Hrishikesh Viswanath | CV

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Education

Purdue University, West Lafayette
PhD in Computer Science, GPA - 3.80/4 *January 23 - Present*

Purdue University, West Lafayette
MS in Computer Science, GPA - 3.83/4 *August 2021 - May 2023*

PES University, Bangalore
B. Tech In Computer Science And Engg, CGPA – 9.03/10 *August 2017 - May 2021*

Research

Geometry agnostic modelling of PDE surfaces for 3D Applications
Ongoing, Mentor: Julius Berner, Caltech *Spring 24*

○ Learning to generalize elliptic and non-elliptic PDEs, regardless of the geometry
○ Exploring Monte-Carlo Walk on Spheres approaches to estimate the surface

Simulating the physics of fluid dynamics using Neural Operators and CROM
Ongoing, Mentor: Peter Yichen Chen, Massachusetts Institute of Technology *Fall 23*

○ Modelled the trajectory (PDE) of viscous fluids with only 20-25% of the mesh, for a 5x speedup
○ Combined Neural Operators and Neural Fields (CROM) to learn the physics of Reduced Order Models
○ Defined a random sampling method that allows for retaining the object properties and ensuring retention of volume

Language guided vision based Navigation through crowds using Neural Operators
Ongoing *Spring 24*

○ Learn the flow of dynamic obstacles from the depth information using Neural Operators
○ Use a combination of vision prompts and Language prompts to comprehend the social aspects of crowd movement

Trajectory Prediction for Robot Navigation using Flow-Guided Markov Neural Operator
Accepted at ICRA 24 *Summer 23*

○ Modelled the movement of crowds as a dissipitative chaotic system
○ Designed a markov process to determine the positions of individuals as a function of current time step
○ Integrated a neural operator based architecture to model the markov process for robot navigation
○ https://arxiv.org/pdf/2309.09137.pdf

Graph-based Decentralized Task Allocation for Multi-Robot Target Localization

Summer 23

○ Integrated elements of Graph Neural Operator with Graph Attention Network to capture long range interactions between agents
○ Enabled a fully decentralized communication architecture in partially observable multi-agent multi-target task allocation and path planning jobs.
○ https://arxiv.org/pdf/2309.08896.pdf

ARTEMIS: AI-driven Robotic Triage Labeling and Emergency Medical Information System

Summer 23

○ Experimented in simulation setting (Gazebo) and real world setting on a Unitree Quadruped
○ Designed a neural network based architecture for mobile search and rescue robots for automatic triage labeling
○ Built an end-to-end prototype for triage labeling and communicating with emergency responders
○ https://arxiv.org/pdf/2309.08865.pdf

AffectEcho: Speaker Independent and Language-Agnostic Emotion and Affect Transfer for Speech Synthesis

Summer 23

○ Designed a Vector Quantized codebook for representing emotions with better interpretability in terms of valence, arousal and dominance
○ Enabled Language agnostic and speaker independent translation of emotion that allows the model to mimic the reference speaker's information in the same valence-arousal-dominance space as the reference speaker, but with the same style as the input speaker
○ https://arxiv.org/pdf/2308.08577.pdf

AdaFNIO: Adaptive Fourier Neural Interpolation Operator for video frame interpolation

Fall 22

○ Designed Neural Operator based architecture for interpolating video frames in a resolution independent manner and beat SOTA architectures
○ Combined flow based neural rendering with neural operator for better generalization at higher resolution
○ https://arxiv.org/pdf/2211.10791.pdf

FairPy: A Toolkit for Evaluation of Social Biases and their Mitigation in Large Language Models

Fall 22

- Developed a plug and play python package for detecting and mitigating social biases (gender, race etc.) in large pretrained Language Models (BERT, GPT-2 etc.)
- The purpose of the toolkit was that there was a lack of generalized multi purpose mathematical tools that were available for direct use. Converted existing mathematical tools from specific purpose to general purpose by decoupling them from datasets and Language models.
- Decoupled detection metrics, models, bias-type and template datasets to allow greater interoperability
- Built template classes and wrapper classes for further expansion of the codebase, with the intent of creating a large open source package similar to Cafy and Scikit Learn
- Improved accessibility of various mathematical tools and techniques to machine learning end users
- https://arxiv.org/pdf/2302.05508.pdf

Publications

Trajectory Prediction for Robot Navigation using Flow-Guided Markov Neural Operator
Bhaskara R., Viswanath H., Bera A (2023)

Graph-based Decentralized Task Allocation for Multi-Robot Target Localization
Peng J., Viswanath H., Tiwari K., Bera A. (2023)

ARTEMIS: AI-driven Robotic Triage Labeling and Emergency Medical Information System
Kotha S., Viswanath H., Tiwari K., Bera A (2023)

AffectEcho: Speaker Independent and Language-Agnostic Emotion and Affect Transfer for Speech Synthesis
Viswanath H., Bhattacharya A., Jutras-Dube P., Gupta P., Prashanth M., Khaitan Y., Bera A. (2023)

AdaFNIO: Adaptive Fourier Neural Interpolation Operator for video frame interpolation
Viswanath, H., Rahman, M. A., Bhaskara, R., Bera, A. (2023).

