

Ross Brancati, PhD

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Human Systems Integration Engineer II

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Summary

Human systems integration engineer and research scientist with a PhD focusing on biomechanics and applied machine learning. Expertise in biomechanics, wearables, motion capture, sensor fusion algorithms, unsupervised and supervised machine learning, user experience research, and more. Passionate about leveraging machine learning and AI to improve human performance.

Education

2020 – 2025	University of Massachusetts Amherst; Amherst, MA Doctor of Philosophy Kinesiology (<i>Concentration: Biomechanics and Data Science</i>) GPA: 3.9/4.0
2020 – 2022	University of Massachusetts Amherst; Amherst, MA Computer Science and Statistics Departments Graduate Certificate in Statistical and Computational Data Science GPA: 3.8/4.0
2018 – 2019	University of Connecticut; Storrs, CT Master of Science Biomedical Engineering (<i>Concentration: Biomechanics</i>) GPA: 3.9/4.0
2014 – 2018	University of Connecticut; Storrs, CT Bachelor of Science Biomedical Engineering (<i>Concentration: Biomechanics</i>) GPA: 3.5/4.0

Experience

Warfighter Systems Integration Lab, Galvion – Portsmouth, NH

Human Systems Integration Engineer II, January 2025 – Present

Lab Manager: Martin Fultot, PhD

- Design and implement algorithms for multimodal data synchronization and signal processing (e.g., IMU, eye tracking, motion capture), focusing on time-series feature extraction, event detection, clustering, and classification.
- Apply mixed methods human factors engineering and user experience research into pre-product exploration and product development lifecycle.
- Contribute to the development of visual augmentation systems with rigorous scientific research, data science approaches, and ML modeling, integrating heads-up displays to improve soldier situation awareness.
- Lead the design and execution of human-participant experiments integrating AR/VR systems, motion capture, and multimodal sensor platforms to assess cognitive and physical load associated with advanced soldier-worn systems.
- Developing physics based humanoid simulations via reinforcement learning models in Unity.

Warfighter Systems Integration Lab, Galvion – Portsmouth, NH

Data Science Intern, March 2024 – January 2025

Lab Manager: Martin Fultot, PhD

- Leveraged hardware and software capabilities to improve soldier training and performance in immersive environments.
- Developed and implemented a sensor fusion algorithm to improve object pose and position in VR/AR with IMUs and camera based fiducial marker tracking.

Experience (*continued*)

Musculoskeletal & Orthopedic Biomechanics Laboratory, University of Massachusetts Amherst – Amherst, MA
Research Assistant, August 2020 – January 2025

PI: Katherine Boyer, PhD

- Optimized supervised and unsupervised machine learning models to robustly identify and classify subgroups of runners with distinct injury mechanisms from time-series biomechanical and inertial sensor data.
- Designed and led human participant experiments focused on collection, processing, and analysis of multimodal physiological data streams.
- Built research-oriented software tools for signal processing and data science applications such as filtering, feature extraction, and time-series analysis.

Center for Health and Human Performance, University of Massachusetts Amherst – Amherst, MA
Data Science Intern, May 2023 – February 2024

PI: Michael Busa, PhD

- Developed gait event detection algorithms for a novel smart wearable insole with pressure and inertial sensors.
- Validated wearable sensors signals using ground truth pressure mapping systems and statistical modeling.
- Created high quality visualizations and presentations to translate findings to key stakeholders such as startup founders.
- Leveraged the results of analysis to inform future decisions around designing and testing new prototypes.

University of Massachusetts Men's Ice Hockey Team, University of Massachusetts Amherst – Amherst, MA
Sports Science Intern, May 2022 – December 2022

Supervisor: Brandon Wickett, MS

- Leveraged Catapult's wearable technology to monitor player load and make informed decisions to reduce injury risk.
- Analyzed and interpret large sets of longitudinal data for optimizing player work output, identifying asymmetries, and more.
- Simplified exhaustive findings to interpretable formats for key stakeholders such coaching staff and strength coaches.

Orthopedic Rehabilitation and Biomechanics Laboratory, University of Michigan - Ann Arbor, MI
Research Associate 1, May 2019 – August 2020

PI: Lindsey Lepley, PhD

- Examined biomechanical implications of ACL tears in animal models using deep learning-based motion tracking system.
- Wrote custom written scripts (Matlab) to automate data processing procedures such as ultrasound muscle fiber tracking.
- Overhauled laboratory space including full synchronization of motion capture, force plate, and ultrasound systems.

