Gerson C. Kroiz

251 W. Lafayette Avenue, Baltimore, MD 21217

linkedin.com/in/gkroiz gkroiz1@umbc.edu github.com/gkroiz 443-205-3052

EDUCATION

University of Maryland, Baltimore County — **Baltimore, MD**
Bachelor of Science, Mathematics and Computer Science (GPA: 4.0) — *Expected: May 2022*

HONORS AND ACHIEVEMENTS

UMBC Honors College — *August 2018 - Present*
UMBC President's List (4.0 GPA) — *December 2018 - Present*
Meyerhoff Program Affiliate — *September 2018 - Present*
- Scholars program at forefront of promoting diversity in STEM

Pi Mu Epsilon Math Honor Society — *September 2019 - Present*
UMBC Undergraduate Research Award (URA) Recipient — *May 2019 - May 2021*
Freeman A. Hrabowski President's Advisory Council Scholarship Recipient — *April 2020, April 2021*
Goldwater Scholar — *March 2021*
PreMARC Scholar at UMBC — *May 2019 - May 2020*
UMBC Travel Award Recipient for GAMM '20 Conference in Kassel, Germany — *February 2020*
Accepted for early admission following sophomore year of high school — *May 2018*

RELEVANT COURSEWORK

* indicates graduate level course

Math-Related: Linear Algebra, Multivariable Calculus, Differential Equations, Real Analysis I & II, Numerical Analysis, Numerical Linear Algebra*, Abstract Algebra & Number Theory I & II
CS-Related: Data Structures, Principles of Programming Languages, Assembly Languages, Algorithms, Machine Learning, Artificial Intelligence, Software Engineering, Computer Architecture, CyberTraining*

SKILLS

Operating Systems: Windows, Mac OS, GNU/Linux
Programming Technologies: Python, C++, C, MATLAB, LaTeX, Git, HTML & CSS, Bash, Slurm, Nasm x86
Softwares: QuantConnect, Django, Tensorflow, Keras, Pytorch, Horovod, MPI, BLAS, Hedgehog, Jekyll

RESEARCH

Oak Ridge National Laboratory — **Oakridge, TN**
Research Intern, Dr. Valentine Anantharaj — *June 2021 - August 2021*
- Developed spatiotemporal precipitation benchmark dataset
- Designed convolutional LSTM deep learning architecture in Python
- Implemented distributive training pipeline within a multi-GPU environment
- Conducted scalability studies on Summit Supercomputer at Oak Ridge

UMBC Department of Mathematics and Statistics — **Baltimore, MD**
Research Assistant, Dr. Matthias Gobbert — *December 2019 - August 2021*
- Collaborated with University of Maryland, School of Medicine
- Worked with large amounts of simulated compton camera Based prompt gamma data for proton radiotherapy
- Co-developed several deep learning architectures in Python to classify data of incoming gamma radiation
- Conducted hyperparameter studies to improve classification accuracy

UCLA Institue of Pure and Applied Mathematics (IPAM) — **Los Angeles, CA**
Research in Industrial Projects for Students (RIPS), Dr. Dan Shiber — *June 2020 - August 2020*
- Sponsored by Aquatic, a quantitative trading company
- Developed forecasting models in C++ for large datasets of U.S. equities
- Studied state-of-the-art descent methods for strong convex optimization
- Optimized computational performance and algorithm design of coordinate descent for memory-bound, CPU setup

UMBC CyberTraining Program (`cybertraining.umbc.edu`) **Baltimore, MD**
Research Intern, Dr. Matthias Gobbert *January 2020 - June 2020*
- Augmented hidden Markov-Chain model to simulate precipitation amounts and occurrences
- Tuned parameters to best simulate precipitation of the Potomac River Basin, U.S.
- Developed parallel utility files in Python with bash scripting for parameter optimization

National Institute of Standards and Technology (NIST) **Gaithersburg, MD**
Summer Undergraduate Research Fellow (SURF), Dr. Timothy Blattner *May 2019 - August 2019*
- Optimized CPU performance through coarse-grained parallelism in numerical linear algebra routines
- Conducted performance studies between my implementations and corresponding OpenBLAS operations
- Contributed to presentation at NVIDIA GPU technology conference (2020)

