

# Debargho Basak

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Google Scholar: <https://scholar.google.com/citations?user=FyCMs2IAAAAJ&hl=en&authuser=1> | [github.com/Debargho99](https://github.com/Debargho99)

## FULL STACK DATA SCIENTIST/MACHINE LEARNING ENGINEER

### PROFESSIONAL SUMMARY

- Accomplished **Machine Learning Engineer** with extensive experience in designing and implementing advanced neural network architectures
- Proven track record in developing state-of-the-art systems for multi-modal 3D Perception and Natural Language understanding and generation tasks
- Expertise in integrating cutting-edge technologies such as **Vision Transformers, Large Language Models, multimodal data fusion, and CUDA-based parallel computing**
- Demonstrated success in optimizing computational algorithms and deploying scalable solutions on cloud (**AWS,GCP**) using containerization tools (**Docker, Kubernetes**)
- Proven ability to curate large datasets, optimize model training, and improve model performance through quantization and high-performance computing methods

### CORE COMPETENCIES

- Deep Learning
- Computer Vision
- Natural Language Processing (NLP)
- Data Curation & Pre-processing
- Model Optimization
- Cloud Computing & Deployment
- Continuous Integration/ Continuous Deployment (CI/CD)
- Technical Communication

### KEY RESULT AREAS

- Model Development:** Designing, implementing, and optimizing deep learning models for both computer vision and natural language tasks
- Data Preparation:** Pre-processing and curating large datasets for training and evaluation
- Algorithm Research:** Staying up-to-date with the latest research in deep learning, and applying novel techniques to improve model performance
- Deployment:** Developing and maintaining scalable solutions for deploying ML models in production environments
- Evaluation:** Conducting rigorous testing and evaluation of ML models, using metrics to ensure accuracy, robustness, and fairness
- Documentation:** Documenting model architecture, training processes, and evaluating results to ensure reproducibility and knowledge sharing within the team

### EDUCATION

**M.Sc. (Computer Science)** from Technische Universität München, Munich, Germany **2024**

**Thesis:** Advancing 3D Object Tracking: Deep Neural Network Framework for Re-Identification and Motion Estimation using Radar, Camera *Thesis submitted to BMVC (British Machine Vision Conference) 2024*

**B.E. (Instrumentation and Control- Minor in Electronics and Robotics)** from University of Delhi, New Delhi, India **2021**

**Thesis:** [Comparative Analysis of Intelligent Classifiers for Seizure Detection Using EEG Signals](#), published at ICACIT 2021

### PROFESSIONAL EXPERIENCE

**NXP Semiconductors, Hamburg, Germany**

**Sep 2024 - Present**

**Machine Learning Engineer**

- Developing radar-based ADAS scene understanding Machine Learning models for NXP, implementing low-latency, hardware-aware pointwise vision transformer model that includes a 5x5x5 (voxel) neighborhood feature extractor for detecting static and dynamic targets, class information, and Instance IDs. Real-time radar processing streamlined on ARM-based processors using ARM Compute Library, OpenCL, and NEON SIMD, achieving efficient and high-performance radar scene understanding
- Utilizing a BEV representation where radar points are projected onto a grid and processed with multi-head self-attention to capture key spatial dependencies. This attention-based approach strengthens object detection, tracking, and classification accuracy, enhancing situational awareness for ADAS applications
- Optimized radar machine learning workflows for edge devices, leveraging deep learning frameworks like PyTorch and TensorFlow with advanced features such as XLA and ATen ops for efficient model execution, ensuring real-time scene analysis even under hardware constraints
- Collaborating with silicon and cross-functional teams across timezones (US & Europe) to align radar transformer architectures with radar hardware for robust, real-time multi-sensor applications
- Supporting patent applications related to radar transformer models and multi-sensor fusion technologies, reinforcing NXP's position in advanced autonomous sensor perception solutions for ADAS and autonomous vehicle applications

**MAN Truck & Bus SE, Munich, Germany**

**May 2023 - Jul 2024**

**Computer Vision Engineer**

- Utilized CUDA-based parallel computing to accelerate real-time sensory data processing, object detection and implemented high-performance computing techniques to enhance multimodal perception software stack (Camera, Radar)
- Achieved robust depth estimation by developing a low-latency, high-frequency neural network architecture tailored for exploiting camera images and weak radar supervision
- Achieved a 20% reduction in data processing time by employing GPU programming and distributed computing frameworks (Apache Spark) to optimise computational algorithms for 3D perception tasks

