphology,” *Speech Communication*, Vol. 18, No. 1, pp. 47-64, 1996.
12. G. Y. Chung and S. Seneff, “A Hierarchical Duration Model for Speech Recognition based on the ANGIE Framework,” *Speech Communication*, Vol. 27, No. 2, pp. 113-134, March, 1999.

13. V. Zue, S. Seneff, J. Glass, J. Polifroni, C. Pao, T. J. Hazen, and L. Hetherington, "JUPITER: A Telephone-Based Conversational Interface for Weather Information," *IEEE Transactions on Speech and Audio Processing*, Vol. 8, No. 1, pp. 85-96, January, 2000.
14. T. J. Hazen, S. Seneff, and J. Polifroni, "Recognition confidence scoring and its use in speech understanding systems," *Computer Speech and Language*, Vol. 16, pp. 49-67, 2002.
15. S. Seneff, "Response Planning and Generation in the MERCURY Flight Reservation System," *Computer Speech and Language*, Vol. 16, pp. 283-312, 2002.
16. S. Seneff and C. Wang, "Statistical Modeling of Phonological Rules through Linguistic Hierarchies," *Speech Communication*, 2004.
17. S. Seneff, "The Use of Subword Linguistic Modeling for Multiple Tasks in Speech Recognition," *Speech Communication*, Vol. 42, No. 3-4, pp. 373-390, 2004.
18. S. Seneff, C. Wang and C. Burge, "Gene Structure Prediction Using an Orthologous Gene of Known Exon-Intron Structure" *Applied Bioinformatics*, Vol. 3 No. 2-3, pp. 81-90, 2004.
19. O. Scharenborg, S. Seneff, and L. Boves, "A two-pass Approach for Handling Out-of-Vocabulary Words in a Large Vocabulary Recognition Task," *Computer Speech and Language*, Vol 21, No. 1, pp. 206-218, 2007.
20. C. Wang, G. Chung, and S. Seneff "Automatic Induction of Language Model Data for a Spoken Dialogue System," *Language Resources and Evaluation*, 2007.
21. S. Seneff, M. Adler, J. Glass, B. Sherry, T. Hazen, C. Wang, and T. Wu, "Exploiting Context Information in Spoken Dialogue Interaction with Mobile Devices, *Proc. Int. Workshop on Improved Mobile Experiences*, Toronto, 2007.
22. I. McGraw, B. Yoshimoto, and S. Seneff, "Speech Enabled Card Games for Incidental Vocabulary Acquisition in a Foreign Language," *Speech Communication*, Special Issue on Applications to Language Learning, Vol 51, No. 10, pp. 1106-1123, 2009.
23. Y. Xu and S. Seneff, "Speech-Based Interactive Games for Language Learning: Reading, Translation, and Question-Answering." *International Journal of Computational Linguistics and Chinese Language Processing*, Vol. 14, No. 2, pp. 133-159, 2009.
24. A. D. Shapiro, P. L. Tyack, and S. Seneff, "Comparing call-based vs. subunit-based methods for categorizing Norwegian killer whale (*Orcinus orca*) vocalisations," *Animal Behaviour* Vol. 81, pp. 377-386, 2011.
25. S. Seneff, G. Wainwright, and L. Mascitelli, "Is the metabolic syndrome caused by a high fructose, and relatively low fat, low cholesterol diet?" *Archives of Medical Science*, Vol. 7, No. 1, pp. 8-20, 2011; DOI: 10.5114/aoms.2011.20598