UMBC Department of Mathematics and Statistics **Baltimore, MD**
Research Assistant, Dr. Matthias Gobbert *December 2018 - May 2019*
- Improved mathematical model of the calcium-induced processes in cardiac cells in C
- Tested changes of parameters for coupled nonlinear time-dependent PDEs with parallel computing
- Analyzed influence of heart cell components through UMBC's High Performance Computing Facility

ISAMR (International Student-Led Arctic Monitoring and Research) **Baltimore, MD**
Mapper *January 2017 - June 2018*
- Funded by NSERC, Johns Hopkins University, and multiple Canadian universities
- Helped place data collected from the arctic permafrost onto geographical map using ArcGIS
- Analyzed trends based on the geographic maps
- Assisted in starting dendroclimatology study in Baltimore

PUBLICATIONS

Articles in Peer-Reviewed Journals:
- J. C. Polf, C. A. Barajas, **G. C. Kroiz**, S. W. Peterson, P. Maggi, D. S. Mackin, S. Beddar, M. K. Gobbert. A Study of The Clinical Viability of A Prototype Compton Camera for Prompt Gamma Imaging Based Proton Beam Range Verification. *Scientific Reports (Preprint)*. Published June, 2021
- **G. C. Kroiz**, C. A. Barajas, M. K. Gobbert, B. E. Peercy. Linkages of Calcium Induced Calcium Release in a Cardiomyocyte Simulated by a System of Seven Coupled Partial Differential Equations. *Involve, a J. in Math*. Published July, 2020.
- C. A. Barajas, M. K. Gobbert, **G. C. Kroiz**, B. E. Peercy. Challenges and opportunities for the simulations of calcium waves on modern multi-core and many-core parallel computing platforms. *Int. J. Numer. Meth. Biomed. Engng.* Published July, 2019.

Articles in Refereed Proceedings:
- **G. C. Kroiz**, C. A. Barajas, M. K. Gobbert, J. C. Polf. Exploring Deep Learning to Improve Compton Camera Based Prompt Gamma Image Reconstruction for Proton Radiotherapy. *17th Int. Conference on Data Science (ICDATA'21)*. Accepted June, 2021.
- J C. Polf, C A. Barajas, **G. C. Kroiz**, S. W. Peterson, P. Maggi, D. S. Mackin, S. Beddar, M. K. Gobbert. A Study of the Clinical Viability of a Prototype Compton Camera for Prompt Gamma Imaging Based Proton Beam Range Verification. *AAPM Virtual 63rd Annual Meeting*. Accepted April, 2021.
- **G. C. Kroiz**, T. Blattner, A. Bardakoff, W. Keyrouz. Study of Exploiting Coarse-Grained Parallelism in Block-Oriented Numerical Linear Algebra Routines. *Proc. in Appl. Math. and Mech. (PAMM)*. Published January, 2021
- **G C. Kroiz**, R. Majumder, M. K.Gobbert, N. K. Neerchal, L. Markert, A. Mehta. Daily Precipitation Generation using a Hidden Markov Model with Correlated Emissions for the Potomac River Basin. *Proc. in Appl. Math. and Mech. (PAMM)*. Published January, 2021
- A. Bardakoff, B. Bachelet, T. Blattner, W. Keyrouz, **G. C. Kroiz**, L. Yon. Hedgehog: Understandable Scheduler-Free Heterogeneous Asynchronous Multithreaded Data-Flow Graphs *Supercomputing 2020 Conference*. Published November, 2020.

Other Publications:
- **G. C. Kroiz**, V. Anantharaj, A Deep Learning Baseline for Spatiotemporal Precipitation Predictions, Technical Report (In Progress), Oak Ridge National Laboratory, August 2021
- C. A. Barajas, **G. C. Kroiz**, M. K. Gobbert, P. Maggi, J. C. Polf. Deep Learning Based Classification

Methods of Compton Camera Based Prompt Gamma Imaging for Proton Radiotherapy. Technical Report HPCF-2021-1, UMBC High Performance Computing Facility, March 2021.

