



Deepak Kumar

MS Research - Mechanical Engineering with AI/ML
 IIT Indore
 Projects Portfolio
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Summary:

Senior AI/ML Engineer blending deep learning with mechanical engineering to deliver production-grade solution and agentic design systems. 2+ years across industry with MS (Research) from IIT Indore; shipped end-to-end ML/GenAI/RAG pipelines and high-performance 3D physics AI models (GNN, PointNet, PINNs). Published research work achieving 95% accuracy for centrifugal-pump blockage fault classification based on signal processign. prior turbo-machinery design exposure at DRDO/GTRE; known for turning physics-rich datasets into reliable, measurable product impact.

ACADEMIC

DEGREE	INSTITUTE	CGPA / %	YEAR
MS (R)	IIT Indore	7.81	2024
BE	Nagpur Univ.	7.8	2018
XII	BSEB Patna	66.2	2013
X	BSEB Patna	75.8	2011

Programming - Tools/Skills

Python	Pandas	Numpy	DSA	Matplotlib
ML models (OpenCV/CNN) (InceptionV3, ResNet, EfficientNet, VGG16, AlexNet etc.)				MCP
EDA	PINN	PointNet	k3D	GNN
NLP	TF-IDF	GenAI	LLM	Plotly
AI agent/ Agentic AI		RAG	Git	Transformer
HuggingFace	Langchain	LangGraph	RestAPI	
Vector Database		Prompt Engineering		AzureAI Lab
Tensorflow	Pytorch	Keras	ML flow	Scipy
Scikit-learn	MySQL	Databricks	Docker	
SSH	MATLAB	MS Office	Llama	Chain
OpenAI models - O4mini, WishperX, gpt3.5-turbo				

Commercial Agents Skills

General purpose	ChatGPT/Perplexity
AI workflow (codes)	Codex/copilot/Qodo/Cursor.ai
Full stack backend frontend development	Replit/FigmaAI/lovable/bolt

Domain - Mechanical / Signal Processing

Centrifugal Pump	Turbulent Flow	CFD
Predictive analytics	Gas Turbine	Punch & Die
Product Design	Drafting	GD&T
Sheet Metal	Surface Modelling	BOM
Solidwork	UGNX10	CATIAv5
Teamcenter	OpenFoam	Creo2.0
Mechanical pipe routing	PLM	Signal Processing
Part Assembly	FFT	StarCCM+
	CWT	ParaView

EXPERIENCE

➤ CRI - Havells India Limited Senior Engineer - AI/ML

Sept. 2024 - Present
Noida, India

Project 1: AI Meta Model for CFD/CAE Pipeline

- Built a fully automated CAD-to-CFD prediction pipeline, integrating preprocessing, inference, and visualization. Leveraging architectures like GNN, PointNet and Physics-Informed Neural Networks (PINNs) to model 3D fluid dynamics, Thermal analysis and Modal analysis.
- Developed state of the art neural network architecture to predict the thermal distribution for Industrial LED light/semiconductor applications, reduces need of traditional CFD simulation. This AI meta model is to predict the junction temperature, Luminous flux, CCT, CRI etc. of LED so that along with thermal stability of the product light performance can be analysed.
- Modified deep learning networks for mechanical applications; created meta-model for ceiling fan aerodynamics analysing flow velocities, pressure distribution, mass flow rate, and efficiency to optimize design and reduce product development iteration time.
- Developing AI meta model to perform modal analysis for Lloyd AC application to reduced the noise, vibrations and increases the efficiency of the product.
- Planned and built DOE-based pipeline: experiment matrix design for simulation data generation, solver data extraction, data analysis, preprocessing, AI model training/evaluation, and UI prototyping; deployed surrogate AI models into production environments with CI/CD, monitoring, drift detection, and scheduled retraining in collaboration with IT teams.
- Collaborated with cross-functional product teams to identify CFD/CAE/Thermal pain points, scoped AI opportunities, defined data requirements, briefed on strategies/roadmaps, and presented implementation plans to stakeholders, accelerating AI adoption in manufacturing workflows.

Project 2: Agentic AI Solution for Automated CAD Generation

- Developing an Agentic AI solution using opensource GenAI models likes TinyLlama, Qwen2.5, gpt-oss-20B to automate CAD model generation and validate it through CFD, thermal, and structural analysis with integration of tools like FreeCAD/Blender. Built RAG workflow that handle components like custom agentic KB, context aware, multi-LLM orchestration, supervisor, prompt engineering etc.
- Designed conditional chains with MLP decision modules for simulation-informed CAD generation; built interactive frontend for query processing, visualization/download; deployed end-to-end pipeline on local server with DVC for datasets, MLflow/Langsmith logging, GitHub Actions/GitLab CI for CI/CD/testing/deployment/drift detection/retraining, and access controls for scalable collaboration.

