SARAH FOBI MENSAH

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RESEARCH INTERESTS

Statistical methods for high-dimensional biomedical data with applications in osteoarthritis research. Focus on functional data analysis and regression modeling to study biological processes. Interested in applying machine learning to improve early diagnosis and advance understanding of disease mechanisms.

PROFESSIONAL EXPERIENCE

Institute for Mathematical and Statistical Innovation, Chicago, Illinois
Data Science Bootcamp Participant   June 2025
- Engaged in hands-on training in Python, R, SQL, Git/GitHub, and Google Colab through an intensive workshop series.
- Collaborated with PhD students on data science exercises involving data wrangling, exploratory data analysis, statistical modeling, and reproducible research workflows.

Montana State University, Bozeman, Montana
Graduate Researcher   August 2024 – present
- Conducted statistical analysis of microcalorimeter data to study chondrocyte heat generation toward improving knowledge of chondrocyte central metabolism.
- Applied a Generalized Least Squares (GLS) model to account for non-constant variance which helped to accurately assess the differences in total heat generation across cell groups.
- Led initial findings to a successful manuscript publication within 4 months and currently expanding the research through functional data analysis to examine heat generation curves over time.

Graduate Research Assistant   December 2023 – May 2024
- Explored dimensionality reduction techniques, including sparse principal component analysis, to improve the interpretability and analysis of high-dimensional metabolomics data in the context of early osteoarthritis diagnosis.
- Investigated the potential of sparse contrastive PCA for reducing the dimensionality of metabolomics data, aiming to make the data more manageable and informative for identifying early molecular markers of osteoarthritis.
- Plan to develop predictive algorithms that could utilize reduced-dimensionality data, with the goal of enabling less invasive diagnostic methods, such as blood-based testing for the early detection of osteoarthritis.

Funded by: National Institute of Arthritis and Musculoskeletal and Skin Diseases (1R01AR081489-01A1)

Statistical Consultant   January 2024 – May 2024
- Applied statistical methodologies including mixed-effects models to assess survey responses and analysed the impact of a storybook-based training on Alzheimer's disease education for children and adults, organised by Montana State University Extension under the direction of my collaborators.
- Provided clear communication of statistical methods to clients which ensured transparency throughout the analysis process and lead to informed decisions for program recommendations and development.

Kwame Nkrumah University of Science and Technology, Kumasi, Ghana
Research Assistant   October 2021 - July 2022
- Assisted in constructing predictive models using six machine learning algorithms to classify alcohol and drug abuse based on risk factors across South Africa's nine provinces.
- Supported the development and validation of machine learning models to predict alcohol and drug abuse using an imbalanced dataset.

EDUCATION

Ph.D. Statistics, GPA: 3.91   Expected 2027
  Montana State University, Bozeman, MT

M.S. Statistics, GPA: 3.89   May 2024
  Montana State University, Bozeman, MT

B.S. Actuarial Science, GPA: 3.89   September 2021
  Kwame Nkrumah University of Science and Technology, Kumasi, Ghana

TEACHING EXPERIENCE

Graduate Teaching Assistant, Department of Mathematical Sciences, MSU   August 2022 – Present
   Courses taught: STAT 216 (Introduction to Statistics), STAT 337 (Intermediate Statistics with R), STAT 411 (Methods for Data Analysis I)
- Provided hands-on instruction with R software, teaching data wrangling, visualization, and interpretation, and guided students in performing statistical analysis and drawing data-driven conclusions.

TECHNICAL SKILLS

Programming Languages: R (Markdown, Quarto), Python (Pandas, NumPy), SAS
Database: SQL
Project Management Tool: Git/GitHub
Machine Learning Methods: Random Forest, Naive Bayes, Support Vector Machines, Logistic Regression, Artificial Neural Networks, Decision Tree.
Statistical Methods: Regression analysis, Bayesian data analysis, Hypothesis testing, Experimental design

PROFESSIONAL ASSOCIATIONS

Member, American Statistical Association   March 2024
Member, Royal Statistical Society   January 2024
Member, The Honor Society of Phi Kappa Phi   January 2024

AWARD/ LEADERSHIP/ VOLUNTEER

Volunteer, Human Resource Development Council (HRDC), Bozeman, MT   February 2025 - present
Student Travel Award, Department of Mathematical Sciences, MSU   February 2025
Fee waiver scholarship, Department of Mathematical Sciences, MSU   February 2024
Fee waiver scholarship, Department of Mathematical Sciences, MSU   August 2022
Ghana Scholarship Secretariat Award, Government of Ghana   May 2021
Judicial Committee Chair, Actuarial Science Students' Association-KNUST Chapter   September 2020 – August 2021
Deputy Finance Chair, Actuarial Science Students' Association of Ghana   September 2019 – May 2020

PUBLICATIONS

Peer reviewed
Chondrocytes Embedded in Agarose Generate Distinct Metabolic Heat Profiles Based on Media Carbon Sources. *Annals of Biomedical Engineering, 1-9* (2025).
- Determined if three-dimensionally encapsulated chondrocytes are capable of heat production toward improving knowledge of chondrocytes central metabolism.

Modeling of the Daily Dynamics in Bike Rental System Using Weather and Calendar Conditions: A Semi-Parametric Approach. *Scientific African* (2024): e02211.
- Proposed a robust method using penalized splines quasi-Poisson regression to model bike rentals, revealing hidden relationships not identified by traditional parametric models which informed future transportation strategies.

Other
Predictive Analysis of Misuse of Alcohol and Drugs using Machine Learning Algorithms: The Case of using an Imbalanced Dataset from South Africa. *Appl. Math* 17, no. 2 (2023): 261-271.
- Compared six supervised machine learning algorithms to predict alcohol and drug abuse across South Africa's nine provinces, proposing an optimal predictive model.

In preparation
Metabolic Heat Profiles in Chondrocytes: A Comparison of Functional and Integrated Data Approaches.
- Compared a functional approach that analyses heat curves over time to an integrated approach that aggregates instantaneous heat measurements over time.