

Xander Varga

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WORK EXPERIENCE

Nodel Financial Services, LLC

June 2023 – January 2024

Founder & CEO

Madison, WI

- Founded Nodel, a zero-trust crowdsourced bounty platform for grassroots development of shared infrastructure.
- Architected a fully functioning MVP backend:
 - Gained proficiency in Cloudflare, AWS EC2, S3, MongoDB, Pinecone, Redis, and Nginx

Invention House LLC

May 2020 – Present

Programmer, Engineer

St. Louis, MO

- Developed an HMI for a conformal coating robot. Focus on usability makes it a favorite among customers.
- Designed and 3d printed compliant mechanisms for the conformal coating robot nozzle.
- Designed, built, and programmed a pressure-swing adsorption system for oxygen recovery in an ozone generator.
- Continued on-site software training and support for HMI customers across the US.

Impossible Sensing

May 2021 – August 2021

Systems Engineering Intern

St. Louis, MO

- Developed a CLI in Python to coordinate the operation of a LIBS (Laser-Induced Breakdown Spectroscopy) instrument, enabling seamless interaction between the camera, laser, spectrometer, and focusing gantry components. The project is on track (TRL4) for being deployed on space missions.
- Created an HMI for a hyperspectral camera, making its operation significantly more convenient for internal use/experiments.

PROJECTS

Independent Study: miniaturized Liquid Nitrogen Generation

Spring 2023

- Designed and attempted to build a miniature liquid nitrogen generator from scratch
- Simulated in ASPEN Plus, significant theoretical work to model behavior and optimize design
- Project failed due to thermal expansion from welding

AI Projects

2017 – Present

- Investigation into alternatives to β -VAEs for optimizing disentanglement utilizing noisy channels
- Exploring properties of decision transformers and model-based reinforcement algorithms on b-suite

EDUCATION

Washington University in St. Louis

May, 2023

BS. Chemical Engineering, Minors: Computer Science, Astrophysics

St. Louis, MO

- Dean's List Fall 2021
- Staam a cappella: Base, VP, and Soloist

SKILLS & INTERESTS

- **CS/software/frameworks:** Tensorflow, Scipi, TypeScript, C#, C++, Arduino C, Java, Python, MATLAB, Bash, MongoDB, AWS, html, css, JavaScript, MATLAB, Aspen Plus, Visual Studio Code
- **Other:** Carpentry, soldiering (electrical and plumbing)
- **Interests:** Music production, arduino projects, rock climbing, megastructures, space travel, consciousness

I am applying for a PhD track in machine learning/robotics with the eventual goal to work in the CAIR lab, RoboPIL, or similar. By the end of this statement, I hope to convey how deeply my personal and professional life has been intertwined with AI and robotics, from the friendships I've made, to personal curiosity, to professional experience. I would love nothing more than to the peers and faculty at Columbia who share my goals and love of this field. Before I tell you my research intentions, I'll show you some of my sources of inspiration.

Gerald was beginning to be able to identify numbers. I had finally found the bug in my script after printing every single step and comparing it to my notes. This was before I knew about the convenience of pre-made machine learning libraries. I, a naïve 16 year old, had painstakingly coded *backpropagation* by hand. As Gerald (my neural network) became smarter, I developed an intuition for not only neural networks--the base layer of all modern machine learning--but also what "intelligence" even means.

InventionHouse was a small, family run company that specialized in designing printed circuit boards. Circuit boards need to be coated with a protective layer of coating, and because spray-coating bots are incredibly expensive, many manufacturers opt to coat the boards by hand--with a paintbrush. I was tasked with designing an automated conformal coating robot. I felt underqualified for the task, but after almost a thousand hours of research and development, we created a fully capable conformal coating robot. Through InventionHouse I discovered two things: that making truly useful robotic tools was addicting, and that the bottleneck was smart software. Because of my software, people's lives were better. This experience cemented my passion for AI powered robotics. During my time working in R&D, I learned practical scrappiness, industriousness, and collaboration skills that I didn't learn in my first few years of college.

In the last year of college, I had the choice of either taking another class or pursuing independent study credits. I had always wanted to make a small-scale liquid nitrogen generator, so I chose independent study. My advisor warned me that the odds were stacked against me; the time constraint and small scale put me at a severe disadvantage. I did, however, have one major advantage: I had attempted to build it two years before, by my own volition. Eventually I presented my final design to my advisor, and I'll never forget what he said: "I didn't think someone would be able to do this, but, I mean, you did."

Unfortunately, one of the steps in my process was to weld a piece of steel in a motor, which ended up ruining it. I passed the independent study anyway.

As someone pursuing machine learning, I hope it doesn't upset you to state that I have no interest in language models. I am not alone in my prediction that the AI of the future will not be language model based. My area of interest lies with agents that can explore and master the worlds we give them, whether they be games, flight simulations, surgeries, or generative designs. A human can become well-read by reading books, just like a language model, but the frontier of new knowledge is always explored by humans who leave the safety of literature and opt to pursue their curiosities deep into the unknown. Why would we expect true artificial intelligence to be any different?

Shuran Song and Yunzhu Li are my models for the type of research that I believe will pay enormous dividends in the next 20 years. I wanted to make a laundry folding machine as a startup company. During my literature search, Song's work proved to be a goldmine. It was profoundly exploratory of manipulation of soft and unpredictable systems. This includes flinging and blowing objects around, swimming robots, and modeling soft, dough-like objects. Much of what I want to do is inspired by DreamerV3: putting a robot in a situation, letting it explore, and eventually outperform humans. DreamerV3 is high-powered, but I would bet that it has significant room to grow in its base architecture. At minimum, If the recurrent portion was swapped for a transformer, it would allow the agents to see long-term patterns with the strength of modern LLMs. If done well, we might see a new class of machines: machines that make rich latent representations of reality around them, allowing them to invent new technology in whatever universe they occupy.

I was advised by one of my friends at Stanford not to apply to a PhD because schools "only care about research experience". I have spent my entire life researching. I have a lifelong track record of spending months diving into problems head-on, ripping them apart, understanding them deeply, and with no reward besides my own intrinsic curiosity. I was lucky enough for that to be witnessed by three brilliant men who I have listed for my letters of recommendation. As much as I hope to make use of the resources at a bustling campus like Columbia, I assure you I will continue researching regardless of admission.