26. S. Seneff, G. Wainwright, and L. Mascitelli, "Nutrition and Alzheimer's Disease: the Detrimental Role of a High Carbohydrate Diet," *European Journal of Internal Medicine*, Vol. 22 No.2, pp. 134-40, Apr 2011.
27. J. Polifroni, I. Kiss, and S. Seneff, "Speech for Content Creation," *IJMHCI* 3(2), April, 2011.
28. S. Seneff, L. Mascitelli, and R. Davidson, "Might cholesterol sulfate deficiency contribute to the development of autistic spectrum disorder?", *Medical Hypotheses*, 8, 213217, 2012.
29. R.M. Davidson, and S. Seneff, "The Initial Common Pathway of Inflammation, Disease, and Sudden Death," *Entropy* 14, 1399-1442, 2012.
30. S. Hartzell and S. Seneff, "Impaired Sulfate Metabolism and Epigenetics: Is There a Link in Autism?" *Entropy* 2012, 14, 1953-1977.
31. S. Seneff, J. Liu, and R. Davidson, "Empirical Data Confirm Autism Symptoms Related to Aluminum and Acetaminophen Exposure." *Entropy* 2012, 14, 2227-2253; doi:10.3390/e14112227
32. S. Seneff, R. M. Davidson and J. Liu, "Is Cholesterol Sulfate Deficiency a Common Factor in Preeclampsia, Autism, and Pernicious Anemia?" *Entropy* 2012, 14, 2265-2290; doi:10.3390/e14112265
33. J. Liu, S. Seneff, and V. Zue, "Harvesting and Summarizing User-Generated Content for Advanced Speech-Based Human-Computer Interactions," *IEEE Journal of Selected Topics in Signal Processing*, 6(8), 982-992, 2012.
34. S. Seneff, A. Lauritzen, R. Davidson, and L. Lentz-Marino. "Is Endothelial Nitric Oxide Synthase a Moonlighting Protein Whose Day Job is Cholesterol Sulfate Synthesis? Implications for Cholesterol Transport, Diabetes and Cardiovascular Disease," *Entropy* 2012, 14, 2492-2530; doi:10.3390/e14122492.
35. S. Seneff, A. Lauritzen, R. Davidson, and L. Lentz-Marino. "Is Encephalopathy a Mechanism to Renew Sulfate in Autism?" *Entropy* 2013, 15, 372-406; doi:10.3390/e15010372
36. A. Samsel and S. Seneff, "Glyphosate's Suppression of Cytochrome P450 Enzymes and Amino Acid Biosynthesis by the Gut Microbiome: Pathways to Modern Diseases," *Entropy* 2013, 15, 1416-1463; doi:10.3390/e15041416
37. Robert M. Davidson, Ann Lauritzen and Stephanie Seneff, "Biological Water Dynamics and Entropy: A Biophysical Origin of Cancer and Other Diseases," *Entropy* 2013, 15(9), 3822-3876; doi:10.3390/e15093822.
38. C.A. Shaw, S.D. Kette, R.M. Davidson, and S. Seneff. Aluminum's role in CNS-immune system interactions leading to neurological disorders. *Immunome Res* 2013, 9: 069. doi: 10.4172/1745-7580.1000069

39. A. Samsel and S. Seneff, "Glyphosate, Pathways to Modern Diseases II: Celiac Sprue and Gluten Intolerance." *Interdiscip Toxicol.* 2013; Vol. 6(4): 159184.
40. W.A. Morley and S. Seneff, "Diminished Brain Resilience: A modern day neurological pathology of increased susceptibility to mild brain trauma, concussion and downstream neurodegeneration." *To Appear Surgical Neurology International.*

Book Chapters, etc.

1. S.Seneff and V. Zue, "Understanding Spoken Language," pp. 595-613, *The Computer Science and Engineering Handbook*, Allen B. Tucker, Jr. Editor-in-chief, CRC Press, 1996.
2. S. Seneff, "Cholesterol: The Essential Molecule and The Adverse Effects and Overuse of Statins," *Well Being Journal*, 20(6), Nov-Dec, 2011.

