Exponent®
Engineering & Scientific Consulting

Kalyn Kearney, Ph.D.
Associate | Biomechanics
Farmington Hills
+1 248-324-9123 | kkearney@exponent.com

Professional Profile

Dr. Kearney has expert knowledge of human movement analysis, with an emphasis on artificial intelligence/machine learning (AI/ML) and simulation techniques. She has developed and validated traditional (e.g., random forests and support vector machines) and deep (e.g., feedforward and long-short term memory neural networks) models of human movement. She has also employed simulation tools in OpenSim (e.g., inverse/forward dynamics, direct collocation, and computed muscle control) to model a range of biomechanical systems. To train and validate her models, she has collected human-participant data using techniques that include electromyography (fine-wire and surface), dynamometric measurements, 3D motion capture, and ultrasound.

Prior to joining Exponent, Dr. Kearney was a graduate researcher for the Musculoskeletal Biomechanics Laboratory at the University of Florida. Her doctoral research focused on the prediction and characterization of upper extremity biomechanics. She developed and validated a simulation-to-real transfer learning approach for the prediction of upper extremity forces and torques in healthy young adults. She employed custom deep-learning pipelines and explainable AI techniques to enhance the transparency and interpretability of her models and their predictions. Her experience also extends to clinical applications, such as the employment of unsupervised techniques to characterize carpometacarpal osteoarthritis expression.

As a graduate researcher, Dr. Kearney completed an internship with the Honda Research Institute (HRI) in Offenbach, Germany. At HRI, she applied her knowledge of ML, musculoskeletal simulations, and human-participant data collections to progress HRI's goals of designing robotic systems capable of cooperative intelligence.

Academic Credentials & Professional Honors

Ph.D., Biomedical Engineering, University of Florida, 2023

B.S., Mechanical Engineering, University of South Florida, 2018

NSF Graduate Research Fellow (2019-2023)

UF Graduate Student Preeminence Award (2018-2023)

UF Institute for Computational Engineering Fellow (2018)

Prior Experience

Graduate Researcher, University of Florida, 2018-2023

Biomechanics Intern, Honda Research Institute, 2022

Undergraduate Researcher, University of South Florida, 2016-2018

Process Engineering Intern, West Pharmaceutical Services, 2017

Engineering Intern, Innov LLC, 2015

Professional Affiliations

American Society of Biomechanics, 2018-2023

Tau Beta Pi, 2015-2018

Phi Theta Kappa, 2014-2015

Publications

Kearney KM, Harley JB, Nichols JA. Inverse distance weighting to rapidly generate large simulation datasets. Journal of Biomechanics 2023; 158:111764.

Kearney KM, Harley JB, Nichols JA. Classifying muscle parameters with artificial neural networks and simulated lateral pinch data. Plos One 2021; 16(9):e0255103.

Presentations

Kearney KM, Diaz TO, Harley JB, Nichols JA. Transfer Learning with Simulated and Recorded Data Improves Predictions of Upper Extremity Biomechanics. Oral presentation, XXIX Congress of International Society of Biomechanics, Fukuoka, Japan, 2023.

Diaz TO, Kearney KM, Wright TW, Nichols JA. Do Muscle Activity Patterns Vary According to the Severity of Carpometacarpal Osteoarthritis Disease? Oral presentation, XXIX Congress of International Society of Biomechanics, Fukuoka, Japan, 2023.

Kearney KM, Diaz TO, Harley JB, Nichols JA. From Simulation to Reality: Predicting Torque with Fatigue Onset via Transfer Learning. Oral presentation, XIX International Symposium on Computer Simulation in Biomechanics, Kyoto, Japan, 2023.

Kearney KM, Diaz TO, Harley JB, Nichols JA. From Simulation to Reality: Predicting Torque with Fatigue Onset via Transfer Learning. Oral presentation, Musculoskeletal Medicine and Bioengineering Biannual Meeting, Gainesville, FL, 2023.

Kearney KM, Harley JB, Nichols JA. Opening the black box: Using explainable AI to understand what a neural network learns from lateral pinch simulations. Oral presentation, 5th North American Congress on Biomechanics, Ottawa, Canada, 2022.

Kearney KM, Harley JB, Nichols JA. Inverse Distance Weighting to Rapidly Generate Large Simulation Datasets. Oral presentation, XXVIII Congress of the International Society of Biomechanics, Stockholm, Sweden, 2021. (Virtual)

Kearney KM, Harley JB, Nichols JA. Learning from the Measurable: Predicting Changes in Hill-Type Muscle Parameters from Lateral Pinch. Poster presentation, Hand and Wrist Biomechanics International

Symposium, Stockholm, Sweden, 2021. (Virtual)

Kearney KM, Harley JB, Nichols JA. Classifying Muscle Parameters with Long-Short Term Memory Networks and Simulated Lateral Pinch Data. Oral presentation, Biomedical Engineering Society Annual Meeting, Philadelphia, PA, 2019.

Kearney KM, Nichols JA. Learning Thumb Biomechanics from Large Simulation Datasets. Oral presentation, OpenSim Advanced Users Workshop, Palo Alto, CA, 2019.

Peer Reviews

IEEE Transactions on Neural Systems and Rehabilitation Engineering