Sports Optimization and Rehabilitation Laboratory, University of Connecticut - Storrs, CT
Graduate Researcher, December 2018 – May 2019

Co – PIs: Lindsey Lepley, PhD and Adam Lepley, PhD

- Investigated anatomical and pathological outcomes after traumatic joint injury, specifically ACL tears.
- Collected and analyzed biomechanical data including kinematics, kinetics, strength, muscle activation patterns, and more.
- Assisted other students with data processing procedures such as tracking of muscle fibers via ultrasound recording.

Teaching and Mentorship

Kinesiology Department, University of Massachusetts Amherst – Amherst, MA
Teaching Assistant, February 2023 – May 2024

Primary Lecturer: Sarah Roelker, PhD and Katherine Boyer, PhD

- Teaching assistant for an undergraduate kinesiology course titled *Kinesiology 430: Biomechanics*.
- Responsible for leading teaching lab sections, meeting with students, hosting office hours, and other teaching related tasks.

Kinesiology Department, University of Massachusetts Amherst – Amherst, MA
Teaching Assistant, August 2022 – December 2022

Primary Lecturer: Gregory Grinnell, MS

- Teaching assistant for an undergraduate kinesiology course titled *Kinesiology 110: Human Performance and Nutrition*.
- Responsible for leading discussion activities, meeting with students, grading assignments, and other related items.

Kinesiology Department, University of Massachusetts Amherst – Amherst, MA
Teaching Assistant, August 2020 – May 2021

Primary Lecturer: Thomas G. St. Laurent, MS

- Teaching assistant for an undergraduate kinesiology course titled *Kinesiology 100: Introduction to Kinesiology*.
- Responsible for planning lessons, executing course material, and providing support for discussion section of the course.

Teaching and Mentorship (*continued*)

Undergraduate Research Opportunity Program, University of Michigan - Ann Arbor, MI

Student Mentor, August 2019 – August 2020

Supervisor: Lindsey Lepley, PhD

- Recruit students in the Undergraduate Research Opportunities Program to participate in lab's research.
- Trained students on project specific protocols including collecting, compiling, and analyzing 3D CT scan image data.

MCB Department, University of Connecticut - Storrs, CT

Teaching Assistant, August 2018 – July 2019

- Lab teaching assistant for an undergraduate biology course titled *Biology 1107: Principles of Biology 1*.
- Responsible for teaching lab exercises, mentoring students, assisting students, grading, and hosting office hours.

Publications

1. **Brancati RJ**, Hoogkamer W, Martini DN, Fitterau M, Boyer KA. Identification of Subgroups of Individuals Experiencing Patellofemoral Pain with Kinematic and Kinetic Features During Overground Running. *Submitted for peer review to Medicine & Science in Sports & Exercise*.
2. **Brancati RJ**, Hoogkamer W, Martini DN, Fitterau M, Boyer KA. Classification of Subgroups of Individuals Experiencing Patellofemoral Pain with Inertial Measurement Unit Signals and Supervised Machine Learning during Treadmill Running. *Currently in preparation for submission to IEEE Transactions on Biomedical Engineering*.
3. **Brancati RJ**, Kent, JA, Boyer. Assessing Aging Related Declines in Postural Control by Quantifying Center of Pressure Movement during the Advanced Version of the Short Physical Performance Battery. *Drafted*
4. **Brancati RJ**, Hamill J, Boyer KA. A Data Mining Approach for Determining Gait Abnormalities in Runners with Patellofemoral Pain Syndrome. *J Sports Science*. 2024 Jan; doi: 10.1080/02640414.2024.2308419
5. White MS, **Brancati RJ**, Lepley LK. Relationship between altered knee kinematics and subchondral bone remodeling in a clinically translational model of ACL injury. *J Orthop Res*. 2022 Jan;40(1):74-86. doi: 10.1002/jor.24943. Epub 2020 Dec 23. PMID: 33295680; PMCID: PMC8187469.
6. Davi SM, **Brancati RJ**, DiStefano LJ, Lepley AS, Lepley LK. Suppressed quadriceps fascicle behavior is present in the surgical limbs of those with a history of ACL reconstruction. *J Biomech*. 2021 Dec 2;129:110808. doi: 10.1016/j.jbiomech.2021.110808. Epub 2021 Oct 11. PMID: 34666248.

