

FY20 Student Research Topic

1. **Research Title:** Assessing humans as a complex model system through multi-omic data analysis over diverse timescales to predict and enhance human performance.

2. **Individual Sponsor:**

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3. **Academic Area/Field and Education Level:**

A PhD level focus on bioinformatics, statistics, computer science, algorithm design and software development with specific application to analyzing high dimensional, multi-sensor, time-series data; with an additional focus on creating novel visualizations.

Previous work with visualization, machine learning algorithms and software usage/design is strongly desirable.

4. **Objectives:**

The objectives of this research include 1) assessing complex biological systems on varying time-scales and combining diverse datasets in a sensible manner, 2) identifying performance-related relationships in multi-omic (genomics, proteomics, metabolomics, etc.) data, 3) incorporating multi-dimensional sensors in a meaningful way to evaluate human performance and 4) creating an algorithm/model through machine learning that leverages results/insights from objectives 1-3 to predict and enhance human performance.

5. **Description:**

Air Force personnel work in unique environments, many with extreme conditions and high cognitive workloads. These challenges necessitate both sustained and enhanced human performance as well as a need to predict individuals with the best potential alignment for those missions. Systems biology looks at a variety of pathways and mechanisms occurring at various levels of biological organization and across multiple timescales that have the potential to impact individual performance. However, the best strategies for exploiting the unique characteristics of each -omics-level dataset, creating a useful, individualized systems biology profile, and ultimately developing predictive performance models are currently unclear. This project aims to address this uncertainty by producing and consolidating a wide variety of data types, identifying important biological and performance-related relationships within and between them, and ultimately produce a useful predictive model for performance evaluation. Thus, this project will successfully combine multi-omic data and multiple sensors to address a variety of questions currently being asked within the Air Force.

6. **Research Classification/Restrictions:**

Current investigators assigned to the project carry a confidential or higher security clearance. Applicants will be subjected to a full background check to obtain these clearance levels.

7. **Eligible Research Institutions (check all that apply):**

DAGSI (Wright State University, AFIT, Ohio State University, University of Dayton, Miami University, Ohio University, University of Cincinnati)

Topic can be submitted for public release

AFIT (only)

USAFA (only)

If you are submitting a topic for the USAFA, indicate if you are also interested in sponsoring a USAF Cadet in summer 2020 (Average cost for USAF Cadet for 33 days is \$5000)

Yes

No