- J. N. Basalyga, C. A. Barajas, **G. C. Kroiz**, M. K. Gobbert, P. Maggi, J. C. Polf. Improvements to the Deep Learning Classification of Compton Camera based Prompt Gamma Imaging for Proton Radiotherapy. Technical Report HPCF-2020-29, UMBC High Performance Computing Facility, August 2020.
- **G. C. Kroiz**. A Comparison of Stochastic Precipitation Generation Models for the Potomac River Basin. Senior Thesis, Department of Mathematics and Statistics, UMBC, May 2020.
- **G. C. Kroiz**, J. N. Basalyga, U. Uchendu, R. Majumder, C. A. Barajas, M. K. Gobbert, K. Markert, A. Mehta, N. K. Neerchal. Stochastic Precipitation Generation for the Potomac River Basin using Hidden Markov Models. Technical Report HPCF-2020-11, UMBC High Performance Computing Facility, May 2020
- J. N. Basalyga, **G. C. Kroiz**, C. A. Barajas, M. K. Gobbert, P. Maggi, J. C. Polf. Use of Deep Learning to Classify Compton Camera Based Prompt Gamma Imaging for Proton Radiotherapy. Technical Report HPCF-2020-14, UMBC High Performance Computing Facility, May 2020

PRESENTATIONS

* indicates presenting author

Contributed Talks

- **G.C. Kroiz***, C. A. Barajas, M. K. Gobbert, J. C. Polf, "Improving Accuracy in Deep Learning Methods on Compton Camera Based Prompt Gamma Imaging for Proton Radiotherapy," Undergraduate Research and Creative Achievement Day (URCAD), Online (April 2021)
- **G.C. Kroiz***, C. A. Barajas, M. K. Gobbert, J. C. Polf, "Improving Accuracy in Deep Learning Methods on Compton Camera Based Prompt Gamma Imaging for Proton Radiotherapy," 91th Annual Meeting of the Int. Ass. of Appl. Math. and Mech. (GAMM), Online (March 2021)
- A. Bardakoff*, B. Bachelet, T. Blattner, W. Keyrouz, **G. C. Kroiz**, L. Yon, "Hedgehog: Understandable Scheduler-Free Heterogeneous Asynchronous Multithreaded Data-Flow Graphs," ACM/IEEE Supercomputing Conference Workshop: The 3rd Annual Parallel Applications Workshop, Alternatives To MPI+X, Online (November 2020)
- B. Young*, A. Dinev*, J. Feitelberg*, **G. C. Kroiz***, "Memory-Bound Elastic Net Over Dense Matrices with Applications in Quantitative Trading," IPAM RIPS Projects Day, Online (August 2020)
- B. Young*, A. Dinev*, J. Feitelberg*, **G. C. Kroiz***, "Memory-Bound Elastic Net Over Dense Matrices with Applications in Quantitative Trading," Southern California Math REU Conference, Online (August 2020)
- **G. C. Kroiz***, J. N. Basalyga, R. Majumder, Carlos Barajas, M. K. Gobbert, "A Comparison Of Stochastic Precipitation Generation Models For The Potomac River Basin," Differential Equations Seminar, Department of Mathematics and Statistics, UMBC, MD (May 2020)
- **G. C. Kroiz***, J. N. Basalyga, R. Majumder, U. Uchendu, M. K. Gobbert, "Hidden Markov Models for Multi-site Daily Precipitation Generation using Satellite Precipitation Estimates," Undergraduate Research and Creative Achievement Day (URCAD), UMBC, MD (April 2020)
- **G. C. Kroiz***, C. A. Barajas, M. K. Gobbert, B. E. Peercy, “Numerical Simulation of Calcium Waves in a Cardiomyocyte Modeled by a System of Seven Coupled Partial Differential Equations,” Annual Biomedical Research Conference for Minority Students (ABRCMS), Anaheim, CA (November 2019)
- **G. C. Kroiz***, T. Blattner, A. Bardakoff, W. Keyrouz, “Exploiting Coarse-Grain Parallelism in Numerical Linear Algebra Routines," National Institute of Standards and Technology Summer Undergraduate Research Fellowship Colloquium, Gaithersburg, MD (August 2019)
- **G. C. Kroiz***, C. A. Barajas, M. K. Gobbert, B. E. Peercy, “Studies of Calcium Induced Calcium Release Linkages in Cardiomyocytes Modeled by Seven Partial Differential Equations," 2019 Regional Undergraduate Math Research Conference, Towson University, MD (April 2019)