Neural Operator: Is data all you need to model the world? An insight into the impact of Physics Informed Machine Learning
Viswanath, H., Rahman, MA., Vyas, A., Shor, A., Medeiros, B., Hernandez, S., Prameela, S.E., Bera A., (2023).

FairPy: A Toolkit for Evaluation of Social Biases and their Mitigation in Large Language Models
Viswanath, H., Zhang, T., (2022).

Twitter Spam Review Detection Using Hybrid Machine Learning Techniques.
Viswanath, H., Singh, R., & Gupta, V. (2022). In ICDSMLA 2020 (pp. 331-342). Springer, Singapore.

Study of using hybrid deep neural networks in character extraction from images containing text.
Preethi, P., Mamatha, H. R., & Viswanath, H. (2021). Trends Comput Sci Inf Technol, 6(2), 045-052.

Video Frame Rate Doubling Using Generative Adversarial Networks.
Bharadwaj, A. R., Gourisaria, H., & Viswanath, H. (2021). In Computer Communication, Networking and IoT (pp. 463-474). Springer, Singapore.

Mentorship

IDEAS Lab

Fall 22 - Present

- Mentored several undergraduate students in Machine learning, robotics and computer graphics projects
- Coached interns on writing research papers
- Did Design reviews for robotics projects done by Autonomous Robotics Club at Purdue

Space And Earth Analogs Research Chapter

Fall 2023

- Mentored undergraduates in Unity and UI/UX designs for NASA SUITS
- Mentored students for Rasc-AL design challenge, instructed freshmen and sophomores in writing design reports

Co-Instructor for VR Course

Spring 2023

- Did multiple lectures during the semester
- Taught the basics of Unity
- Taught students how to interface Unity and Oculus Headsets through hands-on sessions

Clubs

Space and Earth Analogs Research Chapter of Purdue
Vice-President   *Spring 24 - Present*

- Mentored undergraduate students for NASA competitions such as Rasc-Al and SUITS (Finalists)
- Helped plan outreach events with scientists from NASA, SETI, Blue Origin, etc.
- Helped organize student led analog astronaut training on campus
- Involved in fund-raising and planning for construction of an analog space research facility at Purdue University

Computer Science Graduate Student Board
WebMaster   *Fall 22 - Present*

- Designed and Built the Computer Science GSA website
- Involved in organizing social events

Work Experience

ResconAI

Machine Learning Intern   *Summer 22*

Experimented with Neural Operator architectures in Python(Pytorch) for solving general elliptic PDEs. Collaborated with researchers from MIT and Cambridge University. The end goal was to design Neural Operator based models to solve general elliptic and other forms of PDE.

Purdue University

Graduate Teaching Assistant   *Jan 2022 - Present*

GTA for CS 502 Compilers course at Purdue University. Mentoring students with LLVM based USCC compiler project, built with C++
GTA for CS 590VR - Guided students with rendering Unity generated scenes on Oculus
GTA for CS251 - Data structures GTA for CS334 - Computer Graphics

Cisco Systems

Technical Undergraduate Intern   *Jan - Jul 2021*

- Built a web based service to automatically analyze router performance data
- Engineered an alerter service with NodeJS frontend Listener service and Webex plugins to ping engineers on Webex. Built a frontend with Django
- Implemented an NLP engine with python to allow users to obtain router testbed details through an interactive chatbot
- Developed an orchestrator service to process Cisco's project-wide Allure and Jenkins logs and a mediation service to connect the chatbot and the frontend dashboard
- Improved efficiency and reduced man hours of the team by having approximately 60% of the sanity runs successfully auto analyzed
- Won the "Connected Recognition" award for building a tool that benefited everyone on the team

Skills

Strengths: Machine Learning, Neural Operators, Graphics, Deep Learning, Computer Vision, Neural Audio Rendering, Large Language Models

Deep Learning: Transformers, Attention Learning, Large Language Models, VQ-VAE, StyleGAN, Graph Attention Networks, Neural Operators, Diffusion, Consistency models, NeRF

Programming Languages: C++, C, Python3, Java, Javascript

Machine Learning Frameworks: Keras, Tensorflow, ScikitLearn, Pandas, Numpy, Transformers, Pytorch, Huggingface

Web Frameworks: NodeJS, NPM, Vue, React, Flask, Django, REST APIs, Chai, Mocha

Graphics: Unity

Cloud Computing: RabbitMQ, Zookeeper, AWS, MongoDB, Docker

Dev: Git, Allure, Jenkins, Google Colab