Alex Morehead

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Machine Learning • Deep Learning • Computational Biology • High-Performance Computing

Education

University of Missouri — Columbia, Missouri
Ph.D. Computer Science — Aug 2020 - Present
- *Dissertation Advisor*: Prof. Jianlin Cheng
- *Cumulative GPA*: 4.0/4.0
- *Relevant Coursework*: Computational Intelligence, Machine Learning/Pattern Recognition, Unsupervised Learning, Computational Systems Biology, Design & Analysis of Algorithms, Advanced Natural Language Processing

Missouri Western State University — St. Joseph, Missouri
B.S. Computer Science — Aug 2016 - May 2020
- *Minor*: Mathematics
- *Cumulative GPA*: 4.0/4.0 with General Studies Honors

Professional Experience

Bioinformatics & Machine Learning Lab — Columbia, Missouri
Graduate Research Assistant | Advisor: Jianlin Cheng — Aug 2020 – Present
- Research and develop novel geometric deep learning algorithms applicable to computational biology
- Authored and publicly released the NSF-funded DeepInteract, a state-of-the-art geometric deep learning pipeline for predicting protein interface contacts, along with the new Geometric Transformer
- Curated the NSF-funded DIPS-Plus, to date the largest feature-rich protein interface prediction dataset comprised of 42,000 protein complexes, and publicly released it alongside a dedicated manuscript

Altec Data Science Team — Birmingham, Alabama (Virtual)
Data Science Intern | Managers: Seth McCaleb, Austin Green — Jan 2021 – Present
- Design and develop end-to-end machine learning pipelines in AWS using Python and R
- Collaborate closely with business stakeholders and analysts to understand data and the problem to be solved
- Work with other development teams to integrate models into user applications

Altec Information Services Team — St. Joseph, Missouri (Virtual)
Software Development Intern | Managers: Dan White, Annie Martin — Aug 2018 - Jan 2021
- Reduced miscommunication between service centers globally by engineering over 5 new Angular web applications
- Built more than 6 secure backend APIs with the Spring framework in an agile development setting
- Maintained the test environments of 3 in-house applications by writing LINQ queries and tuning up test databases

NSF Research Experience for Undergraduates in Data Science of Risk and Human Activity — Indianapolis, Indiana
Undergraduate Research Assistant | Program Directors: George Mohler, Mohammad Al Hasan — Jun 2019 - Aug 2019
- Authored an ensemble pipeline of 3 convolutional neural networks trained to detect gunshot sounds in the vicinity
- Deployed the pipeline to a cluster of Raspberry Pi 3 Model B+ microcomputers and evaluated its performance in real-world settings in collaboration with Indianapolis public safety officials
- Published as a manuscript and orally presented the gunshot sound detection project's results at the 2019 IEEE International Conference on Big Data

NSF Research Experience for Undergraduates in Synthetic Biology — St. Joseph, Missouri
Undergraduate Research Assistant | Program Directors: Todd Eckdahl, Jeffrey Poet — May 2018 - Aug 2018
- Investigated applications of combinatorial optimization to model lab experiments performed by synthetic biologists
- Produced Variant Sampler, a Java application for modeling the sample space of in vitro experiments
- Published results of the Variant Sampler project in the American Journal of Undergraduate Research

Center for Academic Support — St. Joseph, Missouri
Computer Science Content Tutor | Manager: Karen Luke — Feb 2017 - Aug 2018
- Tutored a total of 5 undergraduate students, 2 being from underrepresented groups
- Spent up to 1 hour with each student per week, reviewing important computer science topics such as data structures and object-oriented programming
- Designed and initiated a customized learning plan for each student's success

Publications

Accepted/Published

High-Performance Deep Learning Toolbox for Genome-Scale Prediction of Protein Structure and Function — IEEE SC '21, St. Louis, MO

M. Gao, P. L. Andersen, **A. Morehead**, S. Mahmud, C. Chen, X. Chen, N. Giri, R. Roy, F. Quadir, T. C. Effler, R. Prout, S. Abraham, W. Elwasif, J. Skolnick, J. Cheng, A. Sedova

Synthetic Biology Bicistronic Designs Support Gene Expression Equally Well in vitro and in vivo — AJUR '20, Journal

O. Koucky, J. Wagner, S. Aguilera, B. Bashaw, Q. Chen, A. Eckdahl, E. Edman, P. Gomez, N. Hanlan, N. Kempf, D. Mattoon, S. McKlin, C. Mazariegos, **A. Morehead**, S. Q. Ong, A. Peterson, M. Rojas, K. Roland, K. Schildknecht, H. Seligmann, K. Slater, A. Tauchen, R. Tittor, T. Travieso, D. Urban, C. Willis, J. Zhou, N. L. Snyder, L. J. Heyer, J. L. Poet, T. T. Eckdahl, A. M. Campbell

