Ross Brancati, MS — *PhD Candidate*

163 Totman Building
Amherst, MA 01003
rbrancati@umass.edu
860-819-6439

Personal Website: rossbrancati.com
LinkedIn: linkedin.com/in/ross-brancati/
Github: github.com/rossbrancati
Twitter: twitter.com/ross_brancati

Summary

Experienced and passionate PhD candidate specializing in biomechanics, human performance, wearable tech, and data science with over six years of experience. My research leverages inertial measurement units, motion capture systems, electromyography, and other physiological measurement devices, along with advanced statistical and computational data science approaches to answer a variety of research questions. I have expertise in creating digestible, informative, and translational outcomes from raw, unstructured data. Specifically, my dissertation project focusses on identifying biomechanical pathways leading to running injuries in athletes and classifying such pathways with cost-effective wearable sensors coupled with machine learning models. Eager to apply my academic research skills in an industry setting. Open to work as soon as possible.

Education

2020 – 2024 University of Massachusetts Amherst; Amherst, MA
Doctor of Philosophy
Kinesiology *(Concentration: Biomechanics and Data Science)*
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 *(Concentration: Biomechanics)*
GPA: 3.9/4.0

2014 – 2018 University of Connecticut; Storrs, CT
Bachelor of Science
Biomedical Engineering *(Concentration: Biomechanics)*
GPA: 3.5/4.0

Experience

Warfighter Systems Integration Lab, Galvion – Portsmouth, NH
Data Science Intern, March 2024 – Present
Lab Manager: Martin Fultot, PhD

- Leveraging hardware and software capabilities to improve soldier training and performance in immersive environments.
- Developing and implementing sensor fusion algorithms for improving object detection in virtual/augmented reality.
- Utilizing technology such as eye tracking, VR/AR, wearable sensors, and motion capture to analyze soldier performance.
- Designing research studies related to understanding human factors and how humans integrate with military technology.

Musculoskeletal & Orthopedic Biomechanics Laboratory, University of Massachusetts Amherst – Amherst, MA
Research Assistant, August 2020 – Present
PI: Katherine Boyer, PhD

- Identifying biomechanical movement adaptations by those with musculoskeletal injuries and in the aging population.
- Utilizing data science approaches such as supervised learning and clustering to analyze and interpret large data sets.
- Developing a wearable sensor-based system for detecting mechanisms of running injuries with machine learning models.
- Automating time-taxing tasks by developing and implementing automated pipelines for data collection and processing.
- Creating high quality, publication ready visualizations for translating findings to diverse audiences.

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 using statistical modeling and testing.
- 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.

Research Experience (*continued*)

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.
- Supported development of interactive dashboards to help the sports performance team and coaches plan practices.
- 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.
- Developed data processing procedures for analyzing CT scans of animal model knee joints with knee osteoarthritis.
- 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.

Entrepreneurial Pursuits

Gait Guard, Early stage/pre-revenue startup
Founder, January 2023 – Present

- Leading a pre-revenue startup focusing on revolutionizing running related injury detection and treatment with wearable tech.
- Conducting extensive customer discovery interviews to understand user pain points, needs, and technology gaps.
- Developing a prototype with inertial measurement units and deep learning models to identify abnormal movement patterns.
- Participating in Innovation Corps programs through MIT and UMass Amherst to identify and refine customer segments.
- Working with key collaborators and partners in the startup space and wearable industry to secure initial seed funding.

Teaching and Mentorship

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

1. **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*
2. **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
3. 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.
4. 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**, Boyer KA. Exploring the Relationship Between Pain and Biomechanical Adaptations in Individuals Experiencing Patellofemoral Pain Syndrome. *Poster Presentation*. Madison, WI. August 6, 2024.
2. 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.
3. **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.
4. **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.
5. **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.
6. **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.
7. **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.
8. **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.
9. **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.
10. **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.
11. **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.
12. 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.
13. 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.

Conference Abstracts and Presentations (*continued*)

14. Lepley LK, White MS, Davi SM, Lepley AS, **Brancati RJ**. Novel Pre-clinical Model of Post-traumatic Osteoarthritis Demonstrates Unicompartmental Declines in Trabecular Bone Volume. Orthopaedic Research Society Annual Meeting. *Poster Presentation.* Phoenix, Arizona. February 10, 2020.
15. 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 – *Not Funded*
2022	DeLuca Foundation Training Initiative Grant – *Not Funded*
2022	National Biomechanics Day Loadsol Grant – *Not Funded*
2021	National Biomechanics Day Loadsol Grant – *Not Funded*
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 – *MCB Department, University of Connecticut*
2017 – 2019	Academic All-American – *American Collegiate Hockey Association*
2017 – 2018	Dean's List – *University of Connecticut School of Engineering*

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.

