CORY KROMER-EDWARDS

https://homepage.cs.uiowa.edu/~coryedwards/
330-704-0176 ⋄ cjedwards1@malone.edu

RESEARCH INTERESTS

I am interested in bridging genetics with machine learning and artificial intelligence to improve current algorithms and create new ones. Additionally, I want to apply these techniques to better hospitals and ultimately improve overall human health. By answering difficult questions in genetics research and leveraging the power of machine learning and AI, we can advance medical research and improve patient outcomes.

EDUCATION

Ph.D. in Computer Science
University of Iowa, Iowa City, Iowa, May 2023
Field: Predicting Antibiotic Resistance using Machine Learning
Dissertation Advisor: Dr. Suely Oliveira

Bachelor of Arts in Computer Science and Mathematics double major
Malone University, Canton, Ohio, May 2018

PUBLICATIONS

Kromer-Edwards, Cory, and Suely Oliveira. "'Compound RNN to Predict MICs Using K-Mer Fingerprints and Antibiotic SMILES." 2023 ACM Conference on Bioinformatics, Computational Biology, and Health Informatics (ACM-BCB), September 2023. **Submitted**.

Kromer-Edwards, Cory, and Suely Oliveira. "'Finding, and Countering, Future Resistance Using Bacterial Antibiotic Adversarial Genetic Algorithm (BAAGA)." 2023 International Joint Conference on Neural Networks (IJCNN), June 2023. **Accepted**.

Kromer-Edwards, Cory, Mariana Castanheira, and Suely Oliveira. "Using Feature Selection to Predict MIC Values with Neural Networks." 2023 International Joint Conference on Neural Networks (IJCNN), June 2023. **Accepted**.

Kromer-Edwards, Cory, Mariana Castanheira, and Suely Oliveira. "K-Mer Fingerprinting with RNN to Predict Mics for K. Pneumoniae." 2022 IEEE International Conference on Bioinformatics and Biomedicine (BIBM), 2022. https://doi.org/10.1109/bibm55620.2022.9995374.

Kromer-Edwards, Cory, Mariana Castanheira, and Suely Oliveira. "Year, Location, and Species Information in Predicting Mic Values with Beta-Lactamase Genes." 2020 IEEE International Conference on Bioinformatics and Biomedicine (BIBM), 2020. https://doi.org/10.1109/bibm49941.2020.9313331.

Kromer-Edwards, Cory, Jace Neubaum, Suely Oliveira, Caitlin Smith, Evan Walser-Kuntz, and Andrew West. "Identifying Beta-Lactam Resistance with Neural Networks." 2019 IEEE International Conference on Bioinformatics and Biomedicine (BIBM), December 2019.
https://doi.org/10.1109/bibm47256.2019.8983058.

Kromer-Edwards, Cory, Suely Oliveira, and David Stewart. "Parallelizing Basis Pursuit Denoising." 2019 International Joint Conference on Neural Networks (IJCNN), July 2019.
https://doi.org/10.1109/ijcnn.2019.8851987.

Seifert, Lauren S., Kara Kaelber, Kathleen Flaherty, and **Cory Kromer-Edwards**. "Using Online Resources in Health Co-Inquiry: A Bifurcated Method for Analyzing Stakeholder Narratives." Current Psychology 38, no. 6 (2019): 1772–88. https://doi.org/10.1007/s12144-019-00474-9.

PRESENTATIONS

C. Kromer-Edwards, M. Castanheira and S. Oliveira, "K-Mer Fingerprinting with RNN to Predict Mics for K. Pneumoniae," in 2022 IEEE International Conference on Bioinformatics and Biomedicine (BIBM), Los Alamitos, CA, USA.

C. Kromer-Edwards, M. Castanheira and S. Oliveira, "Year, Location, and Species Information In Predicting MIC Values with Beta-Lactamase Genes," in 2020 IEEE International Conference on Bioinformatics and Biomedicine (BIBM), Seoul, Korea (South).

Kromer-Edwards. C, "History Modifications to Genetic Algorithm: Remembering Previous Generations", Sigma Zeta National Honors Society March 2018, Evangel University.

Kromer-Edwards. C, "ADMEA", Association of Information Technology Professionals (AITP) October 2017, Malone University.