➤ Gas Turbine Research Establishment - DRDO Graduate Apprenticeship Trainee

Nov. 2018 - Nov. 2019
Bengaluru, India

- Designed and optimized critical components for aircraft engines, demonstrating innovative and creative design in centrifugal compressors, volute casings., bearing housing, low-pressure filter, lay shaft, gears, bobbin, split flange, double eye flange, triangular flange/web, spacer, insert, elbow pipe, and over 300 parts for engine control systems.
- Contributed in the KAVERI, STFE, and GHATAK Engine projects, highlighting strong teamwork and professional conduct. My adaptability and technical acumen were crucial in optimizing design, reducing project timelines by 17% while maintaining ethical standards. My communicative skills were vital in coordinating with cross-functional teams, ensuring seamless project execution and adherence to industry standards.

Positions of Responsibility

➤ Training and Placement Manager, IIT Indore

(Mar. 2022 - Mar. 2024)

- Led a team to expand recruitment by strategizing company outreach, aligning with student aspirations, and employing innovative networking and training for enhanced placement results.

➤ Acting General Secretary/Academic Council Member, IIT Indore

(Apr. 2022 - Apr. 2024)

- Spearheaded event organization to enhance student exposure and master key skills such as public speaking, stage fear management, design thinking, etc through diverse competitions.

➤ ISOPARA Engineering Service Pvt. Ltd.

May 2018 – Nov. 2018

GET – Design Engineer

Pune, India

- Build 3D model of plastic moulds (dies, and punches) for Injection Moulding machines, facilitating the production of diverse products such as TV setup boxes, bottles, chairs, plastic handles, and various small objects, resulting in improved manufacturing efficiency and employing attentive detail to enhance product quality by 20%. Implemented Geometric Dimensioning and Tolerancing (GDT) principles to optimize design quality and manufacturability, resulting in a 28% reduction in production defects and a 15% increase in overall process efficiency.

➤ Freelancing Projects:

Locomotive Crew Audio Processing & Hinglish Transcription Pipeline

- Performed FFT (NumPy) to map broadband spectra, STFT (librosa) for time–frequency pattern extraction, and continuous wavelet transform (PyWavelets) to pinpoint transient interference. Designed and applied a 300–3400 Hz band-pass filter (SciPy) to suppress out-of-band noise (horns, track rumble, announcements) while preserving speech frequencies.
- Isolated human-speech segments (~10 % of raw audio) via webrtcvad/Silero VAD, then applied STFT-based spectral subtraction and filtering (librosa, NumPy) to maximize voice clarity pre-ASR. Utilized pydub and soundfile to split long-form recordings into 1–15 min chunks for efficient downstream processing.
- Converted cleaned voice segments to Hindi-English text using Azure Cognitive Services “Whisper” (requests) and/or OpenAI Whisper API. Leveraged OpenAI GPT-4 API to normalize punctuation, correct mixed-language errors, and standardize “Hinglish” formatting. Ran pyannote for speaker-turn detection, then merged diarization labels with ASR timestamps using pandas.

➤ Projects/Research Work

Fault Diagnosis of Centrifugal Pump using Machine Learning

(Dr. Pavan Kumar Kankar, IIT Indore)

MS Research, Aug. 2022 - July 2024

- Led innovative research to classify blockages in centrifugal pumps, focusing on blockages up to 87.5% in suction and discharge lines, to improve predictive maintenance and reduce industrial downtime.
- 3D Modelling of an entire pump system for visualisation. Conducted thorough exploratory data analysis, plots, and heat-maps to understand the relationships between different statistical features and fluid dynamics in the pump.
- Utilized advanced signal processing techniques, such as FFT and PSD analysis, along with Continuous Wavelet Transform (CWT), to identify key frequencies and generate time-frequency signal representations, facilitating accurate blockage faults classification using Deep CNN methods.
- Made changes to the architecture of the InceptionV3 Network and got 95% accuracy, which is 13% better than the original pretrained InceptionV3 Model. This was done to classify 35 centrifugal pump blockage faults conditions, and published this research work in Advanced Engineering Informatics, a Q1 Journal with 8 Impact Factor (<https://doi.org/10.1016/j.aei.2025.103181>).

Design and Optimization of Vertical Axis Wind Turbine

(Dr. Nitin K. Mandavgade, prof. Jayashri Lanjewar, Priyadarshini College of Engineering Nagpur)

BE, Aug. 2017 - Apr. 2018

- Applied cutting-edge CFD simulations to comprehensively analyse the vertical axis wind turbine’s performance under various environmental conditions and wind speeds.
- Build a turbine system tailor-made for coastal areas, where a minimum elevation of 50 feet ensures optimal wind flow, thereby enabling homes to autonomously generate essential electrical energy.