

Vikram Ramavarapu

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Research Interest: I'm interested in exploring the convergence of high-performance computing, bioinformatics, and graph/network analysis. My enthusiasm lies in leveraging graph theoretic and probabilistic methodologies to address tangible challenges in crucial domains like healthcare, biology, and sociology.

Education

University of Illinois at Urbana-Champaign

Aug. 2022 – May 2024

MS. Bioinformatics: Computer Science

Champaign, IL

- **Course Work:** Bioinformatics, Algorithmic Genomic Biology, Applied Parallel Computing, Machine Learning

University of Illinois at Urbana-Champaign

Aug. 2019 – May 2022

BS. Mathematics and Computer Science

Champaign, IL

- **Graduated with High Distinction**
- **Course Work:** Adv. Algorithms, Deep Learning, Web Programming, Database Systems, Numerical Analysis, Partial Differential Equations, Graph Theory, Real Analysis

Preprints

CM++ - A Meta-method for Well-Connected Community Detection

Vikram Ramavarapu, Fábio Jose Ayres, Minhyuk Park, Vidya Kamath Pailodi, João Alfredo Cardoso Lamy, Tandy Warnow, and George Chacko (2023)

In submission at the Journal of Open Source Software (JOSS) ([Link](#))

Publications and Conference Articles

Well-Connected Communities in Real-World Networks

Minhyuk Park, Yasamin Tabatabaee*, **Vikram Ramavarapu***, Baqiao Liu, Vidya Kamath Pailodi, Rajiv Ramachandran, Dmitriy Korobskiy, Fabio Ayres, George Chacko, Tandy Warnow (2023)*

Proceedings in COMPLEX Networks 2023. Invited for submission at PLoS. (*) These authors contributed equally as first authors ([Link](#))

Demystifying Digital Home Assistant Devices for Older Adults with and without Disabilities

*Kadylak, T., Blocker, K.A., Gowrishankar, S., Malecki, M., Galoso, L., Khamzina, M., **Ramavarapu, V.**, Sreenivas, R.S., & Rogers, W.A. (2021)*

Presented at the Rehabilitation Engineering and Assistive Technology Society of North America (RESNA) 2021 Virtual Conference.

A Smart Power Outlet for Electric Devices that can Benefit from Real-Time Pricing

V.P. Ramavarapu, R. Sreenivas, R. Sowers (2017)

Conference article in The Proceedings of the 2017 International Conference on Control, Electronics, Renewable Energy and Communications (ICCEREC). Published at IEEE ([Link](#))

Work Featured in Talks and Conference Presentations

Inferring Migration Histories of Metastatic Cancers

*Mrinmoy Roddur, **Vikram Ramavarapu**, Mohammed El-Kebir (2023)*

Talk given by Prof. Mohammed El-Kebir at the BIRS Workshop: Mathematical Methods in Cancer Biology, Evolution and Therapy ([Link](#))

Developing a Digital Home Assistant Recommendation and Instructional Support Application for Older Adults with Mobility Disability

***Vikram Ramavarapu**, Travis Kadylak (2021)*

Talk given by Vikram Ramavarapu at the Undergraduate Research Symposium at the University of Illinois at Urbana-Champaign

Technical Reports

Voice-Activated Digital Home Assistant Application/Skill Development: Instructional Support and Recommendation Application Development for Older Adults with Mobility Disabilities (TechSAge-TR-2108).

V. Ramavarapu, T. Kadylak, W. Rogers (2021).

(TechSAge-TR-2108) Rehabilitation Engineering Research Center on Technologies to Support Aging-in-Place for People with Long-Term Disabilities. ([Link](#))

Projects and Software

MACH2-Viz ([Repository](#))

Jan. 2022 – Present

- Visualizer of MACH2, a follow up on [MACHINA](#) to infer migration history of metastatic cancers. Visualizer is backwards compatible with MACHINA. **React, CSS, Cytoscape, Python: Flask**
- Researchers using this software can upload data and navigate and filter through the solution space of inferred migration histories.

CM++/CM Pipeline ([Repository](#))

- Parallel meta-method for generating well-connected (high minimum cut) network clusters. **C++, Shell, Python: Multiprocessing, Networkit**
- Pipeline software for community detection, having stages for clustering, computing community statistics, CM++, and filtration by size

Parallelization of Multiple Sequence Alignment Using MAGUS ([Paper](#))

Dec. 2022

- Parallelized Multiple Sequence Alignment computation by modifying [MAGUS](#) to run multi-processing on the UIUC NCSA Compute Cluster. **Shell, SLURM, Python**
- Parallelized software experienced speedup of up to 12x.

