

# Vivswan Shah

PH.D. CANDIDATE, MACHINE LEARNING SYSTEMS

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## Education

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Ph.D., **University of Pittsburgh & Carnegie Mellon University** Machine Learning Systems, (Expected: 12/2024)  
Dissertation: *Hybrid Digital-Analog Distributed Deep Learning Systems*  
M.S., **University of Pittsburgh** Electrical and Computer Engineering  
B.S., **Illinois College** Computer Science and Physics

## Technical Skills

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**AI/ML** Computer Vision, Reinforcement Learning, Generative AI, Large Language Models  
**Past Roles** AI/ML Engineer/Researcher, Linux Engineer, Lab Automation, Lab Management, Software Engineer, Web Developer  
**Frameworks** PyTorch, TensorFlow, Qiskit, Cirq, Keras, scikit-learn, Lumerical, Node.JS, Mathematica, MATLAB, Firebase, Docker, GCP  
**NanoFab** E-Beam Lithography, PhotoLithography, Thin Film Deposition, Dry Etching (ICP-RIE), Surface Profiler, SEM, FEI, BEAMER  
**Languages** Python, Typescript, Kotlin, JavaScript, C/C++, JAVA, LaTeX, SQL (MySQL, PostgreSQL, NoSQL)

## AI/ML Research Experience

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**Research Assistant (AI/ML)** 06/2020 - Present  
YOUNGBLOOD PHOTONICS LAB, SUPERVISE BY DR. NATHAN YOUNGBLOOD Pittsburgh, US

- **DOD Project:** *Real-Time 4K 480 fps Low Power Object Detection System.*
- Used image recognition to identify and label optical and SEM images of research samples.
- Built and set up new research lab, including research equipments and internal networking, as the **first PhD student.**
- Worked on projects with **Google X, Accipiter Systems, TD Securities, and U.S. Department of Defense.**

**Research Intern, Computational Biology** 05/2019 - 08/2019  
SUPERVISED BY DR. KEENAN MACK, ILLINOIS COLLEGE Jacksonville, US

- Repaired and rebuilt RapidCell program, and added new GUI, decreasing runtime by 60%.
- Used unsupervised k-means clustering to analyze data of *E. coli* two component systems, and set a baseline for future research.

**Research Intern, Computational Biology** 05/2019 - 08/2019  
SUPERVISED BY DR. KEENAN MACK, ILLINOIS COLLEGE Jacksonville, US

- Used novel clustering algorithms on DNA/RNA and other protein networks to find high correlation between degree correlation and degree distribution, and set a baseline for future research.

**Research Assistant, Computer Science** 08/2018 - 01/2019  
SUPERVISED BY DR. TAKAKO SOMA, ILLINOIS COLLEGE Jacksonville, US

- Successfully modeled self play reinforcement learning agent based on AlphaGo Zero to teach chess by expertise matching.

## Selected Publication

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- **Real-Time 4K 480 fps Low Power Object Detection System**, ongoing.
- **Analog-Layers: Translating Photonics Components for Convolution and Self-Attention Mechanisms**, ongoing.
- **Leveraging Continuously Differentiable Activation for learning in Quantized Noisy Environments**, in review
- **Deep Learning acceleration using non-reciprocal photonic computing**, in review (*Nature*)
- **AnalogVNN: A fully modular framework for modeling and optimizing analog neural networks**, *Applied Physics Letters Machine Learning*, Vivswan Shah, Nathan Youngblood. DOI: 10.1063/5.0134156
- **Computational, photonic crossbar arrays for scalable and efficient matrix operations**, *Silicon Photonics XVIII*, Nathan Youngblood, Vivswan Shah. DOI: 10.1117/12.2646996
- **Fast & efficient electrically driven phase change photonics using foundry compatible waveguide-integrated microheaters**, *Optics Express*, John R Erickson, Vivswan Shah, Qingzhou Wan, Nathan Youngblood, Feng Xiong. DOI: 10.1364/OE.446984
- **Realization of an integrated photonic platform for coherent photo-electric processing**, *Optica Open*, Nathan Youngblood, Sadra Rahimi Kari, Nicholas Nobile, Vivswan Shah. DOI: 10.1364/opticaopen.24250795.v1

## Work Experience

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### Lead Automation Engineer

YOUNGBLOOD PHOTONICS LAB, UNIVERSITY OF PITTSBURGH

07/2022 - Present

Pittsburgh, US

- Unified process fabrication and characterization into a single software for UPitt & CMU Ebeams, MLAs, SEMs, etc.
- Built and developed unified software for automated photonic multiple probe stations for testing photonic integrated circuits.
- Developed novel software utilizing photonic chips to perform optical convolutions over fiber optic channels.

