Raymond Lesiyon

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Research Interests

Areas: Computational Biology, Network Analysis, Knowledge Graphs, Natural Language Processing (NLP), Large Language Models, Protein Language Models, Machine Learning, Deep Learning

Education

Michigan State University **East Lansing, MI**
MS in Computational Math Science and Engineering (CMSE), GPA - 3.954 *Aug 2021 – May 2023*

- **Relevant coursework**: Mathematical Foundation for Data Science, Numerical Linear Algebra, Data Mining, Statistical Genetics, Genomic Data Handling: Unix and Python, Genomics and Sequencing Analysis, RNA-Seq Data Analysis

Michigan State University **East Lansing, MI**
BS in Biosystems Engineering — Conc. in Biomedical Engineering, GPA - 3.919 *Aug 2017 – May 2021*

- Minor in CMSE
- Graduated Magna cum laude
- MSU Explore Computational Research Experience (ECRE), 2021
- Dean's Honors List: Fall 2017 – Summer 2020
- MasterCard Foundation (MCF) Scholar Program Recipient, 2017
- **Relevant coursework**: Bioinformatics and Computational Biology, Methods for Parallel Computing, Medical Microbiology

Research Experience

Informatics Research Professional **Aug 2023 – Present**
University of Colorado, Anschutz *Aurora, CO*
Labs: **JRaviLab**, Department of Biomedical Informatics — CU Anschutz, **Wale Lab**, Microbiology, Genetics, and Immunology — MSU

Mentors: Dr. Janani Ravi, Dr. Nina Wale
Project 1: Evolution of bacterial traits in relation to its host association and pathogenicity

- Optimized phylogenetic regression analysis with modular R code, speeding up 200+ model iterations and improving insights into bacterial traits, host-association, and pathogenicity.
- Applied Akaike Information Criterion (AIC) for model selection improving accuracy, and reliability of evolutionary biology research.

Project 2: MicroGenomeR, an R data package to harmonize microbial phenotypic and genotypic traits.

- Built a modular workflow to integrate multiple datasets and effectively harmonize 26+ microbial datasets into a central source with consistent units and trait values.
- Enabled efficient storing, and loading of microbial traits data at strain and species levels using memory-optimized file format (parquet and RDA).
- Utilized NLP techniques like term frequency inverse document frequency (TF-IDF), and LLM to classify bacteria as pathogenic or not using unstructured text.

Technical Aide **Jun – Aug 2021**
Michigan State University *East Lansing, MI*

Labs: **Juan Steibel Lab**, Department of Animal Science, MSU

Mentor: Dr. Juan Steibel

Project: Hyperparameter tuning for Long short-term memory (LSTM), model trained on detecting agonistic behavior of pigs in a single-space

- Leveraged Slurm workload manager for running LSTM deep learning algorithms on high-performance computing clusters, achieving optimized resource utilization and computational efficiency.
- Performed hyper-parameters tuning for LSTM model enhancing model performance on classifying agonistic pig's behaviors.

Biosensor Intern **Aug 2020 – Apr 2021**

Fraunhofer USA Center Midwest *East Lansing, MI*

Mentor: Dr. Suzanne Witt

Project: Immobilizing antibodies into Boron-doped diamond surface for detecting COVID-19 spike protein

- Designed and implemented a data visualization dashboard with tkinter and pandas, streamlining the analysis of data from 37 biosensor fabrication experiments and enhancing decision-making.
- Functionalized antibody biosensors on boron-doped diamond surfaces using N-hydroxysuccinimide(NHS) techniques, and tested their ability to detect COVID-19 spike protein through electrochemical impedance measurements.

Undergraduate Research Assistant **Sept 2019 – Aug 2020**

Michigan State University *East Lansing, MI*

Labs: **MIDI Lab**, Department of Biomedical Engineering, MSU

Mentor: Dr. Adam Alessio

Project: Classification of ovarian torsion using machine learning with radiological features

- Performed ovarian torsion classification with radiological features e.g., ovary size, using decision trees classifiers, random trees, and logistic regression through Sci-kit learn
- Assessed model performance on ovarian torsion using ROC curves, accuracy, specificity, and sensitivity metrics.

Research Assistant Summer Intern **Jun – Aug 2019**

Aga Khan University Hospital, Department of Pathology *Nairobi, Kenya*

Mentor: Dr. Shahin Sayed

Project: Biomarkers utilization for lymphoma diagnosis in different hospital

- Compiled and analyzed three years of biomarker utilization data for lymphoma diagnosis at Aga Khan Hospital and Massachusetts General Hospital, Boston.

Undergraduate Research Assistant **Summer 2018**

Michigan State University *East Lansing, MI*

Labs: **Harada Lab**, Department of Biomedical Engineering, MSU

Mentor: Dr. Masako Harada

- Designed primers using Primer-BLAST, and cloned target gene using Seamless Ligation Extract (SLiCE) method

Industry Experience

Software Development Intern **May – Aug 2022**

Amazon *Seattle, WA*

Project: Developing a central messaging single-page application, consolidating messages from different pages

- Collaborated on a strategic integration plan to consolidate multi-page messages into a single page and implemented in React/TypeScript to enhance user experience.

