AHLAD NETI, Ph.D.
PROFESSIONAL BIOGRAPHICAL OUTLINE

BACKGROUND

Dr. Neti earned his Bachelor of Science in Biomedical Engineering with a minor and concentration in biomechanics from the University of Delaware. He then continued his studies and obtained a Ph. D. in Bioengineering with a concentration in human movement and rehabilitation from the University of Pittsburgh.

He has conducted several research projects in gait mechanics, human motion capture, medical product design and development, rehabilitation engineering, machine learning, engineering education, and clinical practice education. During his undergraduate schooling, Dr. Neti worked on analyzing the effects of ankle-foot-orthoses (AFOs) on gait mechanics in individuals who are post stroke. He continued his research to develop a novel AFO design incorporating user feedback. Dr. Neti currently holds two U.S. Patents for the result of his undergraduate research (US 20240130881 A1 and US 20240225876 A9). While at the University of Delaware, Dr. Neti contributed to research projects in wearable vitals monitoring and woven Kevlar body armor.

During his graduate work, Dr. Neti conducted research at the Human Engineering Research Laboratory in rehabilitation engineering, medical devices, clinical education, and real-time signal analysis. His dissertation work focused on the analysis of a new rear wheel design for manual wheelchair users to reduce the amount of whole-body-vibration administered to the body during propulsion. His other graduate projects included the development of a tool to assist clinicians in analyzing the safety of a manual wheelchair transfer and the development of an at-home upper-body exercise device for use by individuals with disabilities to participate in socially connected and virtual exercise experiences.

His scientific research has focused on human movement, injury mechanisms, and medical device development and design. He has skills in mechanical design, wearable sensor data, time-series analysis, 3D motion capture analysis, machine learning, and failure modes effect analysis. Dr. Neti has completed advanced coursework in the fields of biomechanics, engineering, statistics, mathematics, kinesiology, physiology, and clinical education. Dr. Neti has specialized in several research areas focusing on studying all facets of human movement, injury, and performance, in addition to human factors and rehabilitation. Dr. Neti has published in the area of rehabilitation, sensor analysis, and clinical education.

AREAS OF SPECIALTY

- Human Kinematic Analysis and Testing
- Rehabilitation Engineering
- Medical Device Development
- Joint Biomechanics
- Injury Causation Biomechanics
- Accident Reconstruction
- Whole Body Vibration
- Human Factors
- Gait Analysis
- Statistical Analysis
- Slip/Trip/Fall Kinematics and Kinetics
- Non-linear Time Series Analysis

SUMMARY OF EXPERIENCE

- Analyzed the implementation of a novel medical device in manual wheelchair users for its effect on comfort, pain, and fatigue over a three-month intervention.

- Assisted in the design and development of a computer-vision program to assist clinicians in analyzing the performance and safety of a manual wheelchair transfer using machine learning.
- Performed extensive work in gait mechanics and analysis, with specific focus on ankle-foot-orthoses and post-stroke individuals.
- Assisted in development projects related to wearable vitals monitors, and woven Kevlar body armor.
- Designed and developed a portable compression test frame to assist with engineering education outreach programs to engage more women in bioengineering and orthopedic surgery.

EDUCATION

- Ph.D. in Bioengineering Biomechanics and Human Movement Sub Track, University of Pittsburgh, 2024
    - Academic & Research Supervisor: Dr. Alicia Koontz
    - Dissertation Title: "Good Vibes Only: An In-Depth Analysis on the Implementation of In-Wheel Suspension in Manual Wheelchair Users"
    - Bevier Scholar Recipient
    - Presented research at established conferences (Rehabilitation Engineering Society of North America, International Seating Symposium, Rehabilitation Institute Research Day, Veterans Affairs Pittsburgh Health Care Research Week)
- Bachelor of Science in Biomedical Engineering, 2020
    - Minor in Biomechanical Engineering
    - Distinguished Scholar Recipient due to Merit Accomplishments (Telkes Scholarship)
    - General Honors Award Recipient