Conference Abstracts and Presentations

1. **Brancati RJ**. Towards Development of a System for Implementing Targeted Treatments for Patellofemoral Pain. Institute of Applied Life Sciences Translational Graduate Student Fellowship Symposium. *Oral Presentation*. Amherst, MA. March 21, 2025.
2. **Brancati RJ**, Boyer KA. Exploring the Relationship Between Pain and Biomechanical Adaptations in Individuals Experiencing Patellofemoral Pain Syndrome. *Poster Presentation*. Madison, WI. August 6, 2024.
3. Boyer KA, Holmes SC, **Brancati RJ**, Bushe K, Kent JA, Ayers D. Knee Extensor Functional Demand Following Total Knee Arthroplasty. Orthopaedic Research Society. *Poster Presentation*. Long Beach, CA. February 4, 2024.
4. **Brancati RJ**, Kent JA, Hayes KL, Alvarado F, Boyer KA. Aging and Speed Adaptations in Functional Demand of the Knee Extensors During Walking. American Society of Biomechanics. *Poster Presentation*. Knoxville, TN. August 10, 2023.
5. **Brancati RJ**, Kent JA, Hayes KL, Alvarado F, Boyer KA. Assessment of Aging Related Changes in Postural Control Using Time to Contact. UMass Amherst IALS Core Facilities Showcase. *Poster Presentation*. Amherst, MA. November 29, 2022.
6. **Brancati RJ**. A Data Mining Approach for Determining Gait Abnormalities in Runners with Patellofemoral Pain Syndrome. UMass Amherst Kinesiology Graduate Seminar Series. *Oral Presentation*. Amherst, MA. November 28, 2022.

Conference Abstracts and Presentations (*continued*)

7. **Brancati RJ**, Boyer KA. Data Mining Approach for Determining Gait Abnormalities in Runners with Patellofemoral Pain Syndrome. North American Congress on Biomechanics. *Running Symposium Presentation*. Ottawa, Canada. August 21-25, 2022.
8. **Brancati RJ**, Kent JA, Hayes KL, Alvarado F, Boyer KA. Assessment of Aging Related Changes in Postural Control Using Time to Contact. North American Congress on Biomechanics. *Oral Presentation*. Ottawa, Canada. August 21-25, 2022.
9. **Brancati RJ**, Boyer KA. Biomechanical Characteristics of Runners Recently Recovered from Patellofemoral Pain Syndrome. 9th World Congress of Biomechanics. *Oral Presentation*. Taipei, Taiwan. July 10-14, 2022.
10. **Brancati RJ**, Boyer, KA. Determining gait abnormalities in runners with patellofemoral pain syndrome using a data mining approach. UMass Amherst School of Public Health & Health Sciences Research Day 2022. *Poster Presentation*. Amherst, Massachusetts. April 6, 2021.
11. **Brancati RJ**, Kent JA, Boyer KA. Time to Contact Captures Declines in Postural Control Following Fatiguing Activity. 43rd Annual Meeting of the American Society of Biomechanics. *Oral Presentation*. Virtual Meeting. August 11, 2021.
12. **Brancati RJ**, Boyer, KA. Time to Contact Captures Declines in Postural Control Following Fatiguing Activity. UMass Amherst School of Public Health & Health Sciences Research Day 2021. *Oral Presentation*. Virtual Meeting. April 16, 2021.
13. Davi SM, **Brancati RJ**, Lepley AS, DiStefano LJ, Lepley LK. Examining the Dynamic Complexity of the Quadriceps Following Anterior Cruciate Ligament Reconstruction. National Association of Athletic Trainers Convention. *Oral Presentation*. Orlando, Florida. June 29, 2021.
14. White MS, Davi SM, **Brancati RJ**, Lepley LK. Alterations in Gait and Knee Joint Alignment Substantiate New PTOA Rodent Model of ACL Injury. Orthopaedic Research Society Annual Meeting. *Oral Presentation*. Phoenix, Arizona. February 10, 2020.
15. Lepley LK, White MS, Davi SM, Lepley AS, **Brancati RJ**. Novel Pre-clinical Model of Post-traumatic Osteoarthritis Demonstrates Unicompartamental Declines in Trabecular Bone Volume. Orthopaedic Research Society Annual Meeting. *Poster Presentation*. Phoenix, Arizona. February 10, 2020.
16. Davi SM, **Brancati RJ**, Lepley LK. Characterizing Abnormalities in Dynamic Quadriceps' Function Following Anterior Cruciate Ligament Reconstruction. Orthopaedic Research Society Annual Meeting. *Poster Presentation*. Phoenix, Arizona. February 8, 2020.