Research Projects

Leveraging Wearable Technology for Identifying Mechanisms of Running Related Injuries
Dissertation Project – Musculoskeletal & Orthopedic Biomechanics Lab, September 2021 – Present

- Developing a system to identify biomechanical contributors to running related injuries with wearable sensors, motion capture systems, and deep learning models
- Initial models showed upwards of 90% accuracy in detecting biomechanical pathways leading to injury, outperforming current clinical assessment approaches.
- Overall goal of this project is to develop a user-friendly and cost-effective system for improving clinical assessment and early detection of running related injuries.

Sagittal Plane Joint Angle Estimations with Inertial Measurement Units and Madgwick Orientation Filters
Research Project – Musculoskeletal & Orthopedic Biomechanics Lab, February 2024 – April 2024

- This small side project consisted of validating sagittal plane joint angles estimated from inertial measurement units using Madgwick filters to estimate sensor orientation.
- Resultant knee flexion angles during running were comparable to gold-standard motion capture data within a few degrees.

A Data Mining Approach for Determining Gait Abnormalities in Runners with Patellofemoral Pain Syndrome
Research Project – Musculoskeletal & Orthopedic Biomechanics Lab, May 2021 – December 2023

- As an alternative approach to traditional biomechanical analysis where discrete variables are extracted from waveform variables, I leveraged principal component analysis and interpretable machine learning models to identify variables that classified runners with patellofemoral pain from healthy individuals with accuracy of ~80%.

Research Projects (continued)

Analysis of Aging Related Changes in Postural Control Using Time to Contact
Research Project – Musculoskeletal & Orthopedic Biomechanics Lab, October 2020 – Present

- Force plates embedded with force transducers are a powerful tool for quantifying postural control, and can often pick up on subtle yet important differences in balance
- Postural control was quantified using time to contact (TTC), a metric derived from the center of pressure position, velocity, and acceleration, which is related to the perceived time someone has to make a postural correction to prevent a fall.
- Results showed that TTC was more sensitive to aging related declines in postural control compared to other clinical tests.

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 Stated 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.

Data Science Projects

NASDAQ Stock History Analysis and Prediction
Data Science Portfolio Project – January 2024

- Attempted to predict future stock price with statistical approached (PCA), regression models, and machine learning.
- Models were able to accurately predict prior stock market crashed with good accuracy, especially in March 2020.

Heart Disease Prediction with UCI Dataset
Data Science Portfolio Project – December 2023

- Leveraging features such as age, sex, chest pain, blood pressure, cholesterol level, and more, I developed several supervised classification models to predict if a person would experience heart disease, resulting in an accuracy of 85%.
- Potential to enhance health outcomes by early detection of heart disease, outperforming current clinical standards.

Gait Speed Classification with Wearable Sensors and Deep Learning
Data Science Portfolio Project – January 2023

- Classified gait speed (slow, medium, fast) of 22 individuals walking with inertial measurement units positioned on the feet with accuracy over 80%.
- This proof-of-concept model could have important implications for detecting slowing gait speed (sometimes referred to as the 6th vital sign) in aging individuals, potentially extending their lifespan and improving quality of life.

Data Science Projects (continued)

Abnormal Heartbeat Detection using Deep Learning

Data Science Portfolio Project – December 2022

- Leveraged a dataset of healthy and abnormal audio heartbeat signals to classify murmurs, artifacts, extrahls, or normal beats, with accuracy upwards of 75%.
- Demonstrated that machine learning models may provide important support for doctors, especially as it relates to monitoring patients outside of clinical settings.

Skills Summary

Languages:

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

Frameworks:

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

Tools:

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

Platforms:

- Jupyter Notebook
- VS Code
- PyCharm
- Spyder
- R Studio

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)
- Electromyography (Delsys, BioPac, Neuraxon)
- Force Plates (AMTI, Bertec)
- OpenSim (beginner)
- Indirect Calorimetry
- Instrumented treadmills
- Qualitative methods (surveys)
- Institutional Review Board (IRB)

Engineering Software:

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

Commercial Project Management:

- Agile
- Kanban
- Six Sigma

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
Email: kboyer@kin.umass.edu

William R. Johnson, PhD
Senior Biomechanist
Washington Nationals Baseball Club
Email: bill@johnsonwr.com

Martin Fultot, PhD
Lab Manager
Warfighter Systems Integration Lab
Galvion
Portsmouth, NH
Email: Martin.Fultot@galvion-usa.com