Viktor Samuel Zenkov

General Information

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Publications

- I co-authored a paper about correlations between speeds and turning angles of T cells, available at http://doi.org/10.1088/1478-3975/acb18c.
- I published a paper summarizing the findings of my microbiology research with Vitaly Ganusov about the movement of cells and the search for cell attraction, available at https://doi.org/10.3389/fbinf.2021.770448.
- I wrote a technical report summarizing the results of my work in Summer and Fall 2018 with Jason Laska from my Oak Ridge National Laboratory internship in Summer 2018 and available at https://arxiv.org/abs/1910.02021.

Education

- In May 2019, I graduated summa cum laude from the University of Tennessee, Knoxville with a Computer Science Major and Mathematics Minor in the Chancellor's Honors Program and the Cook Grand Challenge Engineering Honors Program, with a GPA of 3.9 for my Bachelor's degree.
- In August 2020, I graduated from the University of Tennessee, Knoxville with a Masters in Computer Science with a GPA of 3.7.
- I am **currently** a PhD student at the University of Tennessee, Knoxville, studying Computer Science. My advisor is Professor Michael Langston.
- I took seven undergraduate classes at Pellissippi State Community College, with a GPA of 4.0.

- I pursue extracurricular studies such as TheGreatCourses.com, Linked In Learning (formerly Lynda.com), and Masterclass.com.
- I had an exceptional home education.

Internships

- In Summer 2018, I had an internship at Oak Ridge National Laboratory through the SULI (Science Undergraduate Laboratory Internships) program. I used machine learning to train a neural network to classify malware. I learned Python, Numpy, Pyparsing, and Keras to accomplish this goal. After the summer I continued my work, and I submitted my results as a technical report in August 2019.
    - I summarized my results in a paper.
    - I presented my results at the CISR Student Research Convivium.
    - I presented my results at the ORISE Undergraduate Poster Session.

- In Summer 2019, I had another internship at Oak Ridge National Laboratory through the SULI program. I worked on three projects in this internship:
    - I programmed a TURBOVAC i/iX pump for a vacuum chamber such that the pump could be controlled by Python code running tests in the vacuum chamber, which required me to also write machine code in the pump's native language.
    - I wrote a program to transform "smell" data from my fellow intern's electronic nose project into sounds, associating a different instrument with each sensor, essentially creating a sophisticated alarm.
    - In my main project, I worked on using machine learning to "solve" an unsolvable math problem relating measurable data about nanomaterials collected using a Quartz Crystal Microbalance to useful properties of the nanomaterials (density, shear modulus, and shear viscosity). The Voight-Voinova model (which defines the relationship) cannot be solved using mathematics, so I trained neural networks to attempt to predict the useful properties given the measurable data. I presented this work at the ORISE Undergraduate Poster Session.

Research

Undergraduate Research Assistant in the Department of Microbiology (December 2016 to May 2019)

- I studied whether medicinal cells are attracted to malaria parasites or just "run into" the parasites.
    - I performed statistical analyses on microscopy data taken from the liver. (An infected liver is where an important part of the malaria lifecycle occurs.)
    - Some characteristics of the data suggest there is an attraction, while some do not. I investigated why this might be.
        * There may be biological reasons for what we see. I wrote computer simulations to test the biological hypotheses that are falsifiable.
        * I looked at mathematical explanations for what we see. I came up with some theories on why certain measurements of the data seem to yield more definitive results than others.
        * I used statistical ideas to investigate if the data is reasonable enough to detect what we want, or if the experiment itself could be improved. I wrote computer simulations to determine improvements.
- I replicated distributions of sinusoids and movements of cells using mathematical distributions.
    - I used Mathematica to program cells in 3D space, and I used various distributions to add different forms of attraction.
- I altered and then compared datasets which were created in different ways.
    - Since my analysis used data recorded over a set period of time and different datasets might have different time jumps, I analyzed whether the distributions of datasets created from the full datasets are comparable to distributions of datasets taken from every other data point.
- I used technology to trace sinusoid maps of slices of the liver so we could understand the structure and constraints that sinusoids have on t-cells getting to the parasite. These tracings were done by hand, but we are interested in writing programs to automate this.
- For my undergraduate research, I received a graduation accolade in the form of a special Excellence in Undergraduate Research cord. I also won the Lisa Kahn Memorial Undergraduate Research Award in Spring 2019.

Graduate Research Assistant in the Department of Microbiology (August 2019 to present)

- I continued my main undergraduate project (studying whether medicinal cells are attracted to malaria parasites or just "run into" the parasites) and eventually published my results in 2021.

- I started a new project in which I ask the same question, but take into account the sinusoidal structure of the liver, modeled as a graph. I have developed the entirely new methodology for modeling sinusoids as graphs, for analyzing movement on those graphs, and for creating synthetic cells on those graphs.
- I additionally work on a project predicting bacterial counts of tuberculosis using paracliques, a graph concept introduced by my advisor's lab, and more graph algorithms. The goal is to find a set of around 5 genes out of 20,000 that can predict bacterial counts to help us know if a subject has tuberculosis or will have tuberculosis.
- I have begun work on another project about tuberculosis in which I create a graph from imaged cells and other entities in a lung, then examine which entities tend to cluster with each other.