Proceedings of Refereed Conferences

1. S. Seneff, "Pitch and Spectral Estimation of Speech Based on Auditory Synchrony Model," Paper No. 36.2, *Proceedings, IEEE International Conference on Acoustics, Speech, and Signal Processing*, pp. 36.2.1–36.2.4, San Diego, CA, Mar. 19-21, 1984.
2. S. Seneff, "A Computational Model for the Peripheral Auditory System: Application to Speech Recognition Research," Paper No. 37.8, *Proceedings, IEEE-IECEJ-ASJ International Conference on Acoustics, Speech, and Signal Processing*, pp. 1983–1986, Tokyo, Japan, Apr. 8-11, 1986.
3. S. Seneff, "TINA: A Probabilistic Syntactic Parser for Speech Understanding Systems," *Proceedings, DARPA Speech and Natural Language Workshop*, pp. 168–178, February, 1989.
4. V.W. Zue, J. Glass, M. Phillips, and S. Seneff, "The MIT SUMMIT Speech Recognition System: A Progress Report," *Proceedings, First DARPA Speech and Natural Language Workshop*, pp. 179–189, Philadelphia, PA, February, 1989.
5. S. Seneff, "TINA: A Probabilistic Syntactic Parser for Speech Understanding Systems," Paper No. S13.5, *Proceedings, International Conference on Acoustics, Speech, and Signal Processing*, pp. 711–714, May, 1989.
6. V. Zue, J. Glass, M. Phillips, and S. Seneff, "Acoustic Segmentation and Phonetic Classification in the SUMMIT System, Paper No. S8.1, *Proceedings, International Conference on Acoustics, Speech, and Signal Processing*, pp. 389–392, Glasgow, Scotland, May 23-26, 1989.
7. S. Seneff "Probabilistic Parsing for Spoken Language Applications," *Proceedings, International Workshop on Parsing Technologies*, pp. 209-218, Pittsburgh, PA., Aug., 1989.

8. V. Zue, J. Glass, D. Goodine, H. Leung, M. Phillips, J. Polifroni, and S. Seneff, "The VOYAGER Speech Understanding System: A Progress Report," *Proceedings, Second DARPA Speech and Natural Language Workshop*, pp. 51–59, Harwichport, MA, Oct. 1989.
9. V. Zue, N. Daly, J. Glass, D. Goodine, H. Leung, M. Phillips, J. Polifroni, S. Seneff, and M. Soclof, "The Collection and Preliminary Analysis of a Spontaneous Speech Database," *Proceedings, Second DARPA Speech and Natural Language Workshop*, pp. 126–134, Harwichport, MA, Oct. 1989.
10. V. Zue, J. Glass, D. Goodine, H. Leung, M. Phillips, J. Polifroni, and S. Seneff, "Preliminary Evaluation of the VOYAGER Spoken Language System," *Proceedings of the Second DARPA Speech and Natural Language Workshop*, pp. 160–167, Harwichport, MA, Oct. 1989.
11. V. Zue, J. Glass, D. Goodine, M. Phillips, and S. Seneff, "The SUMMIT Speech Recognition System: Phonological Modelling and Lexical Access," *Proceedings, IEEE International Conference on Acoustics, Speech and Signal Processing*, pp. 49–52, Albuquerque, NM, Apr. 1990.
12. V. Zue, J. Glass, D. Goodine, H. leung, M. Phillips, J. Polifroni, and S. Seneff, "The VOYAGER Speech Understanding System: Preliminary Development and Evaluation," *Proceedings, IEEE International Conference on Acoustics, Speech and Signal Processing*, pp. 73–76, Albuquerque, NM, Apr. 1990.
13. V. Zue, J. Glass, D. Goodine, H. Leung, M. Phillips, J. Polifroni, and S. Seneff. "Recent Progress on the SUMMIT System," *Proceedings, Third DARPA Speech and Natural Language Workshop*, pp. 380–385, Hidden Valley, PA, Jun. 1990.
14. V. Zue, J. Glass, D. Goodine, H. Leung, M. McCandless, M. Phillips, J. Polifroni, and S. Seneff. "Recent Progress on the VOYAGER System," *Proceedings, Third DARPA Speech and Natural Language Workshop*, pp. 206–211, Hidden Valley, PA, Jun. 1990.
15. V. Zue, Glass, J., Goodine, D., Leung, H., Phillips, M., Polifroni, J., and Seneff, S. "Preliminary ATIS Development at MIT," *Proceedings, Third DARPA Speech and Natural Language Workshop*, pp. 130–136, Hidden Valley, PA, Jun. 1990.
16. V. Zue, J. Glass, D. Goddeau, D. Goodine, H. leung, M. McCandless, M. Phillips, J. Polifroni, S. Seneff, and D. Whitney, "Recent Progress on the MIT VOYAGER Spoken Language System," *Proceedings, International Conference on Spoken Language Processing*, pp. 1317–1320, Kobe, Japan, November, 1990.
17. L. Hirschman, S. Seneff, D. Goodine, and M. Phillips, "Integrating Syntax and Semantics into Spoken Language Understanding," *Proceedings, Fourth DARPA Speech and Natural Language Workshop*, pp. 366–371, Pacific Grove, CA., February, 1991.
18. S. Seneff, L. Hirschman, and V. Zue, "Interactive Problem Solving and Dialogue in the ATIS Domain," *Proceedings, Fourth DARPA Speech and Natural Language Workshop*, pp. 354–359, Pacific Grove, CA., February, 1991.

