

# THABSHEER JAFER MACHINGAL

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<https://www.linkedin.com/in/Thabsheer-Jafer/> <https://thabsheerjm.github.io>

## EDUCATION

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<b>Worcester Polytechnic Institute</b> <i>Master of Science in Robotics Engineering</i>	Jan 2022 – Dec 2023 Worcester, MA, USA
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*Relevant Coursework:* Robot Dynamics, Robot Control, Artificial Intelligence, Computer Vision, Reinforcement Learning, Natural Language Processing, Motion Planning, Deep Learning (audited).

<b>Kerala Technological University</b> <i>Bachelor's in Mechanical Engineering</i>	Aug 2017 – May 2021 Kerala, India
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## RESEARCH INTEREST

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Investigating model-based learning strategies for robust sim-to-real transfer in contact-rich manipulation and long-horizon planning, with a parallel focus on advancing the fundamental neural mechanisms underlying robot perception and control.

## RESEARCH EXPERIENCE

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<b>Apex Microdevices - R&amp;D</b> <i>Deep Learning Research Engineer</i>	Feb 2024 – Present Dayton, OH
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- Prototyped an end-to-end ML framework that generates optimized, high-transmission, and achromatic metalens designs using custom-built merit functions and physics-informed neural networks.
- Designed task-specific machine learning models (CNNs, LSTMs, VAEs) to accelerate inverse metasurface design, enabling data-efficient exploration of complex design spaces.
- Parallelized RCWA simulations across distributed CPU clusters using MPI, achieving near-linear speedup for high-resolution EM workloads.
- Built scalable, object-oriented training pipelines and model infrastructure for end-to-end experimentation, deployment, and monitoring in deep learning–driven design workflows.

<b>Worcester Polytechnic Institute</b> <i>Research Assistant</i>	Jan 2023 - Dec 2023 Worcester, MA
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### Manipulation & Environmental Robotics Lab

- Built a simulation tool to procedurally generate 27 randomized benchmark pile configurations, reducing manual setup time and enabling robust performance benchmarking in cluttered environments.
- Achieved 82% - 96% success rate in simulated object rearrangement tasks by leveraging density estimation, PCA, and KMeans clustering for non-prehensile manipulation planning.
- Developed and deployed a sim2real pipeline using Unity and ROS, which consistently transferred rearrangement policies to a physical Franka Manipulator with reliable performance.

### Vision, Intelligence, and System Laboratory (ViSLab)

- Improved point cloud processing using an encoder-decoder network architecture, achieving a 10% performance increase over state-of-the-art methods (at the time) in 5+ ShapeNet benchmark categories.
- Conducted ablation studies on PCN and PointNet++ to isolate the impact of self-supervised embeddings, demonstrating their efficacy in enhancing point cloud completion accuracy.
- Developed a CUDA-accelerated Chamfer loss function for hyperbolic neural networks, boosting training efficiency and precision in point cloud completion tasks.

## INDUSTRY EXPERIENCE

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### Agot Co. (acquired by HME)

Computer Vision Intern

May 2023 - Aug 2023

Pittsburgh, PA

- Designed and deployed an AI event detection system using OpenAI's GLIP model to identify anomalies (e.g., kitchen fires, missing safety gear) from RTSP camera streams in real time.
- Implemented a prompt-based vision-language detection pipeline using OpenAI's API, Dockerized for Jetson devices, and integrated with automated email alerting and daily summaries for store managers.
- Enabled end-of-day incident reporting by generating highlight reels and uploading critical event clips to Google Drive, improving store visibility and operational safety for remote restaurant locations.
- Built a real-time facial and pose embedding framework over RTSP streams for employee tracking, with feedback-based refinement and cloud API integration for identity management.

## PUBLICATIONS

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- Thabsheer Jafer. Design Considerations of Anthropomorphic Exoskeleton. 2020.  
<https://api.semanticscholar.org/CorpusID:247717198>

## RELEVANT PROJECTS

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### Atari-Breakout (DQN)

[GitHub]

- Trained a deep Q-learning agent in PyTorch to play Atari Breakout via OpenAI Gym, using experience replay and separate target networks for stable Q-value updates.
- Reached a peak reward of 78 and a mean score of 40 after 15 million training steps.

### Off-road Terrain Segmentation for Autonomous Navigation

[GitHub]

- Designed and trained a real-time DeepLabv3+ model with MobileNetV3 for off-road traversability estimation using only monocular RGB data from the GOOSE dataset; achieved high segmentation accuracy with a custom PyTorch pipeline and binary mask conversion.
- Exported the model to ONNX and deployed it into a C++ inference pipeline using ONNX Runtime and OpenCV, packaged as a .deb installer for seamless integration into AGV platforms operating in unstructured environments.

### Semantic Mapping

[GitHub]

- Built a high-definition map of a LIDAR point cloud using a variant of the Iterative Closest Point (ICP) algorithm from the KITTI-360 dataset.
- Integrated semantic labels from RGB images using a semantic segmentation neural network, achieving precise semantic mapping for dynamic environments.

### Dynamic Obstacle Avoidance & Path Planning in a Hospital Environment

[GitHub]

- Collaborated in a team of three to develop a hospital simulation environment in Unity, connected to ROS, for evaluating real-time motion planning strategies in dynamic and constrained environments.
- Implemented and tested D\* Lite, Hybrid PRM, and Spline-based DWA algorithms on a mobile robot for collision-free navigation around dynamic obstacles, such as staff and equipment.
- Conducted a comparative analysis across planning approaches on metrics such as safety, completeness, optimality, and runtime; presented findings to highlight planning trade-offs in healthcare robotics.

### Neural Radiance Fields (NeRF)

[GitHub]

- Implemented a NeRF pipeline from scratch on the Lego dataset using PyTorch, including custom data loader, MLP-based radiance field, stratified ray sampling, and volumetric rendering.
- Trained the model on multi-view images with known poses to synthesize photorealistic novel views; achieved smooth 360° renderings by optimizing a 5D scene representation over RGB image loss.

## SKILLS

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**Core:** Python, C++, PyTorch, ROS 2, OpenCV, CUDA

**Support:** Linux, Docker, Git, Jenkins, CI/CD

**Simulation:** MuJoCo, Isaac Sim, Bullet, Gazebo, Unity, CARLA