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Engineering & Scientific Consulting

Jessica Gaines, Ph.D.
Associate | Computer, Data & Security Sciences
New York
+1-212-895-8101 | jgaines@exponent.com

Professional Profile

Jessica Gaines, Ph.D., is a consultant at Exponent with experience in computational modeling and control systems. She specializes in modeling and analysis of electrical and biological control systems.

Dr. Gaines is skilled in computational modeling, electromechanical systems, time-series data analysis, and human subjects research. She has experience with tools such as Python, TensorFlow, simulation-based inference (SBI), MATLAB, Simulink, and LabVIEW.

Before joining Exponent, Dr. Gaines conducted research in systems neuroscience where she developed models of the neuro-motor systems underlying speech behavior and led collection and analysis of speech acoustic data. She earned her Ph.D. in Bioengineering jointly from the University of California, Berkeley and the University of California, San Francisco, and earned her B.S. in Engineering (Electrical) from Hope College. She also worked as a controls engineer in the automotive sector at Roush.

Dr. Gaines has published 7 peer-reviewed articles on topics such as computational modeling of biological control systems and bioelectrical systems and speech motor behavior. She has presented at international conferences on neuroscience and biological motor control.

Academic Credentials & Professional Honors

Ph.D., Bioengineering, University of Cali. Berkeley & San Francisco, 2025

B.S., Electrical Engineering, Hope College, 2017

Phi Beta Kappa, Hope College, 2017

Outstanding Poster Award, 8th International Conference on Speech Motor Control, 2022

Prior Experience

Postdoctoral Researcher, University of California, San Francisco, 2025

Doctoral Researcher, University of California, San Francisco, 2019-2025

Controls Engineer, Roush Enterprises, LLC, Livonia, MI, 2017-2019

Publications

Gaines JL, Brent K, Parrell B, Ramanarayanan V, Kim KS, Rangwala R, Pongos AL, Houde JF, Nagarajan SS. “A single computational mechanism explains heterogeneity in pitch feedback perturbation

responses.” (Submitted).

Rangwala R, Subrahmanya A, Brent K, Gupta S, Ranasinghe K, Dale CL, Gaines JL, Pongos AL, Rosen CA, Schneider SL, Barkmeier-Kraemer J, Simonyan K, Houde JF, Nagarajan SS. "Enhanced pitch centering in individuals with laryngeal dystonia," Frontiers in Human Neuroscience, vol. 20, 2026, pp. 1688947.

Gaines JL, Dale CL, Nagarajan SS, Houde JF. "Adaptation response to pitch shift during speech is attenuated upon relearning," Frontiers in Human Neuroscience, vol. 19, 2025, pp. 1689023.

Kim KS, Hinkley LB, Brent K, Gaines JL, Pongos AL, Gupta S, Dale CL, Nagarajan SS, Houde JF. "Neurophysiological evidence of sensory prediction errors driving speech sensorimotor adaptation," Journal of Neuroscience, vol. 45, no. 27, 2025, pp. e2084242025.

Gaines JL, Kim KS, Parrell B, Ramanarayanan V, Pongos AL, Nagarajan SS, Houde JF. "Bayesian inference of state feedback control parameters for F0 perturbation responses in cerebellar ataxia," PLOS Computational Biology, vol. 20, no. 10, 2024, pp. e1011986.

Kim KS, Gaines JL, Parrell B, Ramanarayanan V, Nagarajan SS, Houde JF. "Mechanisms of sensorimotor adaptation in a hierarchical state feedback control model of speech," PLOS Computational Biology, vol. 19, no. 7, 2023, pp. e1011244.

Gaines JL, Kim KS, Parrell B, Ramanarayanan V, Nagarajan SS, Houde JF. "Discrete constriction locations describe a comprehensive range of vocal tract shapes in the Maeda model," JASA Express Letters, vol. 1, no. 12, 2021, pp. 124402.

Gaines JL, Finn KE, Slopsema JP, Heyboer LA, Polasek, KH. "A model of motor and sensory axon activation in the median nerve using surface electrical stimulation," Journal of Computational Neuroscience, vol. 45, no. 1, 2018, pp. 29–43.

Selected Presentations

Gaines JL. Computational modeling of psychophysics in speech motor control. Oral Presentation. Dissertation Exit Seminar, San Francisco, CA, 2025.

Gaines JL, Brent K, Rangwala R, et al. A single computational mechanism can account for both compensatory and following responses to auditory feedback perturbations of vocal pitch. Poster Presentation. Society for Neuroscience Conference, San Diego, CA, 2025.

Gaines JL, Kim KS, Pongos AL, et al. Bayesian inference of state feedback control parameters reveals control differences in F0 perturbation responses in cerebellar ataxia. Oral Presentation. Conference on Motor Speech, San Diego, CA, 2024.

Gaines JL, Kim KS, Parrell B, et al. Simulation-based Bayesian inference of state feedback control model parameters to fit F0 perturbation responses in laryngeal dystonia. Poster Presentation. International Seminar on Speech Production, Autrans, France, 2024.

Gaines JL, Kim KS, Parrell B, et al. Bayesian inference of state feedback control model parameters for pitch perturbation responses. Poster presentation. 8th International Seminar on Speech Motor Control, Groningen, Netherlands, 2022.

Gaines JL, Kim KS, Parrell B, et al. Discrete constriction locations describe a comprehensive range of vocal tract shapes in the Maeda model. Poster presentation. International Seminar on Speech Production, Online/Virtual, 2020.

Gaines JL, Kothare H, Raharjo I, et al. State feedback control model can account for differences in

abnormal pitch perturbation responses in Alzheimer's disease and cerebellar ataxia. Poster presentation. International Seminar on Speech Production, Online/Virtual, 2020.

Gaines JL, Finn KE, Slopsema JP, et al. Development of a NEURON model to predict electrically stimulated sensation. Poster presentation. Michigan Space Grant Consortium Fall Conference, Ann Arbor, MI, 2016.

Peer Reviews

Reviewer for Scientific Reports, Journal of Speech, Language and Hearing Research