KOVARTHANAM MUTHUSAMY

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SUMMARY

ML & Robotics Engineer bridging intelligent systems and physical automation. Specializes in machine learning, computer vision, and autonomous systems, with hands-on experience building multi-agent architectures and LLM-driven pipelines (LangChain, AutoGen) alongside ROS-based robotic platforms. Focused on translating AI capabilities into reliable, real-world robotic behaviour.

SKILLS

- **Programming:** Python, C++, MATLAB, Rust, SQL
- **ML:** Pytorch, Tensorflow, Pandas, ML flow,TensorBoard Hugging face transformers, NumPy
- **Generative AI:** Langchain, Hugging face, REST API, RAG, AutoGen, LoRA fine-tuning, VLMs, Sentence-BERT, Claude Code
- **Robotics & Sensor Data:** ROS2, Gazebo, RViz, MoveIt2, Isaac Sim, SLAM, ABB RobotStudio, Sensor Fusion
- **Deployment**: FastAPI, Pydantic, Docker, GitHub Actions, CI/CD, Pytest, Ruff, Git, Linux
- **Computer Vision**: YOLOv8, Object detection, stereo vision, Point clouds, CNN
- **Data Analysis**: Statistical analysis, Time series analysis, Data visualization, Matplotlib, Prometheus
- **Database**: ChromaDB, SQL Lite, SQL Alchemy
- **Languages**: English (fluent), German (B1), Tamil (native)

EDUCATION

Technical University of Dortmund *October 2022 – November 2026*

Master of Science in Automation and Robotics *Dortmund, Germany*

- Specialization: Autonomous Robotics, Computer Vision, Machine Learning in industrial systems, Generative AI, AI-driven systems.

Sri Krishna College of Engineering and Technology **July 2017 – May 2021**

Bachelor of Engineering in Mechatronics *Coimbatore, India*

- Knowledge: Mechatronic systems, Embedded systems, Electrical & electronics systems, Robot manipulators, Sensor systems, C++, Mechanical design.

PROFESSIONAL EXPERIENCE

Technical University of Dortmund *May 2026 – November 2026*

Master's Thesis – Generative AI Surrogate Models for PCB Design *Dortmund, Germany*

- Developed a multimodal Product-of-Experts VAE in PyTorch as a generative surrogate that replaces slow physics simulations.
- Built gradient-based inverse design in the VAE latent space to meet a given performance target.
- Scaled training across multiple GPUs with PyTorch DDP and tracked experiments in MLflow.
- Made training fault-tolerant with checkpoint resume, gradient clipping and NaN guards.
- Deployed the model as a FastAPI inference service in Docker.
- Set up CI with pytest and GitHub Actions to test every code change.

Technical University of Dortmund *September 2024 – May 2025*

Group Research – Multi-Agent LLM Assistant for PCB Design *Dortmund, Germany*

- Built a multi-agent LLM system with a DeepSeek-R1 orchestrator in LangChain that routes requests to specialist agents.
- Fine-tuned DeepSeek-R1-Distill-Llama-8B with LoRA as the PCB domain-expert agent.
- Built a RAG pipeline on ChromaDB that routes each query to internal PDFs or live web search.
- Built structured tool calling with typed Pydantic schemas that turns free-text requests into validated eCADSTAR simulation parameters.
- Integrated a fine-tuned vision-language model as a sub-agent to interpret circuit diagrams and simulation plots.
- Owned the AI backend in a team project and connected it to the React front end.

Bull Machines Pvt Ltd - Plant 1 *March 2021 – February 2022*

Robotics Engineer *Coimbatore, India*

- Developed offline welding programs in ABB RobotStudio and validated them on the production robot via the teach pendant.
- Integrated a second positioner so welding and part loading ran in parallel, eliminating robot idle time.
- Built a C++ tool that generated weld-path data and program parameters for new part variants, reducing manual programming.

HYDAC, India *January 2019 – May 2019*

CAD design Intern *Coimbatore, India*

- Created 3D models of hydraulic components and assemblies in SolidWorks from 2D drawings.

PROJECTS

Object Detection using Sensor Fusion for Autonomous Vehicles **April 2024 – August 2024**

Technical University of Dortmund *Dortmund, Germany*

- Built a camera–LiDAR–radar sensor-fusion network in PyTorch for 3D object detection.
- Used a YOLOv8 backbone to extract image features for the camera branch.
- Processed LiDAR and radar point clouds with Open3D.
- Fused the modalities at the feature level to improve robustness over single-sensor detection.
- Trained and evaluated it on the full nuScenes dataset using the nuScenes devkit.
- Integrated the pipeline with ROS2 and visualized detections in RViz.

Personal Cashflow Forecasting Assistant *Personal Project | 2026*

- Built a Python and Streamlit app that forecasts cash flow from Sparkasse bank exports.
- Selected the forecasting model automatically through rolling backtests.
- Quantified the risk of a cash shortfall with Monte Carlo simulation.
- Built a versioned SQLite data layer with SQLAlchemy and Alembic migrations.
- Covered the code with 31 automated tests running in GitHub Actions.