# YAYATI JADHAV

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## EDUCATION

**Carnegie Mellon University** — Pittsburgh, PA
Ph.D. Mechanical Engineering — Sep 2025
Thesis: Deep Generative Models for Accelerated Mechanical Design and Manufacturing
Advisor: Amir Barati Farimani

**Carnegie Mellon University** — Pittsburgh, PA
Master of Science in Mechanical Engineering — May 2020
Research: Soft Robotics

**Vellore Institute of Technology (VIT)** — Vellore, India
Bachelor of Technology in Mechanical Engineering — May 2015

## SKILLS

- **Programming:** Python, MATLAB, C++
- **Python Libraries:** PyTorch, Keras, TensorFlow, SciPy, Pandas, Scikit-learn, OpenCV, LangChain
- **Deep Learning:** Graph-NN, DDPM, Transformers, Multi-Modal Generative AI, LLM, GAN, VAE, DDPO.

## SELECTED PROJECTS

**Ph.D. Research** — Aug 2021 - Current
**Carnegie Mellon University** — Pittsburgh, PA

*AssembleD: Text driven Generative Assembly of 3D structures using DDPM*

- Developing a **CLIP-guided auto-regressive DDPM** model for text-driven assembly of both exact and non-exact parts, enabling **generative assembly** with contextual adaptability.
- Creating a dataset of mechanical assemblies with **detailed contextual text**, including part descriptions and functional attributes, to enhance AI-driven generative assembly.

*LinkD: Inverse Design of Mechanical Linkage Systems Using Latent Diffusion Models*

- Designed a **graph-based denoising diffusion framework (DDPM)** to synthesize mechanical linkages from end-effector trajectories.
- Achieved **70% successful generation rate for n-bar linkages**, ensuring that the generated designs form valid mechanical mechanisms with stable motion.

*LLM-3D Print: Large Language Models To Monitor and Control 3D Printing*

- Developed a **hierarchical multi-agent LLM framework** with LangChain for real-time defect detection and correction in 3D printing, improving process reliability.
- Designed an AI-driven**, in-situ monitoring system** for adaptive print parameter adjustments, **achieving 98% accuracy** in autonomous error mitigation.

*Generative Lattice Units with 3D Diffusion for Inverse Design: GLU3D*

- Developed a **3D denoising diffusion**-based model for inverse design of metamaterial lattice structures, achieving an R2 score of 0.86 in generating structures that match target stiffness moduli.
- Designed a novel scaling function for **DDPM** in 3D implicit fields, enabling direct generation of 3D models through diffusion-based sampling.

- Developed a new class of **TPMS-hybrid lattice structures**, leveraging non-linear transition functions to combine multiple TPMS configurations, offering **equivalent or enhanced strength** compared to conventional designs at low densities

*StressD: 2D stress estimation using denoising diffusion model*

- Developed StressD, a framework integrating a **U-net-based denoising diffusion model** and **vision transformer** network to predict von Mises stress distribution fields with **99% accuracy** in both elastic and hyper-elastic models, **reducing computational time by more than 55%** compared to traditional FEA simulations.

**MS Research** Aug 2018 – May 2020

*Application of stiffness tuning material in medical devices*

- 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.
- Developed a cTPE **deformation model** under magnetic force using **Elastica rod theory** by tracking shape changes with **optical flow in Python** to characterize material properties..

## PROFESSIONAL EXPERIENCE

**Carnegie Mellon University** Pittsburgh, PA

*Machine Learning Engineer (Research Assistant)* Jul 2020 – Aug 2021

- Developed framework to model **time-dependent differential equation** representing dominant motion of **multi-agent system** from high dimension video data by extracting latent vector using LSTM based variational autoencoder, for data drive model discovery.
- 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, air ducts, and cross-car beam for S-Class and C-Class prototypes in Siemens NX, **achieving 20% weight reduction**, while coordinating cross-functional teams and global suppliers for S-Class cockpit part readiness during prototype builds.
- **Invented spill proof utility concept** to isolates cup holder and other utilities from vehicle movement in 6 degrees of freedom.

## 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*)
- **Jadhav, Y**. and Farimani, A.B., 2024. Large language model agent as a mechanical designer. arXiv preprint arXiv:2404.17525. (*Under Review*)
- **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.