YAYATI JADHAV

yayatij@andrew.cmu.edu • 412-539-7712 • www.linkedin.com/in/yayatij

EDUCATION

Carnegie Mellon University   Pittsburgh, PA
Ph.D. Mechanical Engineering   August 2021 - Current
Research: Generative Machine Learning for Science and Design
Advisor: Professor Amir Barati Farimani

Carnegie Mellon University   Pittsburgh, PA
Master of Science in Mechanical Engineering (GPA: 3.98/4.00)   May 2020
Research: Soft Robotics

Vellore Institute of Technology (VIT)   Vellore, India
Bachelor of Technology in Mechanical Engineering (GPA: 8.11/10.00)   May 2015

RESEARCH EXPERIENCE
Ph.D. Research
Carnegie Mellon University   Pittsburgh, PA

LLM-3D Print: Large Language Models To Monitor and Control 3D Printing
- Developed a pre-trained multimodal LLM-based multi-agent workflow to detect and solve 3D printing errors in real-time.
- Enabled in-situ monitoring and hierarchical machine-to-machine communication for automated defect identification and correction.
- Achieved 98% error correction in both single and multi-layer 3D prints through the framework.

Large language model agent as a mechanical designer
- Developed a reactive agent-based workflow using pre-trained LLMs to generate novel truss structures with 90% success.
- Optimized the solution process to meet specifications in under 25 iterations.

Generative Lattice Units with 3D Diffusion for Inverse Design: GLU3D
- Developed a 3D denoising diffusion-based model to generate lattice unit cell structures with a 0.87 R-squared correlation to target mechanical properties.
- Created a scaling function for 3D implicit field DDPM models, enabling direct generation of 3D models through DDPM.

StressD: 2D stress estimation using denoising diffusion model
- Developed StressD, a framework integrating a U-net-based denoising diffusion model and transformer networks to predict von Mises stress distribution fields with 99% accuracy in both elastic and hyper-elastic models, significantly reducing computational costs compared to traditional FEA simulations.
- Designed vision transformer based auxiliary network for predicting stress scaling values under varying boundary and loading conditions, optimizing iterative design processes for complex structures.

MS Research
Application of stiffness tuning material in medical devices (MS Thesis)
- Created novel conductive stiffness tunable thermoplastic elastomer (cTPE), capable of more than 800% change in Young's Modulus in soft state compared to stiff state and reduced activation time to less than 5 seconds.
- Tracked shape change of cTPE under magnetic force using optical flow in Python to characterize material properties and formulated Euler and Elastica rod models to predict shape and deformation of cTPE under force.

PROFESSIONAL EXPERIENCE

Carnegie Mellon University   Pittsburgh, PA
Machine Learning Engineer   Jul 2020 – Aug 2021
- Extracted spatio-temporal information from videos using optical flow for data driven model discovery of dynamical systems.
- Developed framework to model time-dependent differential equation representing dominant motion of multi-agent system from high dimension data by extracting physics informed latent vector using LSTM based variational autoencoder.
- Built hyperparameter-less pipeline for video processing and unsupervised segmentation of ciliated region from cell based on Farneback's algorithm for dense optical flow and integrated neural network for active learning.

Mercedes-Benz Research and Development India   Pune, India
Product Design Engineer   Dec 2015 - Jul 2018
- Designed manufacturing ready Instrument Panel parts, air-ducts and cross car beam for Next Generation S-Class and C-Class prototype vehicle in Siemens NX based on inputs from cross functional teams.
- Monitored and coordinated development progress with cross functional teams and global suppliers for readiness of S-Class cockpit parts during successive prototype builds.
- Executed Pre-Development studies, benchmarking studies, part investigations studies such as design and manufacturing feasibility, part interface study, mounting strategies to plan for permissible deviations during development cycle.
- Invented spill proof utility concept to isolates cup holder and other utilities from vehicle movement in 6 degrees of freedom.

ADDITIONAL EXPERIENCE

Carnegie Mellon University   Pittsburgh, PA
- Course Assistant (TA): Engineering Design II   Jan 2023 – May 2023
- Course Assistant (TA): Multivariable linear controls   Jan 2020 – May 2020
- Course Assistant (TA): Engineering Computation   Aug 2019 – Dec 2019
- Course Assistant (TA): Design II   Jan 2019 – May 2019
- Grader: Design for Manufacture and the Environment   Aug 2018 – Dec 2018

SKILLS

- **Programming:** Python, MATLAB, C++
- **Python Libraries:** PyTorch, Keras, TensorFlow, SciPy, NumPy, Pandas, Scikit-learn, OpenCV.
- **Algorithms:** Graph-NN, DDPM, Transformers, Generative AI, LLM.

Selected Publications

- Jadhav, Y., Pak, P. and Farimani, A.B., 2024. LLM-3D Print: Large Language Models To Monitor and Control 3D Printing. arXiv preprint arXiv:2408.14307. (Under Review Nature Communications)
- Jadhav, Y. and Farimani, A.B., 2024. Large language model agent as a mechanical designer. arXiv preprint arXiv:2404.17525. (Under Review JMD)
- Jadhav, Y., Berthel, J., Hu, C., Panat, R., Beuth, J. and Barati Farimani, A., 2024. Generative Lattice Units with 3D Diffusion for Inverse Design: GLU3D. Advanced Functional Materials, p.2404165.
- Jadhav, Y., Berthel, J., Hu, C., Panat, R., Beuth, J. and Farimani, A.B., 2023. StressD: 2D Stress estimation using denoising diffusion model. Computer Methods in Applied Mechanics and Engineering, 416, p.116343.
- Jadhav, Y. and Barati Farimani, A., 2022. Dominant motion identification of multi-particle system using deep learning from video. Neural Computing and Applications, 34(20), pp.18183-18193.

PATENTS

- Jadhav Yayati, Spill Proof Utilities India 201641043950 A, 7th January 2017.