Contributed Posters

- **G. C. Kroiz***, V. Anantharaj, "A Deep Learning Baseline for Spatiotemporal Precipitation Predictions," 2021 Summer Intern Symposium, Online (August 2021)
- **G. C. Kroiz***, C. A. Barajas, M. K. Gobbert, J. Polf, "Improving Accuracy in Deep Learning Methods on Compton Camera Based Prompt Gamma Imaging for Proton Radiotherapy," SIAM Conference on Computational Science and Engineering (CSE 21), Online (March 2021)
- **G. C. Kroiz***, C. A. Barajas, M. K. Gobbert, B. E. Peercy, “Numerical Simulation of Calcium Waves in a Cardiomyocyte Modeled by a System of Seven Coupled Partial Differential Equations,” Undergraduate

Research Symposium in the Chemical and Biological Sciences, UMBC, MD (October 2019)

- **G. C. Kroiz***, C. A. Barajas, M. K. Gobbert, B. E. Peercy, "Numerical Simulation of Calcium Waves in a Cardiomyocyte Modeled by a System of Seven Coupled Partial Differential Equations" ACM Richard Tapia Celebration of Diversity in Computing, San Diego, CA (September 2019)

LEADERSHIP EXPERIENCE

UMBC Korean Student Association **Baltimore MD**

Executive Board Member *Spring 2020 - Current*

- President (June 2021-Present), Vice President (June 2020-June 2021)
  - Restructured foundation of the organization
  - Wrote organization's constitution
  - Increased member engagement despite COVID-19 pandemic through family programs, general body meetings, and events
  - Administered interviews and selected executive board positions and interns

UMBC Pi Mu Epsilon Math Honors Society **Baltimore MD**

Vice President *Fall 2021 - Current*

- Developed community for undergradaute math and stat majors
- Hosted informational sessions and panels about aspects of careers in math
- Provided students with resources for support in their studies

UMBC Department of Mathematics and Statistics **Baltimore, MD**

Teaching & Grading Assistant *Fall 2019 - Winter 2020*

- Numerical Analysis (Fall 2020)
  - Graded assignments and exams
  - Designed grading rubrics
- Multivariable Calculus (Spring 2020)
  - Supported students with adjusting to online learning due to COVID-19
  - Lead supplementary class to strengthen comprehension of material covered in lecture
  - Proctored and graded quizzes and exams
- Introduction to Mathematical Software Packages: Matlab (Winter 2020, 2021)
  - Provided assistance on lecture and homework material
- Calculus 2 (Fall 2019)
  - Lead supplementary classes to strengthen comprehension of material covered in lecture
  - Proctored and graded quizzes and exams

Creative Coders Program at Arbutus Middle School **Baltimore, MD**

Mentor *Fall 2019 - Spring 2020*

- Taught fundamentals of computer science through game design
- Mentored middle school students on their computer science paths

SELECTED PROJECTS

Personal Website *December 2021*

- Created basic personal webpage highlighting my research experiences and selected projects
- Hosted website on Github via Jekyll
- Utilized HTML, CSS, and Boostrap

UMBC Syllabus Project *September 2021 - December 2021*

- Implemented Django-based application to universalize syllabus creation for professors
- Developed databases for old syllabi and user information
- Developed website functionality with databases to provide ease of use for searching and taking from old syllabi

Project for SMC Data Challenge 2021 *June 2021 - August 2021*

- Implemented UNet deep learning architecture in Python for semantic segmentation
- Developed pipeline suitable for parallel multi-gpu training and testing
- Designed various data augmentation techniques to further improve training and testing accuracies

Hackathon Project for Bitcamp 2019 *April 2019*

- Worked backend: data mining for machine learning in Python
- Allowed the user to easily input their commute to and from two separate locations
- Predicted likelihood that a driver will crash on their designated path using machine learning
- Displayed on a map using google API