Justin A. Brantley

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Detailed CV: 📄   Full list of publications: 📖 🎓

EXPERTISE

Brain/Human-Machine Interfaces   Neuro-prosthetics & Exoskeletons   Biomechanics   EEG

EMG   IMUs   Machine Learning   Deep Learning   Motor Control   Bayesian Behavior

SUMMARY OF QUALIFICATIONS

- PhD. in Electrical Engineering with a focus on neural signal processing and brain-machine interfaces.
- Expertise in signal processing, classical machine learning, deep learning, and statistics in both MATLAB and Python.
- Significant experience as a project leader in human movement experiments (NIH and NSF funded), including EEG, EMG, IMUs, and motion capture.
- Publication record in both exploratory and hypothesis-driven research: 1 book chapter, 10 journal papers (5 first author), 3 papers in review (2 first author), 7 conference papers, and 2 publicly contributed data sets
- Strong verbal and written communication skills in scientific and non-scientific environments.

RESEARCH EXPERIENCE

Postdoctoral Researcher   Feb 2020–Present

 Körding Lab , Department of Bioengineering, University of Pennsylvania
Supervisor: Konrad Körding, Ph.D.

Major Skills Obtained: Python-based data acquisition and analysis, Bayesian modeling of behavior, deep neural networks, deep reinforcement learning, pose-estimation (video-based MoCap)
Projects:

➡ **Bayesball: Bayesian Integration in Professional Baseball Batters (project lead)**   ▶ **NMC 4.0 Presentation**

- Used large-scale open-source baseball data (millions of pitches) to demonstrate that professional batters manage batting uncertainty in way that consistent with Bayesian statistics.
- First study to translate small-scale lab studies of Bayesian behavior to the real world
- **Deliverable:** Journal article (submitted), conference presentation, open-access python notebook

➡ **Studying Movement in Naturalistic Environments Using Pose Estimation (project lead)**

- Used open source pose estimation techniques to track human movement and extend existing studies of motor control and Bayesian behavior in naturalistic environments
- **Deliverable:** Python notebooks ready for reuse in future projects

Graduate Research Assistant   Aug 2014–Jan 2020

 Laboratory for Non-Invasive Brain Machine Interfaces , Electrical & Computer Engineering, University of Houston
Supervisor: Jose L. Contreras-Vidal, Ph.D.

Major Skills Obtained: Signal processing and machine learning for neural signals; data acquisition and analysis of EEG, EMG, IMU-based motion capture, goniometers, and fMRI; experience in the design and development of rehabilitation robotics, such as prosthetic limbs and exoskeletons; collaboration and communication in multi-disciplinary teams, including engineers, scientists, clinicians, and the end-user population
Projects (Selected):

➡ **Brain-Machine Interfaces (BMIs) for Control of Prosthetic Devices (project lead)**   **NIH 1F99NS105210-01**

- Utilized EEG, EMG, IMUs, and fMRI to investigate the cortical representation of phantom limb in amputees
- Developed a closed-loop control framework (cleaning/prediction) using a nonlinear Kalman filter to predict phantom limb movements from EEG for control of an external robotic prosthesis.
- Led a strong collaboration with a mechatronics research lab and an fMRI lab to complete the study.
- **Deliverable:** Fully realized EEG-based real-time BMI, a published book chapter, two papers submitted/in preparation, mentored undergraduates

➡ **Neural Correlates of Human Multi-Terrain Walking (project lead)**   ▶ , 🗎 **Media highlights**

- Developed a unique experimental framework for mobile brain and body imaging (MoBI) to record simultaneous EEG, EMG, and IMU-based motion capture during unconstrained walking.
- Developed offline decoding strategy using signal processing and machine learning for prediction of terrain transitions directly from brain signals.
- **Deliverable:** Complete experimental framework for MoBI data collection, published numerous journal and conference paper, published multi-modal data as open-access repository 💾, mentored undergraduate and graduate students.

➡ **Regulatory Concerns for Rehabilitation and Neurotechnology (project co-lead)**

- **Deliverable:** Lead the section,"End-effectors: Actuators and Feedback" in the *IEEE Neurotechnologies for Brain-Machine Interface Standards*; published two journal articles discussing regulatory and clinical concerns related to exoskeletons and direct to consumer neurotechnology.

Graduate Research Assistant   Aug 2012–Aug 2014

📍 Orthopaedic Biomechanics & Biomaterials Laboratory 🔗, University of New Mexico
Supervisor: Mahmoud Reda Taha, Ph.D; Deana Mercer, MD; Christina Salas, Ph.D

Major Skills Obtained: Synthetic and cadaveric bone experimental testing, finite element modeling, collaboration and communication with surgeons

Projects:

➡ **Experimental and computational investigation of Orthopaedic surgical techniques (project lead/ research assistant)**

- Utilized mechanical testing instruments and finite element modeling to design and validate treatment options for complex fractures and musculoskeltal conditions.
- Worked directly with orthopedic residents, fellows, and attending faculty members to develop novel engineering solutions to problems encountered in the operating room.
- **Deliverable:** Experimental and computational results of surgical treatments, publications and conference presentations

EDUCATION

Ph.D Electrical & Computer Engineering, University of Houston   Dec 2019
- Thesis: A Noninvasive Neural Interface for Control of a Powered Lower Limb Prosthesis
- NIH Doctoral Fellow—NIH Blueprint Diversity Specialized Predoctoral to Postdoctoral Advancement in Neuroscience (D-SPAN) Award (NIH 1F99NS105210-01) 🔗

M.S., Biomedical Engineering, University of New Mexico   Dec 2014
- Thesis: A Biomechanical Analysis of One-Third Tubular Plates for the Treatment of Benign Lesions in the Distal Femur. 🔗

B.S., Mechanical Engineering (minor: Mathematics), New Mexico State University   Dec 2011
- Minor: Mathematics

TECHNICAL SKILLS

Languages: (Native) English; (Advanced) Spanish

Programming: (Advanced) Matlab, Python; (Basic) C, JavaScript

Toolboxes/ Libraries: (Advanced) EEGLab, FieldTrip, Python generic libraries, PyBaseball; (Intermediate) Pytorch, DeepLabCut, VIBE, OpenPose, OpenAI Gym; (Basic) Tensorflow, Brainstorm, AFNI

Other: (Advanced) Inkscape, LaTeX; (Intermediate) Illustrator, Anaconda, Github, Markdown, Arduino; (Basic) Labview