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20. J. Polifroni, S. Seneff, and V. Zue, "Collection of Spontaneous Speech for the ATIS Domain and Comparative Analyses of Data Collected at MIT and TI," *Proceedings, Fourth DARPA Speech and Natural Language Workshop*, pp. 360–365, Pacific Grove, CA., February, 1991.
21. V. Zue, J. Glass, D. Goddeau, D. Goodine, L. Hirschman, H. Leung, M. Phillips, J. Polifroni, and S. Seneff, "Spoken Language Systems for Human/Machine Interfaces," *Proceedings, International Conference on Intelligent Text Image Handling*, Barcelona, Spain, 2-5 April, 1991.
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23. D. Goodine, S. Seneff, L. Hirschman, and M. Phillips, "Full Integration of Speech and Language Understanding in the MIT Spoken Language System," *Proceedings, Second European Conference on Speech Communication and Technology*, pp. 845–848, Genoa, Italy, September, 1991.
24. V. Zue, J. Glass, D. Goodine, L. Hirschman, H. Leung, M. Phillips, J. Polifroni, and S. Seneff, "The MIT ATIS System: Preliminary Development, Spontaneous Speech Data Collection and Performance Evaluation," *Proceedings, European Conference on Speech Communication and Technology*, Vol. 2, pp. 537–541, Genoa, Italy, September, 1991.
25. S. Seneff, "A Relaxation Method for Understanding Spontaneous Speech Utterances," *Proceedings, Fifth DARPA Workshop on Speech and Natural Language*, pp. 23–28, Harriman, NY, February, 1992.
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27. J. Polifroni, L. Hirschman, S. Seneff, and V. Zue, "Experiments in Evaluating Interactive Spoken Language Systems," *Proceedings, Fifth DARPA Speech and Natural Language Workshop*, pp. 28–33, Harriman, NY, February, 1992.
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29. S. Seneff, H. Meng, and V. Zue, "Language Modelling for Recognition and Understanding Using Layered Bigrams," *Proceedings, Second International Conference on Spoken Language Processing*, pp. 317–320, Oct. 12-16, 1992.
30. D. Goodine, L. Hirschman, J. Polifroni, S. Seneff, and V. Zue, "Evaluating Interactive Spoken Language Systems," *Proceedings, Second International Conference on Spoken Language Processing*, pp. 201–204, Oct. 12-16, 1992.
31. S. Hunnicutt, L. Hirschman, J. Polifroni, and S. Seneff, "Analysis of the Effectiveness of System Error Messages in a Human-Machine Travel Planning Task," *Proceedings, Second International Conference on Spoken Language Processing*, pp. 197-200, Oct. 12-16, 1992.
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