Grants, Fellowships, Awards, and Honors

2023 – 2024	UMass Institute of Applied Life Sciences Graduate Student Translational Research Fellowship - \$40,000
2023	Sigma Xi Research Society Dissertation Grant – <i>Not Funded</i>
2022	DeLuca Foundation Training Initiative Grant – <i>Not Funded</i>
2022	National Biomechanics Day Loadsol Grant – <i>Not Funded</i>
2021	National Biomechanics Day Loadsol Grant – <i>Not Funded</i>
2021	UMass Amherst School of Public Health and Health Sciences Research Day Award Winner - \$1500
2020 – 2021	UMass Amherst Kinesiology Department Graduate Student Annual Travel Award - \$150
2018 – 2019	Outstanding Teaching Assistant Recognition – <i>MCB Department, University of Connecticut</i>
2017 – 2019	Academic All-American – <i>American Collegiate Hockey Association</i>
2017 – 2018	Dean's List – <i>University of Connecticut School of Engineering</i>

Affiliations, Leadership, and Service

2021 – present	National Biomechanics Day – Lead Organizer
2020 – present	American Society of Biomechanics UMass Amherst Student Chapter – Vice President
2020 – present	American Society of Biomechanics Member
2020 – present	National Center for Neuromodulation for Rehabilitation Member

Prior Industry Experience

Karl Storz Endovision., Charlton, MA

Continuous Improvement Intern, May 2018 - August 2018

- Implemented lean manufacturing techniques such as Kanban and Six Sigma to improve device production.
- Improved machine shop product flow by creating an efficient work environment and improving work culture.

Medtronic, North Branford, CT

Research and Design Intern, May 2017 - August 2017

- Performed feasibility and reliability testing on prototypes utilizing high tech machinery to optimize design.
- Analyzed data using Minitab to formulate statistical analysis of data sets and decide on design factors.

Coursework Projects

An Exploration of Inertial Measurement Data in NCAA Division 1 Ice Hockey Players

Regression Analysis Class Project, September 2022 – Present

- Inertial data collected from microelectromechanical inertial measurement units provides data for coaches and sports performance teams to improve athlete performance.
- Explored a large data set derived from Catapult Sports inertial units and used regression analyses techniques to assess player load, determine athletes at higher risk of injury, and ultimately optimize player performance.
- Results determined optimal practice schedule based on intensity of drills and led the team to performing very well in games.

A Data Visualization of Ski Resorts and Statistics Across the United States

Data Visualization Class Project, January 2022 – May 2022

- Developed a fully interactive map of the United States highlighting ski resorts, providing information on skiable acreage and terrain difficulty, along with proximity to airports.
- All development was completed using HTML, JavaScript's D3 library, and GitHub for collaboration purposes.

Movie Recommendation Engine with a Simulated Feedback Analysis

Statistical Computing Class Project, August 2021 – December 2021

- A project inspired by the famous Netflix Prize competition, we sought to understand the self-modifying effects of recommendation algorithms which effectively create their own data to use in subsequent predictions and effect those predictions in unknown ways.
- Several machine learning algorithms were tested for the recommendation engine, and a user-rating simulation was completed to understand how the user's movie selections deviated from the original recommendations.

Pawpularity Contest – Generating a Cuteness Score of Adoptable Pets using Machine Learning Approaches

Machine Learning Class Project, August 2021 – December 2021

- Predicted "cuteness" of animal photographs with a convolutional neural network using tensorflow, achieving accuracy of up to 75% compared to ground truth data.
- Results of this project suggest that neural networks could be viable options for improving probability of dog and cat adoption.

Skills Summary

Languages:

- Python
- Matlab
- R
- Labview
- SQL
- C++

Frameworks:

- Pandas
- Numpy
- Scikit-Learn
- Matplotlib
- Seaborn
- PyTorch
- GGPlot2

Tools:

- Excel
- Streamlit
- PowerPoint
- Tableau
- Weights and Biases
- Github

Platforms/IDEs:

- Jupyter Notebooks
- VS Code
- PyCharm
- R Studio

Research:

- Human factors engineering
- User experience research
- Human subjects research
- Wearable technology (IMUs, EMG, HR)
- Motion capture (Qualysis, Vicon, Visual 3D)
- Sensor fusion algorithms (Madgwick, Kalman)
- Computer vision (Apriltag detection)
- Medical imaging (MRI, CT, Ultrasound)
- Image processing (Dragonfly ORS, 3d Slicer)
- Force Plates (AMTI, Bertec)
- Indirect Calorimetry
- Qualitative methods
- Institutional Review Board (IRB)

Engineering Software:

- CAD (SolidWorks, FreeCad)
- Ansys Finite Element Analysis

Soft Skills:

- Communication
- Problem solving
- Teamwork
- Adaptability
- Leadership
- Time management
- Attention to detail

References

Katherine A. Boyer, PhD

Associate Professor

Principal Investigator, Musculoskeletal Orthopedic Biomechanics Laboratory

Department of Kinesiology

Department of Orthopedics and Physical Rehabilitation, UMass Medical School

University of Massachusetts – Amherst

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William R. Johnson, PhD

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Martin Fultot, PhD

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