### Linux System Engineer

YOUNGBLOOD PHOTONICS LAB, UNIVERSITY OF PITTSBURGH

03/2021 - 07/2022

Pittsburgh, US

- Added new High Computing Server to Lab, and trained coworkers on the use of all functionalities.
- Implemented secured internal network for all devices and computers of the lab with DHCP, DNS, and Kemp load balancer.
- Implemented RDP, VPN, and configured non-networked devices to add work from home functionality.
- Deployed Jupyterhub, NI server, and other management tools to control lasers, DAQ, and other measurement equipment.

### Software Engineer - Backend

INTERNSHIP, PEHLA KADAM FOUNDATION

05/2018 - 08/2018

London, UK (Remote)

- Set up and tested the new donation system, decreasing errors by 20%.
- Optimized the main website's api functions, decreasing latency by 30%.

### Software Engineer - Backend & Database

INTERNSHIP, IT DEPARTMENT, ILLINOIS COLLEGE

08/2017 - 05/2018

Jacksonville, US

- Developed alarm system for Illinois College Archives, increasing lifespan of antique books and artifacts.
- Automated IT service request system, decreasing 15% workload, and updated Sharepoint 13 to 16, improving 20% performance.
- Migrated databases and workflows from SharePoint 2013 to 2016, improving the performance by 20%.

## Projects

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- **gdsfactory, as Developer for Google X**, [gdsfactory.github.io](https://github.com/gdsfactory/gdsfactory), analog, photonic, quantum chip design Since 04/2023  
Feature development, bug fixes, and documentation for gdsfactory on behalf of University of Pittsburgh for YPL Lab.
- **AnalogVNN**, [analogvnn.github.io](https://github.com/analogvnn/analogvnn), framework for modeling and optimizing analog neural networks Since 08/2022
- **DeDuplicationDict**, [deduplicationdict.github.io](https://github.com/deduplicationdict/deduplicationdict), HashMap with deduplication to optimize memory Since 05/2023
- **DynPartition**, Optimal Pipeline Parallelism of Dynamic Neural Networks over Heterogeneous GPUs using Reinforcement Learning
- **ChatGPTAdversarialAttack2023**, LLM Adversarial Attack Challenge using ChatGPT for The Pitt Challenge 2023
- **YPL-Servers-Setup**, Configure internal network, DNS, DHCP, access control, backup server, and activity logger for research lab.
- **Probe-Automation**, Centralized web interface/server for probe station enabling automated measurement of 1000's of devices.
- **EBeam-Processor**, Unified workflow to convert chip layouts into compatible formats for E-Beams, MLA, ICP-RIE, etc.
- **SEM-Image-Labeler**, Image Labeler for SEM Image from University of Pittsburgh and Carnegie Mellon University NanoFab

**Contributions to Open Source Projects:** pytorch, torchmetrics, tensorboard

## Leadership & Activities

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<b>Organizer &amp; Mentor</b>	Pitt Challenge (Medical/Phrama Hackathon) at University of Pittsburgh	08/2022 - Present
<b>Mentor</b>	AWAP'23 at CMU, HackCMU'22 at CMU, HackMIT'22 at MIT	2022 - 2023
<b>Tutor</b>	Physics, Mathematics, Computer Science, and Chemistry at Illinois College	08/2018 - 05/2020
<b>Teaching Assistant</b>	College Physics and Calculus at Illinois College	08/2018 - 01/2020

## Honors & Presentations

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2022	<b>IEEE Photonics Conference</b> , AnalogVNN	Vancouver, Canada
2020	<b>OnePlus Crackables 2.0</b> , Among top 10 hackers to solve all the puzzles	OnePlus
2018-2020	<b>HackMIT Puzzles 2018, 2019, and 2020</b> , One of first 10 hackers to solve all the puzzles	MIT
2019	<b>1st Prize in ISAS in the Physics, Math, and Astronomy Division</b> , MorseCodeRS2	ISAS

## Selected Coursework

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Deep Reinforcement Learning & Control, Adv. Computer Vision, Probabilistic Graphical Models, Adv. Machine Learning & Deep Learning, Quantum Computing Systems, Computational Game Solving, Quantum Information, Adv. Operating System & Distributed Systems, Modern Computer Architecture & Design, Adv. Machine Learning: Theory and Methods, Algorithm Design and Analysis, Complexity Theory, etc.