Kyra D. Rudy

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EDUCATION

Northwestern University, Evanston, IL — Aug. 2018 – Dec. 2023
Ph.D. in Mechanical Engineering, *NSF Graduate Research Fellow* — GPA: 3.98/4
Thesis: Assessment and Assistance for Dynamic and Safety-Critical Human Motion, Advisor: Todd Murphey

Cleveland State University, Cleveland, OH — Aug. 2014 – May 2018
Bachelor of Mechanical Engineering, *Washkewicz College of Engineering Salutatorian* — GPA: 3.98/4

TEACHING EXPERIENCE

Loyola University Chicago, Dept. of Engineering, Chicago, IL — Jan. 2025 – Jun. 2025 (End of Contract)
Full-Time Instructor – Engineering Systems III, Engineering Freshmen Seminar, Fundamental Statistics

- Emphasize student-centered instruction through active learning techniques and tailored feedback, fostering a supportive and engaging classroom environment that enhances student participation and critical thinking skills.
- Develop and grade assessments, including homework assignments, exams, and projects, to evaluate student learning in alignment with course objectives and inform continuous instructional improvement to better support students.
- Participate in regular faculty meetings and trainings to continuously improve the effectiveness of instruction.
- Utilize learning management systems (LMS) and online textbook platforms (e.g., Sakai, McGraw Hill Connect) to organize course materials, administer assignments, and facilitate communication.

Northwestern University, Dept. of Mechanical Engineering, Evanston, IL — Sept. 2019 – Jun. 2023 (Various Quarters)
Teaching Assistant & Grader – Machine Dynamics, Numerical Methods in Optimal Control of Nonlinear Systems

- Provided continuous instruction and support to students during the COVID-19 pandemic by adapting to a fully remote format, using online platforms (e.g., Zoom, Canvas) and digital tools to promote student engagement, collaboration, and academic progress.
- Developed assignments in Python, such as simulations and algorithm implementations, to enhance students' computational skills while applying course concepts to real-world problems and systems.
- Provided small group and one-on-one mentorship to undergraduate and graduate students across 4 quarters.

Cleveland State University, Dept. of Mechanical Engineering, Cleveland, OH — Sept. 2016 – Dec. 2016
Teaching Assistant – Engineering Thermodynamics

- Assessed student learning through assignments and quizzes, providing specific and actionable feedback to promote academic growth and mastery of the subject matter.

RESEARCH & INDUSTRY EXPERIENCE

Outlier AI, Remote — Apr. 2024 – Present
AI Consultant – Math and Physics Expert

- Create high-quality and complex training data to improve the performance of large language models (LLMs) at mathematical and scientific reasoning through reinforcement learning from human feedback (RLHF).
- Review the work of other contributors to ensure compliance with quality and safety standards, providing actionable feedback to improve future performance.
- Manage multiple workflows and constantly adapt to new projects based on the client's priorities and feedback.

Northwestern University, Interactive and Emergent Autonomy Lab, Evanston, IL — Aug. 2018 – Dec. 2023
Graduate Research Assistant
Safety-Constrained Shared Control for Human-Robot Interaction — 2020 – 2023

- Designed and implemented (C++/Python) novel algorithms for allocating control between a human operator and an autonomous partner to maintain system safety while maximizing the control authority of the human operator.
- Formulated a task-agnostic model of safety based on model predictive control (MPC) that accurately predicted 99.7% of safety violations in simulation without any knowledge of the simulated operator's control policy or desired task goal.
- Planned and executed a 20-person, IRB-approved study to evaluate human performance under safety-based assistance, showing that safety can be maintained while allocating 98% of control authority to the human operator.
- Improved arbitrary task execution by 9% under safety-constrained shared control, a modest but exciting improvement over alternative approaches that sacrifice task performance to guarantee safety.

Quantifying Dynamic Human Reaching Quality and Functional Deficit Following Stroke 2018 – 2021

- Created a custom virtual environment (C++/OpenGL) coupled with a haptic robotic interface (Moog HapticMASTER) to elicit human arm motion at various frequencies while providing adjustable arm weight support/assistance.
- Developed a novel metric to quantify an individual's ability to match a desired movement frequency; energy exerted around the resonant frequency of the test task describes how well the person is performing at the task in the frequency domain.
- Collaborated with multi-disciplinary teams of physical therapists, biomedical engineers, and healthcare professionals to build impactful technology aimed at improving our understanding of human health and supporting practitioners.
- Executed and planned multiple IRB-approved human subject studies (32 participants) to investigate the effect of stroke on functional arm motion; results revealed a 40% loss in arm function at high movement frequencies (≥ 2.5Hz) and a 50% improvement in reaching function with arm weight support.
- Performed statistical analyses, including multi-factor ANOVAs, on large sets of time-series data (SciPy/R); applied signal processing techniques including filtering, Fourier analysis (FFT), and principal component analysis (PCA) in MATLAB and Python.

Cleveland State University, Center for Human-Machine Systems, Cleveland, OH June 2016 – June 2018
Undergraduate Research Assistant

- Developed controller software (C++/MATLAB) to integrate custom transcutaneous electrical muscle stimulation hardware with a custom powered exoskeleton for hybrid control of arm motion, resulting in a 94% reduction in tracking error and 74% reduction in exoskeleton torque requirements.
- Modeled arm joint torques produced by electrically stimulating muscles using Gaussian process regression (MATLAB), enabling optimal selection of stimulation patterns for functional reaching motions of a paralyzed arm.

SKILLS

Programming Languages: Python (Numpy, Pandas, Matplotlib, TensorFlow, PyTorch), C/C++, MATLAB, R
Other: Git, Simulink, technical writing, statistical analysis, data visualization, machine learning, human trial design, IRB

SELECTED PUBLICATIONS AND PRESENTATIONS

- A. Kalinowska, M. Schlafly, **K. Rudy**, J. P. Dewald, T. D. Murphey (Under Review 2025). Quantitative Assessment of Dynamic Movement Reveals Deficits Due to Hemiparetic Stroke. *Journal of NeuroEngineering and Rehabilitation.*
- A. Kalinowska, M. Schlafly, **K. Rudy**, J. P. Dewald, T. D. Murphey (2022). Measuring Interaction Bandwidth During Physical Human-Robot Collaboration. *Robotics and Automation Letters.*
- A. Kalinowska, **K. Rudy**, M. Schlafly, K. Fitzsimons, J. Dewald, T. D. Murphey (2020). Shoulder Abduction Loading Affects Motor Coordination in Individuals with Chronic Stroke, Informing Targeted Rehabilitation. *IEEE RAS/EMBS Int. Conference on Biomedical Robotics and Biomechatronics.*
- D. Wolf, N. Dunkelberger, C. McDonald, **K. Rudy**, M. O'Malley, C. Beck, E. Schearer (2017). Combining Functional Electrical Stimulation and a Powered Exoskeleton to Control Elbow Flexion*. The International Symposium on Wearable and Rehabilitation Robotics*.

MAJOR AWARDS

- National Science Foundation Graduate Research Fellowship (NSF GRFP, $138,000) 2018–2023
- Washkewicz College of Engineering Student Achievement Award 2016, 2017
- Mandel Honors College Full Tuition Scholarship ($40,000) 2014–2018