RESEARCH EXPERIENCE

University of Iowa, Iowa City, Iowa

- Academic Research — Mar 2019 - May 2023
  - Created Genetic Algorithms to optimize convex and non-convex functions
  - Generated Decision Tree model to take input from gene acquisition data and patient data
  - Designed a Neural Network model to take input from gene acquisition data and patient data
  - Worked to make Lasso function distributed using University of Iowa's Argon compute cluster and Message Passing Interface (MPI)
  - Compared Random Forest and K-Nearest Neighbors ability to predict antibiotic resistance using gene acquisition data through multiple data splits
  - Used Feature Importance from XGBoost to select DNA based K-Mers from bacteria to predict resistance against antibiotics
  - Constructed Recurrent Neural Networks to predict bacterial resistance against antibiotics using DNA
  - Trained Recursive Neural Networks to predict bacterial resistance against antibiotics using DNA and antibiotic SMILES representations
  - Built adversarial Genetic Algorithms into a simulation to stochastically generate new antibiotics and bacteria based on raising and lowering resistance values (MICs)
  - Optimized K-Mer fingerprint generation for bacteria by utilizing a GPU, writing the base code in C, and algorithm modification to achieve a 6,101x speedup (61.01 seconds down to 0.01 seconds)

JMI Laboratories, North Liberty, Iowa

- Research Assistant — Jan 2021 - May 2021
  - Accessed ability for gene expression data to predict Minimum Inhibitory Concentration (MIC) using Machine Learning
- Research Assistant — Jan 2020 - May 2020
  - Worked with genetic data, notably gene acquisition data, for bacteria to predict MIC values for the bacteria when in an antibiotic

- Built a Random Forest model to predict MIC values given the genetic data
- Developed a K-Nearest Neighbors model to predict MIC values given the genetic data
- Tested different ways to split up the input data to achieve higher accuracy in the models

Malone University, Canton, Ohio

- National Science Foundation (NSF) Research Project Lead — May 2016 - Aug 2018
  - Programmed and implemented a system that automated the review process of web sites by scraping and collecting data from webpages
  - Created a web application and batch system that combines multiple data sources – United States Geological Survey (USGS), National Oceanic and Atmospheric Administration (NOAA), US Census, Center for Disease Control (CDC) ArboNet
  - Constructed a web application and batch system that combines multiple public data sources – NOAA, Cornell's eBird system, USGS
- Academic Research — Aug 2015 - Aug 2018
  - Mentor: Dr. James Glasgow
  - Developed AI algorithm called Abstract Dynamic Multi-tasking End-to-end Algorithm (ADMEA)
  - Tested ADMEA against students and faculty using website game called Game of Life and Death (GOLAD)
  - Assembled Genetic Algorithm that uses history to make better moves to play Tic-Tac-Toe

POSTERS

Kromer-Edwards, Cory, Mariana Castanheira, and Suely Oliveira. (2022, June), "Minimum Inhibitory Concentration (mic) Predictions For Four B-lactam Agents For Escherichia Coli And Klebsiella Pneumoniae From A Large Surveillance Program Using Genomic Data And A Machine Learning Model", Presented at ASM Microbe, Washington, DC.

Kromer-Edwards, C. (2017, April), "AIA (Artificial Intelligence Algorithm)", Presented at Student Research Symposium: A Celebration of Scholarship and Creative Expression, Canton, Ohio.

Kromer-Edwards, C. (2017, April), "AIA (Artificial Intelligence Algorithm)", Presented at Student Research Symposium: A Celebration of Scholarship and Creative Expression, Canton, Ohio.

Kromer-Edwards, C. (2016, April), "Machine learning using tic tac toe", Presented at Student Research Symposium: A Celebration of Scholarship and Creative Expression, Canton, Ohio.

Kromer-Edwards, C. (2016, April), "Super capacitor technology", Presented at Student Research Symposium: A Celebration of Scholarship and Creative Expression, Canton, Ohio.

RELEVANT MACHINE LEARNING CERTIFICATIONS

Certificates earned on Coursera

- Improving Deep Neural Networks: Hyperparameter tuning, Regularization and Optimization by deeplearning.ai.
  Certificate earned on August 19, 2017
- Neural Networks and Deep Learning by deeplearning.ai.
  Certificate earned on August 18, 2017

- Structuring Machine Learning Projects by deeplearning.ai.
  Certificate earned on August 19, 2017
- Machine Learning by Stanford University.
  Certificate earned on February 27, 2016
- Convolutional Neural Networks by deeplearning.ai on Coursera.
  Certificate earned on November 5, 2017
- Sequence Models by deeplearning.ai on Coursera.
  Certificate earned on February 4, 2018
- Deep Learning, a 5-course specialization by deeplearning.ai on Coursera.
  Specialization Certificate earned on February 4, 2018

