REPPERGER RESEARCH INTERN PROGRAM

RESEARCH PROJECT #: AFRL-RHB-25-05

Wearable Performance for Lumbar Load Prediction

PROJECT DESCRIPTION: The Advanced Research in Musculoskeletal Modeling for Operational Readiness (ARMMOR) group is committed to quantifying and mitigating musculoskeletal injury risks for warfighters through advanced biomechanical sensing and modeling. OpenSim, an open-source musculoskeletal modeling software, is central to the ARMMOR group's efforts and the wider biomechanics community. This tool enables researchers to leverage experimentally collected data, such as motion capture and ground reaction forces, to gain insights into whole-body, muscle, and joint mechanics. These insights inform strategies to optimize warfighter readiness and reduce injury risks. However, significant opportunities remain to learn from data captured in the field using portable, wearable sensors like inertial measurement units (IMUs) and pressure insoles.
This project aims to evaluate the effectiveness of these wearable sensors in estimating loading in the lumbar spine as a means of assessing injury risk. Interns will investigate the performance of machine learning algorithms in estimating lumbar spine joint forces based on various combinations of wearable sensor inputs. They will also compare lumbar load estimations derived from current state-of-the-art methods (motion capture and force plate data) with those obtained from wearable sensors (IMUs and pressure insoles). This comparison will help quantify the feasibility of achieving reliable and accurate estimations of lumbar loading and other injury risk metrics from field-collected data.
Qualified candidates will have experience in data analysis and processing and experience with machine learning. Highly competitive candidates will also have familiarity with biomechanics concepts, experience with musculoskeletal modeling (i.e., software such as Visual3D, OpenSim, etc.), and statistics.
Required Software Skills: Coding (Python)
Preferred Software Skills: MATLAB

LEARNING OBJECTIVES: 1) Integrate into a multidisciplinary team combining biomechanics, physiology, engineering, and data software skills. 2) Engage with projects related to interventions for the warfighter. 3) Gain hands-on experience with leveraging advanced computational methods to enhance lumbar spine injury risk assessment.

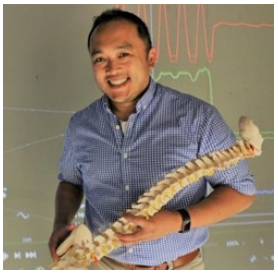
ACADEMIC LEVEL: Undergraduate; Masters; Doctoral

DISCIPLINE NEEDED:

- Engineering
- Computer Science
- Data Science

RESEARCH LOCATION: Wright-Patterson Air Force Base, Dayton, Ohio

RESEARCH MENTOR: Peter P. Le, Ph.D.
Industrial and Systems Engineering, The Ohio State University, 2016



Dr. Peter Le is a Senior Research Biomedical Engineer at the Air Force Research Laboratory, 711th Human Performance Wing and serves as the Lead for the Aerospace Operations Chronic Health Risk Modeling Line of Effort. He earned his PhD in Industrial and Systems Engineering (Human Systems Integration) from The Ohio State University in 2016 with extensive training at the Spine Research Institute. His current research interests are in aircrew neck and back pain, musculoskeletal modeling, and wearable sensing to inform decision guidance tools for injury mitigation / human performance optimization.

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