- Ensured scalable deployment by enhancing system performance through high-performance computing environments, including parallel computing, cloud-based computing (AWS), and containers (Docker, Kubernetes)
- Supported the rapid analysis of large datasets by engineering a cohesive data ecosystem by integrating SQL and NoSQL databases for efficient data storage and retrieval
- Demonstrated the effectiveness of the approach on the nuScenes dataset (>1TB) by surpassing state-of-the-art baselines by an impressive 2% margin
- Integrated the proposed neural network module into the perception stack's feature backbone
- Optimized deployment pipelines using TensorRT and C++, by implementing comprehensive code reviews and rigorous testing procedures to ensure high reliability and performance

## CONVAISE A.G, Munich, Germany

May 2022 - Sep 2022

### Natural Language Processing Researcher

- Developed a novel NLP model using Bayesian inference for sentence clause separation in English and German, tailored for tax and financial auditing software.
- Achieved a 15% improvement in sentence parsing accuracy by combining the latest research in Text Simplification and Open Information Extraction with the T5 transformer and a novel decoder architecture
- Utilized advanced data pre-processing and augmentation techniques (Hadoop MapReduce and Back-Translation) to optimise model training
- Procured and curated a custom dataset of 50,000 samples (>320 GB) each in German and English for the training model
- Achieved a 30% reduction in model size and 25% increase in inference speed by implementing model quantization with the ONNX framework
- Performed extensive unit and load testing to ensure seamless and efficient system operations by deploying the solution code stack to Google Cloud Platform using Docker containers and Kubernetes

### TECHNICAL SKILLS

<b>Languages:</b>	Python, C++, R, JavaScript, MATLAB, Java, ROS 2, SQL
<b>Tools and Frameworks:</b>	PyTorch, Hugging Face, Keras, OpenCV, SpaCy, JAX, CUDA, ONNX, Apache Spark, Hadoop
<b>Operating Systems:</b>	Linux, Microsoft Windows, Ubuntu
<b>Deployment Tools and Version Control:</b>	Git, Docker, Kubernetes, FastAPI, TensorRT
<b>Cloud:</b>	GCP, AWS S3, AWS EC2
<b>Networks and Approaches:</b>	CNN, Vision Transformers, PointNet++, MLPs, LLMs, LSTMs

### ACCOLADES

- Bagged a merit certificate from the Ministry of Education for achieving 96.4% in A-level exams and achieved rank in the top 5 percentile of Haryana
- Graduated as valedictorian and was elected student council representative at the University of Delhi
- Volunteered as a Math Tutor for Ukrainian and Syrian refugee children in München Landeshauptstadt

### PUBLICATIONS

- Singh, A., Basak, D., Das, U., Chugh, P., & Yadav, J. (2022). A Comparative Analysis of Intelligent Classifiers for Seizure Detection Using EEG Signals. In *Advanced Computing and Intelligent Technologies: Proceedings of ICACIT 2021* (pp. 577-591). Springer Singapore
- Basak, D., Wolters, P., & Rigoll, G., Prof. Dr. (2024). Advancing 3D Object Tracking: A Deep Neural Network Framework for Re-Identification and Motion Estimation using Radar and Camera [Master's Thesis, Technical University of Munich]

### PROJECTS UNDERTAKEN

<b>Project:</b>	Segment Anything NeRF	<b>Duration:</b>	Apr 2023 – Sep 2023
<b>Link:</b>	<a href="https://github.com/Debargho99/Segment-Anything-NeRF">github.com/Debargho99/Segment-Anything-NeRF</a>		
	<ul style="list-style-type: none"> <li>• Developed an algorithm that integrates Segment Anything with NeRF, enabling locking of 3D objects for various views and segmenting in 3D using language and point prompts</li> <li>• Incorporated language prompts through ClipSeg and SAM fusion, and replaced SAM and ClipSeg image encoders with a volumetric rendering process, reducing encoding time by 10%</li> <li>• Improved mask quality by using and aggregating patch-based renderings based on neighbouring features to compensate for lost inner interactions</li> </ul>		
<b>Project:</b>	LLM-ConvRec	<b>Duration:</b>	Apr 2023 – Sep 2023
<b>Link:</b>	<a href="https://github.com/Debargho99/LLMConvRecSys">github.com/Debargho99/LLMConvRecSys</a>		
	<ul style="list-style-type: none"> <li>• Developed a prompt-based conversational system using LLMs for seamless interaction and enhanced recommendation algorithm with LLMs and user input for dynamic updates.</li> <li>• Improved text generation speed by 8% while maintaining key context and implemented information retrieval with late attention fusion for effective query response.</li> </ul>		

### PERSONAL DETAILS

**Languages Known:** English (C1), German (B2), Dutch (B1), Hindi (C1), Bengali (C1)

**Date of Birth:** 15.11.1999