REPPERGER RESEARCH INTERN PROGRAM

RESEARCH PROJECT #: AFRL-RHB-27-18

The Brain and the Body: Multimodal Psychophysiological Imaging to Understand Cognition

PROJECT DESCRIPTION: Understanding an individual's cognitive state is of critical importance to the Air Force for effectively training personnel, planning missions, and designing relevant interventions if performance is compromised. To characterize an individual's state, a combination of neural (e.g., EEG), peripheral (e.g., EKG, eye tracking, and pupillometry), and behavioral (e.g., task performance) data is used. These rich multimodal data, capturing the interaction between the brain and the body, are modeled alongside task performance to understand which signals provide the most value, in which settings, and to derive actionable insights using sophisticated analytical and machine learning techniques.

LEARNING OBJECTIVES: Under the guidance of a mentor, you will gain hands-on experience to complement your education and support your academic and professional goals. Along the way, you will engage in activities and research in several areas, including but not limited to:

1. Develop statistical skills and coding abilities.
2. Gain experience in data visualization, multisensor data fusion, and algorithm development.
3. Expand conceptual and theoretical knowledge of physiologically measured cognitive states.
4. Gain experience in critical thinking, public speaking, and collaboration within multidisciplinary teams.

ACADEMIC LEVEL: Doctoral; Master's

DISCIPLINE NEEDED: Cognitive Neuroscience, Biomedical Engineering, Data Science

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

RESEARCH MENTOR: Grace Clements, PhD

Cognitive Neuroscience, University of Illinois Urbana-Champaign, 2022



Grace Clements, Ph.D., is a research psychologist at the Air Force Research Laboratory. After completing her undergraduate degree in Psychology and Neuroscience at Miami University, Grace pursued a Ph.D. in Cognitive Neuroscience at the University of Illinois Urbana-Champaign, where she specialized in advanced imaging methods (EEG, MRI, fNIRS). Her research focused on how brainwave activity changes with attention, how "background noise" in the brain is a signal that varies across the lifespan, and how the brain's white matter health relates to age, fitness, and the brain's vascular health. In 2024, Grace joined the 711th Human Performance Wing at AFRL, where she designs studies and tests products using human neuroscience, psychophysiological methods, and advanced statistics to understand human cognitive and functional state and protect Airmen and Guardians.

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