PROFESSIONAL EXPERIENCE

October 2024 – Present | ARCCA, LLC | Senior Biomechanist

- Applies the principles of human factors and biomechanics to the anatomy and physiology of the human body to explore the cause, nature, and severity of injuries.
- Performs analysis of building codes associated with personal injuries and premises liability Building Codes and Standards.
- Provides instruction in the area of human factors, and biomechanical and injury causation analysis.
- Conducted dynamic vehicle and underbody blast testing to evaluate and design a new seating and
- restraint system for the military.
- Currently performs research and analysis to evaluate and study the relationships between crash injuries
- and crash forces, occupant kinematics, and human tolerances by utilizing human subjects and
- anthropomorphic test devices.
- Specializes in crash injury analysis, injury mechanism determination, and crash kinematics
- Evaluate forensic evidence associated with impact and inertial loading conditions produced during
- events such as motor vehicle collisions, slips, trips, and falls, and workplace and leisure incidents.
- Participates in biomechanical investigations that explore human kinematics and tolerance to

- potentially injurious environments
- Researches injury mechanisms and contributes to the design of vehicles, products, and environments
- to mitigate injurious events in sports, automotive, and work settings.

August 2020 – April 2024 | Human Engineering Research Laboratories (HERL) | Graduate Student Researcher

- Developed a computer-vision and machine learning based system, TransKinect, to assist clinicians in evaluating the biomechanical quality of wheelchair transfer. Utilized LiDAR sensors for human movement tracking
- Evaluated the usability of the Transkinect interface and performance of the model in a clinical setting, iteratively incorporating feedback from the users and updating the model over time
- Built, trained, and evaluated machine learning models to identify performance of activities of daily living (ADL) in manual wheelchair users via data derived from inertial measurement units (IMUs) attached to the wheelchairs
- Designed and built a simple application interface to support the collection of sensor data and real time data visualization in a laboratory setting from IMU, EMG, load cells, PPG, and optical sensors
- Analyzed the effect and impact of a novel in-wheel suspension system for wheelchairs compared to standard wheels to assess the impact on exposure to harmful vibration, pain, fatigue, and overall quality of life for individuals with spinal cord injuries in both a laboratory and community setting using remote sensor integration
- Developed preliminary designs for an at home exercise device with an interface for community interaction for individuals with spinal cord injuries and gathered feedback through focus groups

February 2017 – June 2020 | Orthotics & Prosthetics for Enhanced (O.P.En.) Mobility Research Laboratory | Undergraduate Lab Assistant

- Researched the biomechanics of gait analysis under the guidance of Dr. Elisa Arch
- Worked with data analysis, motion capture, modeling ankle-foot-orthosis (AFO), CAD parameterizing of 3D models, remodeling of models with CAD programs, and design of tools for testing mechanical properties of AFOs
- Undergraduate Senior Thesis: "Development of a novel ankle foot orthosis design incorporating user perspective and medical purpose"
- Conducted and performed qualitative coding on interviews with individuals with mobility disabilities to identify crucial themes to guide the development of an affordable, accessible, and comfortable customized ankle foot orthotic (AFO)
- Analyzed and modeled the human gait using motion capture data to identify key parameters for the AFO
- Modeled several iterations of the AFO design utilizing CAD and built and tested the mechanical properties of the final designs.

January 2019 – June 2020 | UD Health & Design Innovation Lab | Undergraduate Lab Assistant

- Prototyped a wrist worn device to cue Alzheimer's and dementia patients to drink water
- Held focus groups with members of the DOD and FEMA to identify key themes for the development of a wearable hydration and biometrics sensor for first responders. Heavy emphasis on bio-sensor fusion and analysis
- Prototyped a wearable hydration and biometrics sensor for first responders

PROJECTS

TransKinect:
Lead Graduate Student
August 2020 – April 2024
Developed a machine learning and computer-vision system and application to assist clinicians in evaluating the biomechanical quality of a wheelchair transfer. A LiDAR performs human motion recognition of individuals while performing a transfer and quantifies several properties such as joint angles, body position, and accelerations. Values are input into trained machine learning models on proper technique and outputs a score on the quality of the transfer. Developed a simple touchscreen graphical user interface to allow clinicians easy and seamless integration into practice. Validation studies revealed high potential for use in long-term patient health.

In-Wheel Suspension in Manual Wheelchair Users
Lead Graduate Student (Dissertation Work) August 2020 – January 2024
Assessed the effects and impacts of novel in-wheel suspension systems on whole body vibration (WBV), comfort, and health in manual wheelchair users. Inertial measurement units (IMU) quantified accelerations over obstacles and used to assess exposure to WBV. Results revealed that in-wheel suspension reduces WBV significantly at the backrest and footrest compared to non-suspension wheels. Further testing revealed noticeable propulsion inefficiency with suspension wheels where the system absorbs the force from the user needed to propel and has significantly greater dynamic movements.