EMPLOYMENT

JMI Laboratories, North Liberty, Iowa

- Bioinformatics Scientist — Feb 2022 - Present
  - Training a new Bioinformatics Scientist
  - Reviewing old pipelines to better optimize them
  - Managing molecular requests that could require allele data collection or analysis of pipeline outputs
  - Building and maintaining multiple bioinformatics pipelines written in Shell, R, Java, Python, and C languages and running within Docker containers
- Software Engineer — Jun 2021 - Present
  - Developing and maintaining a pipeline hosting website
  - Collaborating with QA and Infrastructure teams to maintain quality and functionality of hosted websites
  - Designing a pipeline system to efficiently utilize AWS Fargate for high throughput, parallel running jobs using Docker containers
  - Collaborating on a team to maintain multiple Github Repositories
  - Working extensively with a functional programming language to build tools and a website
  - Developing a Machine Learning pipeline to determine bacterial isolate outliers using the MIC values found for each isolate given different antimicrobial agents
- Summer Internship — May 2020 - Aug 2020
  - Created a front-end website for Bioinformatics pipeline to allow users to input containers, give configurations for input arguments into containers, and have a dynamically created webpage built to facilitate any Bioinformatics tool's container
  - Facilitated AWS Batch and ECR service for dynamic allocation of containers for versioning and creation of pipelines
  - Set up a Ruby on Rails API container to communicate with Docker, AWS Batch, and AWS ECR
- Summer Internship — May 2019 - Aug 2019

- Built annotation pipeline that took in a bacterial isolate, and a reference, and output annotations and annotated amino acid sequence
- Developed a front-end website using Ember JS
- Worked with AWS to facilitate Batch service for parallel job runs
- Built Ruby on Rails API to communicate with AWS

University of Iowa, Iowa City, Iowa

- Data Structures Aug 2020 - Dec 2020
  - Teaching Assistant under the University of Iowa Computer Science Department
  - Held three hours of office hours per week to assist and work one on one with students
  - Graded student's Java code through Jenkins
- Design and Implementation of Algorithms Jan 2020 - May 2020
  - Teaching Assistant under the University of Iowa Computer Science Department
  - Held three hours of office hours per week to assist and work one on one with students
  - Graded student's homework
- High Performance and Parallel Computing Aug 2019 - Dec 2019
  - Teaching Assistant under the University of Iowa Computer Science Department
  - Held three hours of office hours per week to assist and work one on one with students
  - Graded students' C code on University of Iowa's Argon compute cluster
- Data Structures Aug 2018 - Dec 2019
  - Teaching Assistant under the University of Iowa Computer Science Department
  - Lectured two sections each with 22 students once a week
  - Constructed an auto grader using a Jenkins and Github
  - Held three hours of office hours per week to assist and work one on one with students
  - Provided feedback to professor and fellow TAs on how to improve the course
  - Graded three exams and five written homework assignments, each for 160 students
  - Wrote a Github Desktop tutorial for students
  - Proctored two exams and answered students' questions

Malone University, Canton, Ohio

- National Science Foundation (NSF) Research Project Lead May 2016 - Aug 2018
  - Lead team to build research websites and databases to facilitate research in multiple disciplines
  - Created Apache Tomcat websites using Github in Microsoft Structured Query Language (SQL) Servers
  - Built and maintained a Shibboleth Single Sign On (SSO) Service Provider Federated Authentication
  - Designed, implemented, and maintained a Representational State Transfer (RESTful) API
  - Developed and implemented a Shibboleth 2 Discovery Service for a Service Provider

TECHNICAL SKILLS

- Python
- TensorFlow
- Elixir
- Java
- C/C++
- Julia
- Javascript
- DevOps
- Scrum
- Agile
- Continuous integration
- HTML
- LISP
- Octave
- XGBoost
- Deep Neural Network
- U-Neural Network
- Recursive Neural Network
- Convolutional Neural Network
- Principle Component Analysis
- Dimensionality Reduction
- Support Vector Machine
- Optical Character Recognition
- Random Forest
- Regression
- Classification
- Q Learning
- Genetic Algorithm
- Bayesian algorithm
- Decision Tree
- K-Means
- K-Nearest Neighbor
- CSS
- Ocaml
- Numpy
- Ember JS
- Ruby
- Ruby on Rails
- AWS
- Docker
- Git
- TensorBoard
- Markdown
- LaTeX
- Apollo
- GraphQL
- Phoenix
- Tailwind