Presentations

- In April 2018, I presented one of my research discoveries at the URSA (Undergraduate Research Students' Association) conference, giving an oral presentation. I discussed an improvement I found to a metric used to analyze position data of moving cells.
- In April 2018, I presented the same result as above at EUReCA (Exhibition of Undergraduate Research and Creative Achievement), a poster presentation which can be viewed at `http://trace.tennessee.edu/utk_eureca/2018/engineering/1/`.
- Also in April 2018, another student and I presented at the Undergraduate Math Conference, giving an oral presentation. We studied the movement of points in a constrained environment as part of a project for a mathematical modeling class and presented our results.
- In August 2018, I presented the results of my malware classification internship at the ORISE Undergraduate Poster Session at Oak Ridge National Laboratory. I used four neural networks for classifying malware and found the model that performed best.
- Also in August 2018, I presented my malware classification results at the CISR Student Research Convivium, an oral presentation session in the Cyber and Information Security Division.
- Once again in August 2018, I presented my malware classification results at Discovery Day 2018, a poster session at UT.
- In October 2018, I presented my research discoveries at the NIMBIOS conference, giving a poster presentation. I discussed various metrics I use to analyze position data and compared the metrics' effectiveness.

- In April 2019, I presented my work at the Microbiology day poster session in the UT department of microbiology.
- In May 2019, I presented my work in a poster and an oral presentation in San Diego at **Immunology 2019**, the leading immunology event in the world. (Expenses were paid by the Chancellor's Honors program.)
- In August 2019, I presented the results of my model solving internship at the ORISE Undergraduate Poster Session at Oak Ridge National Laboratory. I worked on using machine learning to "solve" an unsolvable mathematical model to estimate properties of nanomaterials.
- In August 2020, I presented my research at the eSMB2020 (Society of Mathematical Biology) conference in a virtual poster.
- In March 2021, I presented a combination of my undergraduate and graduate projects at the UTK Microbiology department colloquium in an oral presentation.
- In May 2021, I presented the same combation work in a poster and an oral presentation virtually at **Immunology 2021**.
- In August 2021, I presented the same combination at the ACM-BCB (Association for Computing Machinery Conference on Bioinformatics, Computational Biology, and Health Informatics) conference in a virtual poster.
- In September 2021, I presented the same combination at Virus Dynamics 2021 in a virtual poster.

Technical Skills

- I use Mathematica for most of my research and for many of my classes.
- I used LaTeX to make this document as well as other reports and articles.
- I used C and C++ regularly in my computer science classes..
- I learned Python in depth for my Summer 2018 internship, especially the Numpy and Pyparsing packages. For my Summer 2019 internship, I learned how to use more packages, including PyQt and PyGame , and gained experience using python to "communicate" with code in other programming languages like C.
- In doing the assignments of a Stanford computing class involving neural networks, I learned how to use Jupyter notebooks .
- For my Summer 2018 internship, I learned about neural networks and machine learning, and made neural networks myself using Keras , a Python package.

- I have used the Swift language and formerly Objective-C for IOS/Apple application development.
- I began my programming studies with Scheme , Python , and Java .
- I work with Unix(Bash) off and on as needed.
- I make websites using HTML , CSS , and Javascript . I also used JQueryMobile to make websites before it became dated.
- I use Premiere Pro for video production, and can also use After Effects and Cinema4DLite .
- Using my piano controller, I have worked with Logic Pro for many years for composing and sound design.
- I use Audition for sound editing.
- I use Illustrator and Photoshop for graphic design.
- When I need more control over page layout, I use InDesign for desktop publishing.
- I can use XCode and Dreamweaver as development environments. I used Eclipse in the past.
- For simple word processing and spreadsheets, I use Excel , NeoOffice , and Pages . For text editing I use BBEdit .
- I have used Microsoft Word and Microsoft Powerpoint to create documents and presentations when required.
- I have also used Origin to make graphs for documents in Microsoft softwares.
- My largest experience with SDK's is Parse , a cloud storage company that was bought out and closed down.
- I have experience using SVN and Git to maintain my files.
- I used MongoDB to store data for a website project.
- For my research I occasionally use ImageJ / Fiji to view microscopy data.
- In college one semester I worked with the Assembly language on Arduino.
- In Spring 2018 I began using a supercomputer (then known as ACF, now called ISAAC) to run several intensive C++ programs for a Math Modeling class. These programs involved modeling the movement of points in a 2D environment, resulting in billions of operations and tens of millions of results. In Fall 2018 I used the supercomputer to train neural networks to classify malware, and in Summer 2019 I used the supercomputer to "solve" unsolvable math equations. As such I have worked with pbs files. I also use the supercomputer to run many simulations for my main PhD research.

