

NISS National Lab Career Fair



About me

Education

- PhD, Statistics, The Ohio State University, 1993
- MS, Statistics, the Ohio State University, 1991
- BS, Mathematics and Computer Science, Muskingum College, 1989
- Work Experiences
 - Postdoc, National Institute of Statistical Sciences 1993-1995
 - Battelle 1995-present: Where did the time go!



Nancy McMillan Director Health Analytics

Battelle Memorial Institute is a private nonprofit applied science and technology development company headquartered in Columbus, Ohio.



Professional Trajectory

Research Areas





Battelle Analytics Staffing & Resources

Staff Profile

- Approximately 111 employees in Health Analytics
 - 75% in Columbus, 25% elsewhere in US
 - 36 are data scientists; software engineering is other primary component
- Nearly all data scientists have advanced degrees in:
 - Statistics, Applied Mathematics, Electrical Engineering, or Physics
- Resources
 - State-of-the-art statistical and data management software
 - Funding may be available for internal research projects
 - microIR&D and IR&D
 - Experienced and certified project managers

| | Diverse Academic Backgrounds |
|-------|--------------------------------------|
| onent | BS, MS, and PhD Levels |
| | Statistics |
| | Computer Science |
| | Mathematics |
| | Physics |
| | Bioinformatics |



What Data Scientists Do At Battelle

- Leading and supporting roles in diverse range of projects
- Core Capabilities:

| Statistics/ Machine Learning | Study Design Sample Size Determination Data Quality Assessment Data Mining Pattern Recognition Algorithm Development Sensitivity Analysis | Probabilistic Modeling Simulation Statistical Analysis Presentation Interpretation Reporting |
|------------------------------------|---|---|
| Data Application | Database System Development Data Acquisition Systems Data Management | Information Analysis Tools Multi-user Data Systems Scientific Computing |



What's It Like to Work at Battelle?

- Multiple projects at once continuously collaborating across multiple disciplines
 - Labor Forecasting process to help ensure workloads are well-balanced
- Different projects need different capabilities
 - Staffing is a combination of staff member interest and capabilities and organizational needs
- Staff members work in a matrix organization
 - Line organization X project assignments



About Battelle



A company like no other...

Battelle is the world's largest, independent, not-for-profit research and development organization

Vision:

Delivering remarkable, impactful science, technology and engineering outcomes while solving our nation's most difficult challenges

Mission:

To translate scientific discovery and technology into societal





Nonprofit, charitable trust formed in 1925 by the will of Gordon Battelle



Decades of innovation having an impact today













Building a healthier world



Advanced neuroscience

Harnessing the power of our technologies to go beyond paralysis and enhance physical and cognitive function

- Assisting the body to go beyond physical limitations where biology is broken
- Restoring the body by optimizing recovery through targeted neuroplasticity
- Advancing the healthy body to perform beyond current physical and cognitive abilities





Related Projects

NeuroLife

- Brain-computer interface for reanimating a paralyzed limb, just completed 5-year clinical trial
- Exploring non-invasive EMG interfaces using the sleeve
- Currently funded by DARPA for next-generations neural interface (N3) and AI-based algorithm work (INI)



Bioelectronic Medicine

- Utilizing non-invasive & 2) I minimally invasive neural stimulation to control cardiovascular state and treat disease
- In progress on rodent study for vagus nerve stim to disrupt heart attack
- Plan to move to humans next year





DARPA Intelligent Neural Interfaces





DARPA Intelligent Neural Interfaces





Autocalibration

- Automated calibration of Functional Electrical Stimulation using a Differential Evolution algorithm
 - Reduce setup time
 - Potentially allow for independent set up by end-users, obviating the need for a clinician or technician to be present
 - Convert practical questions to mathematical problems
 - Constraints paired, ramp-up, measurement errors







Life sciences research

Conducting research and efficacy testing of medical countermeasures for biological and chemical defense

- Largest privately owned Biosafety Level 3 (BSL-3) facility in United States
- 100 different medical countermeasures (vaccines, antimicrobial agents, antivirals, antitoxins and other drug types) tested since 2000
- More than 400,000 square feet of dedicated in vitro and in vivo lab space





Biostatistical Support to the Battelle Biomedical Research Center



- Battelle's Biomedical Research Center (BBRC) specializes in the design and execution of research to develop medical countermeasures against pathogenic microorganisms and highly toxic materials.
- We provide integration of data management and statistical support in support of BBRC research programs.
- Provide support for study design, assay development, meta-analysis, risk assessment and pharmacokinetic models across various pathogens and toxins.
- Work with both pharmaceutical and defense clients.





Safeguarding our military and homeland



Chemical biological detection and defense

Systems to detect, identify and enumerate biological pathogen threats in the air without the need for laboratory support

- 70 years of experience in chemical, biological, radiological, nuclear and explosive technology
- 900+ Joint Biological Point Detection Systems deployed
- 50 Resource Effective Biodetection Systems sold, eight deployed in Korea





REBS: Rapid Enumerated Bioidentification System Overview

- REBS is a device Battelle has designed and manufactured with the goal of detecting and identifying air- and water-borne biological particles
- Linked work with Advanced Mission Solutions
 - We lead the development of analytics solutions, including:
 - Spectral classification
 - Instrument diagnostics
 - Library building
- Target markets: National Defense, Health
- Also developing REBS technology on DARPA SIGMA+





REBS: Rapid Enumerated Bioidentification System Library Building

- REBS identification depends on a library of spectral signatures for organisms and materials of interest
- **Techniques:** Signal processing (signal-to-noise quantification), spectral outlier detection, particle size measurement, exploratory data analysis





REBS: Rapid Enumerated Bioidentification System Spectral Classification

- On REBS and SIGMA+, we are developing new methods of identifying organisms based on their spectral signatures
- Techniques: Signal processing, partial least squares, support vector machines, convolutional neural networks, generative adversarial networks, variational autoencoders





Risk Assessment

- Assist DHS in developing quantitative risk assessments of biological agents
- Infer probabilities of bioterrorist acts of various degrees of lethality
- Based on event trees of bioterrorism acts
- Develop software to summarize expert opinion on branching probabilities, compute node probabilities, and estimate consequences
- Perform modeling and simulation for inhalation, ingestion, and epidemiological spread





Advanced forensics

Massively parallel sequencing (MPS) for speed, accuracy and more genetic information to assist forensic investigators

- Deployed at Ohio Bureau of Criminal Investigation Laboratory
- 2017 National Institute of Justice study report demonstrated that MPS provides the accuracy, reproducibility and sensitivity needed to support forensic investigations





Functional Genomic and Computational Assessment of Threats (Fun GCAT)

- Objective:
 - Identify taxonomic origin, function, and threat status of 50-1000bp nucleotide sequence fragment
- Battelle's Solution:
 - Modular, extensible framework with SME and AI informed models
 - Taxonomic and function prediction incorporated self curated and publicly available datasets
 - Threat prediction accuracy typically coincided with expert opinion on threat
 - CPU run time 3-orders of magnitude faster than current state-of-the-art





Giving back to society



Profit for purpose

Battelle focuses our philanthropic efforts to make the greatest impact.

Corporate Giving

\$7-10 million donated each year to education, civic and community organizations

Employee Giving

Battelle's dollar-fordollar employee giving match benefits more than 900 agencies each year



Volunteerism

Since 1992, employees have donated thousands of hours to their communities



STEM school network growth



Founding partner of Metro Early College High School

In partnership with the Ohio Department of Education, one school grew to 31

In partnership with the State of Tennessee, one state grew to two states

From two states to 20 states, STEMx unites state STEM networks







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