Activities of Daily Living Datalogger for Manual Wheelchair Users
Lead Graduate Student
August 2020 – January 2024
Developed a wearable sensor and machine learning system to analyze performance of activities of daily living by manual wheelchair users. Inertial measurement units collect user wrist, wheelchair frame, and wheel rim movements and are input into trained and validated models to identify several activities of daily living. Daily distance, propulsion time, number of pushes, encounters with different obstacles (curb drop, ramps, grass, etc.), over-head reaches, wheelies, transfers, and exposure to whole body vibration are collected over the whole day.

Woven Kevlar Body Armor:
Co-op Project
January 2019- June 2020
Development of shrapnel resistant body armor for Department of Defense personal with knit Kevlar. Seamless body armor is developed through the SHIMA SEIKI WholeGarment machine and Kevlar yarn and customized to size for the user. Body armor should allow for full optimization of movement, comfort and protection. LiDAR allows for accurate measurement of anthropometry for the best fit and customization.

Wearable Vitals Monitor:
Project Lead for Three Member Team
July 2019- June 2020
The goal of this project is to design a durable, wearable device for firefighters, first responders and members of the United States Department of Defense (DOD) that provides accurate, real-time feedback of an individual's vitals (heart rate, hydration, VO2 Max, blood pressure, body temperature, and GPS

location). Bluetooth enabled microcontroller integrates signals from several physiological sensors and processes data in real-time.

PUBLICATIONS & PRESENTATIONS

Manuscripts Published

1. Neti, Ahlad Good Vibes Only: An In-Depth Analysis on the Implementation of In-Wheel Suspension in Manual Wheelchair Users. Doctoral Dissertation, University of Pittsburgh.
2. Neti, A. et al. (2024). TransKinect: a computer vision and machine learning clinical decision support system for automatic independent wheelchair transfer technique assessment. Disability and Rehabilitation: Assistive Technology, 1–10.
3. Neti, Ahlad, et al. "Usability and Acceptability of the TransKinect Application for the Assessment of Wheelchair Transfer Technique with Novice Therapists." Rehabilitation Engineering Society of North America Annual Conference 2022.
4. Koontz, A.M.; Neti, A.; Chung, C.-S.; Ayiluri, N.; Slavens, B.A.; Davis, C.G.; Wei, L. Reliability of 3D Depth Motion Sensors for Capturing Upper Body Motions and Assessing the Quality of Wheelchair Transfers. Sensors 2022, 22, 4977.

Manuscripts in Review

1. Ahlad Neti; Holly Wilson-Jene; Jon Pearlman; and Alicia M. Koontz "Characterizing the Rolling Resistance, Deformation and Propulsion Oscillations of In-Wheel Suspension Systems in Manual Wheelchairs"

Manuscripts in Development

1. Neti, A., Koontz, A. Longitudinal effects of in-wheel suspension on pain and fatigue in manual wheelchair users.

Conference Abstracts & Presentations

1. Neti, Ahlad. "Development of the TransKinect". RESNA Annual Conference. Student Scientific Paper Competition Winner
2. Neti, Ahlad, et al. "Development and Validation of an Overuse Risk Monitor for Manual Wheelchairs Users Through Wearable Sensors". 38th International Seating Symposium.

TEACHING EXPERIENCE

University of Pittsburgh

BIOENG 2040 - TRANSPORT PHENOMENA FOR BIOMEDICAL AND CHEMICAL ENGINEERS 08/ 2021 – 01/2022

(~40 students)

Teaching Assistant: Assisted the professor in grading homework, quizzes exams; leading recitation sessions for students; teaching some classes in place of professor.

BIOENG 1630 - BIOMECH 1-MECHL PRIN BIO SYMS 08/ 2022 – 01/2023

(~40 students)

Teaching Assistant: Assisted the professor in grading homework, quizzes exams; leading recitation sessions for students; teaching some classes in place of professor.

University of Delaware
D-Studio (Maker Space) Teaching Assistant
08/2022 – 06/2024
(~50 students)
Teaching Assistant: Assisted students in the maker space with machine shop, power tools, CAD, electrical engineering, soldering, circuit design, and test design. Instructed first year mechanical engineers on safe practices and use of maker space.