Grants and Funding

TechSage App Factor: Developing a Novel Voice-Activated Alexa Skill (Awarded: 2021, June)

Funder: TechSage RERC

Project Title: Amazon Alexa Interactive Help and Recommendation Application for Older Adults with Mobility Disabilities

Team: Travis Kadylak (PI) and **Vikram Ramavarapu** (Engineering Research Assistant)

Award amount: \$5,000

Research Experience

Metastatic Cancer Migration Inference and Visualization, Department of Computer Science

Jan. 2023 – Present

Independent Study, University of Illinois at Urbana-Champaign

Urbana, IL

- **PI: Prof. Mohammed El-Kebir**
- Visualization of cancer migration history given input clonal histories. **Javascript: React/Express, HTML/CSS, Python: Flask**
- Extensible application to explore the solution space of the parsimonious migration history inference problem. **Graph Theory, Tree Inference**

Scientometrics and Network Science, Department of Computer Science

Jan. 2023 – Present

Graduate Research Assistant, University of Illinois at Urbana-Champaign

Urbana, IL

- **PIs: Prof. George Chacko, Prof. Tandy Warnow**
- Graph-theoretic clustering of research citation networks to understand the structure and development of scientific communities. **Python, C/C++**
- High performance computing to run clustering algorithms in parallel. **HPC, Python: Multiprocessing, Networkit/NetworkX**
- Developed a multi-purpose community detection pipeline package to run graph analytics and clustering, as well as a meta-method for well-connected community detection.
- Analysis of a multi-dimensional framework to assess breadth and depth of publication impact. **Python: Pandas, Networkit/NetworkX, Jupyter Notebook**

Cyclicality Analysis on COVID19 in North America, Department of Mathematics

Jul. 2021 – May 2022

Independent Study, University of Illinois at Urbana-Champaign

Urbana, IL

- **PI: Prof. Yuliy Baryshnikov**
- Cyclicality analysis is the technique of aggregating regional linear time series to map spread of a signal over a medium. (Traditionally in neuroscience to map the spread of trauma during a brain injury).
- Using American and Canadian provincial COVID case time series, spread is mapped across North America. **Python: Pandas/Matplotlib/Jupyter Notebook**

Human Factors and Aging Laboratory, College of Applied Health Sciences

Jul. 2020 – May 2022

Undergraduate Research Assistant, University of Illinois at Urbana Champaign

Urbana, IL

- **PIs: Prof. Wendy Rogers, Travis Kadylak (PhD)**
- Created Amazon Alexa skills with voice and visual interface using AWS Lambda. Took into account **Nielsens Usability Heuristics** to ensure the app is usable by older adults and those with mobility disabilities. **NodeJS/AWS Lambda**

A Smart Power Outlet for Electric Devices that can Benefit from Real-Time Pricing, College of Engineering

Jun. 2017 – Aug. 2017

Independent Study, University of Illinois at Urbana Champaign

Urbana, IL

- **PIs: Prof. Richard Sowers, Prof. RS Sreenivas**
- Designed software to fetch real-time utility pricing and parse it into a readable format by a programmable **Intel Edison**.
- Wrote **JavaScript** Code in Figures 8 and 9 of the above conference paper

Professional Experience

Uhnder Inc.

Apr. 2022 – Jan. 2023

Research and Development Intern

Champaign, IL

- Graphical simulation and frame generation of vehicle camera/radar footage. **CARLA (Unreal Engine)/Python/C++**
- Parallel Radar Image processing. Noise removal and image compression sped up from non-parallel implementation by a factor of >100x. **CUDA**
- Object detection for self driving cars: Trained **2D U-Net** on 2D rectangular projections of spherical radar data (r, theta, phi) to perform **Semantic Segmentation**. Improved mean IoU by 30% since initial segmentation model's implementation. **Gitlab, Python: Pytorch/MMSegmentation, AWS S3**
- Built methods to validate effectiveness of various self driving car simulator versions: Created methods that used **Wasserstein Distance (EMD)** to compare simulated and real radar images, as well as older and newer simulator generated images. **C++: Catch2**

HBO Max (Warner Bros. Discovery)

Jan. 2022 – Apr. 2022

SWE Intern – Data

Culver City, CA

- Designed, implemented and productionalized method to identify potential international pricing abusers of the streaming service. **SQL/Python**
- Built a scheme to auto-generate the list using an orchestrator **Airflow, Snowflake**

Exelon

Aug. 2021 – Dec. 2021

SWE Co-Op

Chicago, IL

- Built an application to run statistical analysis of simulations based on the reactor design. **Python: Tkinter/Matplotlib/Pandas**
- Reduced analysis time from a week's worth of manual effort to about an hour for over 99% improvement in work efficiency.

Inprentus

Jun. 2018 – May 2019

Research and Development Intern

Champaign, IL

- Built an application to automatically generate precise statistical product reports from Atomic Force Microscopy (AFM) images of diffraction gratings. Recipients of these reports included NASA and SLAC (Stanford). **Python: Matplotlib/PyGTK**
- Created macros to identify components of Scanning Electron Microscope (SEM) images of indentation tools. **ImageJ, Java**
- Material indentation simulations in a joint project with UC Berkeley. **Mathematica**

Programming Languages

Technical Skills

Python: >100k lines of code
JavaScript: >100k lines of code
C/C++: >50k lines of code
Java: >10k lines of code
Shell: >10k lines of code

High Performance Computing: Multiprocessing, CUDA, Slurm
Web Development: HTML, CSS, Javascript, React, Django
Databases: SQL, MongoDB, Neo4j
Machine Learning: PyTorch, OpenCV