Skills

Programming languages: Python, R, Matlab, C++

Computational tools: Unix/Linux, Git, High-performance computing

Data analysis: Dimensional reduction - Principal Component Analysis, data wrangling, summarization, and visualization — tidyverse, ggplot, pandas

Machine learning: Linear and Logistic regression, Support Vectors, K-means

Deep learning: Neural networks, Transformers — BERT, BioBERT

Natural language processing: TF-IDF, Text-embedding, LLM

Publications

1. Nina Wale*, **Raymond Lesiyon***, Clay Cressler, Janani Ravi. *Are bacterial (pathogens) special?*. Manuscript in preparation
2. **Raymond Lesiyon**, Janani Ravi. *MicroGenomeR: An R data package for integrating and harmonizing microbial data.* Manuscript in preparation
3. Junjie Jan, Janice Siegford, Dirk Colbry, **Raymond Lesiyon**, Anna Bosgraaf, Chen Chen, Tomas Norton, Juan Steibel. *Evaluation of computer vision for detecting agonistic behaviour of pigs in a single-space-feeding stall Through Blocked Cross-Validation Strategies.* 10.2139/ssrn.4098711
4. Suzanne T Witt, Alexis Rogien, Diana Weiner, James R Siegenthaler, **Raymond Lesiyon**, Noelle Kurien, Robert Rechenberg, Nina Baule, Aaron Hardy, Michael Becker. *Boron doped diamond thin films for the electrochemical detection of SARS-CoV-2 S1 Protein.* 10.1016/j.diamond.2021.108542

Presentation

Research and Technical Talks

- **2024**: **BioC2024 International Conference**, MicroGenomeR, an R data package that harmonizes microbial phenotypic and genotypic traits. Van Andel Institute, Grand Rapids, Michigan

Posters

- **2024**: **CU Anschutz Department of Biomedical Informatics Retreat**, Are (bacterial) pathogens special? Aurora, CO
- **2024**: **Quantitative Cell and Molecular Biology Symposium**, Are (bacterial) pathogens special? Colorado State University, Fort Collins, CO
- **2024**: **American Society of Microbiology Rocky Mountain Branch**, Are (bacterial) pathogens special? University of Colorado Boulder, Boulder, CO
- **2020**: **Mid-Michigan Symposium for Undergraduate Research Experiences (Mid-SURE)**, Ovarian torsion identification using machine learning. Michigan State University, East Lansing, MI

Teaching Experience

Graduate Teaching Assistant **Aug 2021 – May 2023**

Michigan State University, *Dept. of Computational Math Science and Eng.* *East Lansing, MI*

CMSE 802: Methods in Computational Modeling

CMSE 202: Computational Modeling and Data Analysis II

Academic Tutor **Jan 2019 – May 2021**

Michigan State University, *College of Engineering* *East Lansing, MI*

- Tutored STEM students in calculus and physics, providing guidance and support in their coursework

Service and Leadership

Educational Support Initiative **Aug 2023**

Kokwa Island Primary School *Baringo, Kenya*

- Led a school uniform donation initiative to provide uniforms to 11 students from orphaned or low-income families, enhancing their access to education.

Lead Tutor **Aug 2020 – May 2021**

Michigan State University, *Dept. of Computational Math Science and Eng.* *East Lansing, MI*

- Guided tutors for smooth tutoring center operations and organized STEM review sessions to prepare students for exams.

Maji Safi ni Uhai Initiative **Oct 2019**
KAPKURES COMMUNITY *Bomet, Kenya*
- Co-founded Maji Safi ni Uhai Initiative, and secured $4000 from MCF program to drill water kapkures community in Bomet, Kenya

International Orientation Leader **Aug 2018**
MICHIGAN STATE UNIVERSITY, *Office of International Students* *East Lansing, MI*
- Guided a group of 10 international students throughout their first week of enrolling at MSU

Simbolei Project **Sep 2017**
Rural books cataloging *East Lansing, MI*
- Helped in cataloging books donated to rural library in Kenya

Community Need Assessment Leader **Mar – May 2017**
BARINGO SOUTH *Baringo, Kenya*
- Lead a group of 10 students from Education and Social Empowerment Program(EaSEP) conduct a community need assessment in Ilchamus community

Volunteer Teacher **Jan – June 2016**
KOKWA PRIMARY SCHOOL *Baringo, Kenya*
- Volunteered to teach STEM classes to grade eight students

Community Need Assessment Guide **Jan 2016**
KOKWA ISLAND *Baringo, Kenya*
- Assisted in community need assessment in Kokwa Island with Friends of Kenya Schools and Wildlife (FKSW) by activating as a translator