Volunteer Service

- I played piano each week at the National Healthcare Corporation, NHC Farragut, a nursing home near my house, from my beginning at UT in Autumn 2016 until my graduation in May 2019 (including one summer).
- Starting in Spring 2018 I occasionally played piano at Deane Hill Place, another nursing home in Knoxville.
- Also in my freshman year I occasionally visited the elderly with the Knoxville County SCAN program.

Further Skills and Interests

- One of my main skills is mathematics . I took the SAT mathematics level 2 subject test and received a perfect 800.
- I have played piano for 19 years, including piano competitions.
- I play violin .
- I took Pipe organ lessons along with piano lessons at Meredith College in North Carolina.
- I played over-the-board chess for many years and have a USCF rating around 1570. In past years I have been a member of the ICCF, which is the American chess correspondence team, and have played against teams from over a dozen countries.
- I sold apps on the Apple app store for many years, although by 2024 they have all been removed from the app store due to not being updated for years.
- I have made and published Android apps as well.
- I published a novel called *The Next World* on Amazon Kindle and I am working on its sequel, as well as a Kindle Vella novel.
- One of my favorite topics is history , which I have studied extensively over the years. I took the SAT subject test in history and got 720 out of 800.
- I am interested in astronomy , making use of my 12-inch Dobsonian telescope. Our house was in the path of totality of the eclipse of 2017, which was a special experience. I tracked sunspots the few weeks before the eclipse.
- My main hobby is listening to film score music . I often use Audition to tweak or rearrange the music to make a better listening experience.
- I have studied, but am not fluent in, Latin and American Sign Language. I have forgotten all the Chinese I studied, although I can still pronounce pinyin.
- I have some experience in carpentry , where I used power tools as well as hand tools to make things like dovetails.
- A past hobby is work with electronics , including soldering.

- I enjoy cooking and eating the fruits of my labor.

Leadership/Mentoring

- In college, classmates have asked me for registration advice and help on homework for different classes, and I have both led them in class choices and helped them understand what they are studying.
- Starting in August 2020, I am the secretary of the University of Tennessee, Knoxville chess club.
- I have been a chess mentor to a young friend.
- I was a website design mentor to another young friend.
- I created JQueryMobile and XML Tutorials for children.

Some Awards and Accomplishments

- I participated in **many** math, science, chess, and geography competitions. I won first place at many of these before college started.
- In the Duke Talent Identification Program, I was a State and National ACT score winner when I was ten years old.
- I took the Putnam exam in my freshman year, Fall 2016, and scored 18 . (The median for the test is generally 1.)
- In the Allen Medal competition in my freshman year of college, Spring 2017, I got second place, with a prize of $100.
- I took the Putnam again in Fall 2017 and scored 11 .
- I took the Putnam again in Fall 2018 and scored 3 . (It was harder that year.)
- For my undergraduate research, I won the Lisa Kahn Memorial Undergraduate Research Award in Spring 2019.
- I received a travel grant from the Chancellor's Honors program for the Immunology 2019 conference.
- I won a poster prize for a poster at the eSMB2020 conference.

Scholarships

- Throughout my UT career, I received these merit-based scholarships: Engineering Fee Scholarship, Harvey Family Scholarship, Roddy-Holden Scholarship, Frank Manning Memorial, UT Volunteer Scholarship, Parents Association Scholarship, Billy & Sylvia Moore Scholarship.

Memberships

- I have been a part of the US International Correspondence Chess Federation team starting in 2011.
- I am a member of the United State Chess Federation.
- I am a member of the University of Tennessee, Knoxville chess club.
- I joined several honors associations since entering college, but stopped when the number of invitations became too large.
- I am a member of the National Society of Collegiate Scholars.
- I am a member of **Tau Beta Pi**.
- I am a member of **SIAM** (Society for Industrial and Applied Mathematics).
- I am a member of **AAI** (the American Association of Immunologists).

Paid Work History

- December 2016 to May 2019 - I did undergraduate research (described above).
- June 2018 to August 2018 - I had an internship at ORNL through SULI (described above).
- June 2019 to August 2019 - I had another internship at ORNL through SULI (described above).
- August 2019 to present - I continue my research (described above) with a full-time research assistantship (graduate RA).
- I was invited to play piano at an assisted living facility for $150.
- I sold apps on the Apple App Store.
- Ongoing - I self-published a science-fiction novel with ISBN 978-0-9993663-0-1, called *The Next World*, which is available at https://www.amazon.com/author/viktorzenkov. I additionally am in progress on a Kindle Vella publication, which is a book published piecewise in chapters.

Websites

- My UT ePortfolio: `http://portfolios.utk.edu/vzenkov/`
- My UT website: `http://web.utk.edu/~vzenkov/`
- My app website: `http://www.unbreakableapps.mobi`
- My research lab website: `http://ganusovlab.utk.edu/default.htm`
- My novel website: `https://www.amazon.com/author/viktorzenkov`

References are available upon request.