Agamdeep Chopra

agamchopra.github.io • work.agamchopra@gmail.com • GPA: 3.8

EDUCATION

Doctor of Philosophy (Ph.D.) in Mechanical Engineering, focusing on Deep Learning and Computer Vision — *Sep 2022 – present*
University of Washington, Seattle, WA, USA

Master of Science (M.S.) in Computer Science and Machine Learning — *Aug 2020 – May 2022*
Stevens Institute of Technology, Hoboken, NJ, USA

Bachelor of Science (B.S.) in Physics — *Aug 2015 – May 2020*
Purdue University, West Lafayette, IN, USA

EXPERIENCE

Doctoral Student at KurtLab, University of Washington. Seattle, WA, USA — *Sep 2022 – present*

- Researching novel discrete and highly controllable latent diffusion generative models for cross-modal 3D medical image synthesis, focusing on Tau-PET and MRE synthesis for clinical applications
- Participated and achieved competitive scores in 2022, 2023, and 2024 Brain Tumor Sequence challenges, for 3D image synthesis, tumor classification, and pre-post operative registration
- Successfully obtained funding from competitive Amazon research grant and internal Data Science grant at the University of Washington for investigating novel data-driven research projects
- Collaborated on Amplified 4D(3D temporal) MRI and AFLOW projects to enhance iterative physics algorithms with the aid of artificial intelligence, optimizing computational efficiency
- Spearheading AI-driven Magnetic Resonance Elastography (MRE) Inversion project aimed at comprehending non-linear physics of inversion algorithms and optimizing MRE pipelines to enhance efficiency in clinical applications
- Created open-source packages and tools for easy integration of medical data processing pipelines with gradient friendly PyTorch implementations for the medical AI community
- Experience working with multi-modal datasets of image, 3D scans, temporal scans, text, and other tabular metadata for training cross-modal generative AI algorithms

Graduate Teaching Assistant, University of Washington. Seattle, WA, USA — *Jan 2023 – present*

- Instructed 1 quarter of ME535 and 3 quarters of ME230 to a class of 200 students, focusing on application of computational techniques in engineering by delivering lectures and hands-on lab sessions in Python, C, and C++, emphasizing algorithm development and problem-solving techniques.
- Taught core mathematical concepts, including numerical methods, linear algebra, and differential equations, foundational to the courses

Research Assistant at KurtLab, Stevens Institute of Technology. Hoboken, NJ, USA — *Jan 2021 – Jan 2022*

- Researched, tested, and implemented deep learning based 4D spatial-temporal image registration algorithms to accurately extrapolate displacement fields of 3D aMRI time sequence using Python and MATLAB
- Theorized novel deep learning based automatic brain morphology algorithm to accurately estimate morphology of target region of a brain scan for any patient sample

Software Developer I, II at Reindeer Shuttle, INC. West Lafayette, IN, USA — *May 2018 – Jun 2020*

- Optimized company's website using Google Analytics, PWA, and UI design principles
- Conducted data analysis to identify trends and correlations for cost-effective fleet operations
- Presented data-driven reports using Google Analytics, Python, and Excel

RELEVANT PUBLIC PROJECTS

Reinforcement Learning-Based Autonomous Video Game Agent (ongoing)
Designed innovative Reinforcement Learning-driven Artificial Intelligence to autonomously master First-Person video games.

Bio-Inspired Artificial Neural Networks for high dimensional Multi-modal Data Stream (ongoing)
Working on backpropogation free high sample efficiency framework for Artificial Neural Networks that uses optimization and growth algorithms inspired form biological mechanisms in early brain development.

Synthetic Image Synthesis using Diffusion-based A.I. (complete)
Coded Stable diffusion based generative efficient attention models to synthesize realistic images from noise, text, and images

Synthetic Image Synthesis using WGAN-GP-based A.I. (complete)
Programmed generative model based on Wasserstein GAN with gradient penalty to synthesize images from pure noise

3D Real-time N-body Newtonian Particle Dynamics Physics Simulator (complete)
Contrived real time 3D sandbox simulation toolbox for simulating N-body dynamics on multicore CPUs and CUDA GPUs

Torch-Register, Torch-NMI, 3D Edge Loss, and Standardized 3D Medical Image Processing Pipeline for PyTorch (complete)
Developed and published open-source 3D and 2D medical image processing software for Python3 and PyTorch on Pypi.org

3D-Scene Generation from 2D Images using Conventional and A.I. Algorithms (complete, continuous update)
Wrote applications to transfer 2D image domain to approximate 3D scene domain using AI and conventional mathematics

A.I. based Pet Companion Robot (complete, revision ongoing)
Prototyped robots to recognizing pets and avoiding collisions with obstacles using deep learning-based object detection

Life Engine based on my 3D Physics Engine and Evolutionary Reinforcement Learning (ongoing)
Developed real-time AI simulations for complex organism evolution in dynamic environments. Implemented intricate physical, sensory (visual, vibrations, thermal), and chemical interaction models, enabling organisms to adapt and compete effectively

SKILLS

Technological Exposure: Python, PyTorch, Git Version Control, C++, High Performance Computing (HPC), C, CUDA, Tableau, Azure, AWS, SQL
Theoretical Understanding: Machine Learning, Computer Vision, Generative AI, Physics, Mathematics, Data Analysis, Robotics, Medical Imaging
Academic/Professional Skills: Academic Research, Academic Publishing, Grant Writing, University Teaching, MLOps, DevOps
OS Familiarity: Linux, Windows

PUBLICATIONS

1. Chopra, A. S., et al. (Under review). **Disentangled VQ-VAE for explainable Tau-PET synthesis from multi-modal MRI: A robust and non-invasive approach for Alzheimer's disease detection and localization. Submitted to the Medical Imaging with Deep Learning (MIDL) 2025 Conference.
2. Chopra, A. S., Heras Rivera, J. E., Ren, T., Oswal, H., Pan, Y., Sordo, Z., Walters, S., Henry, W., Mohammadi, H., Olson, R., Rezayaraghi, F., Lam, T., Jaikanth, A., Kancharla, P., Ruzevick, J., Ushizima, D., & Kurt, M. (Under review). Medical Image Inpainting using Efficient Transformer and Fourier UNet. Paper submitted for BRATS 2024.
3. Abderezaei, J., Pionteck, A., Chopra, A., & Kurt, M. (2024). 3D Inception-Based TransMorph: Pre- and Post-operative Multi-contrast MRI Registration in Brain Tumors. Brainlesion: Glioma, Multiple Sclerosis, Stroke and Traumatic Brain Injuries.
4. Ren, T., Honey, E., Rebala, H., Sharma, A., Chopra, A., & Kurt, M. (2023). An optimization framework for processing and transfer learning for the brain tumor segmentation. International Challenge on Cross-Modality Domain Adaptation for Medical Imaging.
5. Ren, T., Sharma, A., Rivera, J. E. H., Rebala, H., Honey, E., Chopra, A., & Kurt, M. (2024). Re-DiffiNet: Modeling discrepancy in tumor segmentation using diffusion models. Medical Imaging with Deep Learning.
6. Rivera, J. E. H., Chopra, A. S., Ren, T., Oswal, H., Pan, Y., Sordo, Z., Walters, S., & Kurt, M. (2024). An Ensemble Approach for Brain Tumor Segmentation and Synthesis. arXiv preprint arXiv:2411.17617.