Low Cost Gunshot Detection using Deep Learning on the Raspberry Pi — IEEE BigData '19, Los Angeles, CA

A. Morehead, L. Ogden, G. Magee, R. Hosler, B. White, G. Mohler

Under Review

Geometric Transformers for Protein Interface Contact Prediction — ICLR '22, Addis Ababa, Ethiopia (Virtual)

A. Morehead, C. Chen, J. Cheng

Preprint

DIPS-Plus: The Enhanced Database of Interacting Protein Structures for Interface Prediction — arXiv '21, Preprint Archive

A. Morehead, C. Chen, A. Sedova, J. Cheng

Presentations

Low Cost Gunshot Detection using Deep Learning on the Raspberry Pi — IEEE BigData '19, Los Angeles, California

A. Morehead, L. Ogden, G. Magee

Low Cost Gunshot Detection using Deep Learning on the Raspberry Pi — IUPUI Student Summer Poster Symposium, Indianapolis, Indiana

A. Morehead, L. Ogden, G. Magee

Variant Sampling in vitro with a Scheduling Twist — Alpha Chi National Convention '19, Cleveland, Ohio

A. Morehead

Variant Sampling in vitro with a Scheduling Twist — MWSU PORTAL Summer Research Showcase '18, St. Joseph, Missouri

A. Morehead

Predicting Game Genres by Analyzing Code Structure — CSCC Central Plains Conference '18, Maryville, Missouri

Spencer Frazier, **A. Morehead**, Steven Prine

Predicting Game Genres by Analyzing Code Structure — MWSU Multidisciplinary Research Day '18, St. Joseph, Missouri

Spencer Frazier, **A. Morehead**, Steven Prine

Leadership Activities

NeurIPS Datasets & Benchmarks Track Reviewer — Sep 2021 - Present

EnCircle Technologies Volunteer & Teaching Assistant — Jun 2021 - Present

Upsilon Pi Epsilon (ΥΠΕ) | University of Missouri Chapter — Aug 2020 - Present

Alpha Chi (AX) | Missouri Western State University Chapter — Mar 2018 – May 2020

Kappa Mu Epsilon (KME) | Missouri Western State University Chapter — Mar 2018 – May 2020

Awards & Grants

Dean's Engineering Excellence Fellowship — *Aug 2020*

James W. and Joan M. O'Neill Graduate Fellowship in Engineering *Aug 2020*
MWSU Outstanding Graduating Computer Science Student Award *May 2020*
MWSU President's Honor Roll *May 2020*
Floyd Tesmer/Strayer University Prize in Computer Science and Engineering *Apr 2019*
Alpha Chi Region IV Scholarship *Apr 2019*
Grand Midwest Asynchronous Programming Contest 3rd Place Prize *Apr 2017*
East Side Lions Club Scholarship *May 2016*

Projects

Equivariant-GNNs | GitHub: https://github.com/amorehead/Equivariant-GNNs Feb 2021 – Present

- Assembled a deep learning environment for running experiments with equivariant GNN architectures
- Integrated into environment equivariant networks such as Tensor Field Networks and SE(3)-Transformers

DLHPT | GitHub: https://github.com/BioinfoMachineLearning/deep-learning-hpc-project-template Jan 2021 – Present

- Created a PyTorch Lightning-based deep learning high-performance computing (HPC) project template (DLHPT) for performing distributed deep learning on large HPC systems
- Tested template on large-scale computing systems such as Oak Ridge National Laboratory's Summit compute server

Jazz-NN | GitHub: https://github.com/amorehead/jazz-nn Dec 2019 - Jan 2020

- Trained an LSTM RNN to generate original jazz scores
- Uploaded a sample of the most coherent scores to SoundCloud for public consumption

Technical Skills

Programming: Python 3 • Java • Angular 2+ • C/C++ • HTML/CSS • SQL • C# • R • MATLAB

Tools/Frameworks: PyTorch • TensorFlow • NumPy • Pandas • Spring Boot • NodeJS • Docker • AWS • Google Cloud

Methodologies: RESTFUL APIs • Version Control {Git} • Agile Development

News & Media Outreach

[1] MU Engineering. (2020, October 27). *Alex Morehead*. University of Missouri College of Engineering. https://engineering.missouri.edu/2020/10/alex-morehead/.