

## 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 data science. Blending quantitative and qualitative expertise to drive innovative solutions. Expertise in wearables (IMUs, EMG, HR monitors), motion capture, virtual/augmented reality, sensor fusion algorithms, data science/analytics, user experience research, human perception, and more. Passionate about developing user-centric products by integrating advanced technologies with thoroughly validated human-centered design.

## Education

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

- Apply mixed methods human factors engineering and user experience research into pre-product exploration and product development lifecycle.
- Design experiments, leverage technical hardware and software, and apply quantitative analytic methods to assess physical/cognitive load of equipment.
- Focus on warfighter situational awareness through the integration of HUDs, visual augmentation systems, and aural/haptic communication systems.

### 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.

### Musculoskeletal & Orthopedic Biomechanics Laboratory, University of Massachusetts Amherst – Amherst, MA

*Research Assistant*, August 2020 – January 2025

PI: Katherine Boyer, PhD

- Explored biomechanical factors related to orthopedic running injuries with rigorous experimental design, feature engineering approaches, statistical analysis, machine learning models, and more.
- Utilized unsupervised and supervised machine learning models and statistical and computational approaches to identify biomechanical mechanisms of joint injury and classified injury mechanisms with wearable sensor data.
- Creating high quality, publication ready visualizations for translating findings to diverse audiences.

## Research Experience (*continued*)

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### **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

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### **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.

### **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

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1. **Brancati RJ**, Hoogkamer W, Martini DN, Fiterau M, Boyer KA. Identification of Subgroups of Individuals Experiencing Patellofemoral Pain with Kinematic and Kinetic Features During Overground Running. *Currently in preparation for submission to Medicine & Science in Sports & Exercise*.
2. **Brancati RJ**, Hoogkamer W, Martini DN, Fiterau 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

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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.
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. 9<sup>th</sup> World Congress of Biomechanics. *Oral Presentation*. Taipei, Taiwan. July 10-14, 2022.

## Conference Abstracts and Presentations (*continued*)

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. 43<sup>rd</sup> 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
2019 – 2020	University of Michigan Undergraduate Student Research Program Mentor

## 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

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### **Katherine A. Boyer, PhD**

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Principal Investigator, Musculoskeletal Orthopedic Biomechanics Laboratory  
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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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Washington Nationals Baseball Club  
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### **Martin Fultot, PhD**

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