Karan Shah

M.Sc. , German Aerospace Centre

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EXPERIENCE

Software Developer - Autonomous Driving
German Aerospace Centre (DLR) - Institute Systems Engineering for Future Mobility
03/2024 – present Oldenburg, DE

- Designed and integrated simulation pipelines using SUMO (Simulation of Urban Mobility) and CarMaker, enabling detailed scenario testing for cooperative transport systems.
- Conducted research on distributed learning intelligence and cooperative traffic management, resulting in a 15% improvement in simulation accuracy for safety-critical scenarios.
- Created custom evaluation metrics in Python to assess the trustworthiness and robustness of autonomous systems in diverse environments, validating functionality across over 17 simulated traffic scenarios.

Research Assistant - Autonomous Driving
TUM - Chair of Traffic Engineering and Control
09/2022 – 02/2024 Munich, BY, DE

- Developed a digital twin of the city of Ingolstadt, Germany by integrating data from various GIS sources, using ArcGIS CityEngine, Blender, and Unity3D to create a realistic 3D urban environment.
- Modeled traffic dynamics using the SUMO traffic simulator, enabling accurate simulations of lane-based and lane-free scenarios for autonomous vehicle testing.
- Conducted a user study on a high-fidelity driving simulator to analyze participant responses and behavioral data to assess safety, efficiency, and comfort perceptions of autonomous mobility.

Internship - Business Analyst
BMW Group
03/2022 – 07/2022 Munich, BY, DE

- Developed and implemented a comprehensive customer feedback processing system using Big Data technologies, resulting in a 7% increase in customer satisfaction ratings.
- Designed and executed a clustering pipeline for document analysis, resulting in a 15% reduction in processing time for customer feedback.
- Collaborated with cross-functional teams to launch the new-7 series (2022) across Europe and North America, resulting in over 10% increase in CSAT levels across dealerships within the first month of sales as compared to previous iterations.

Research Assistant - Reinforcement Learning
TUM - Chair of Modelling and Simulation
03/2021 – 03/2022 Munich, BY, DE

- Developed a novel approach to modeling agent-agent and agent-environment interaction in real-world 3D environments using Unity 3D
- Integrated Unity ML Agents with Open AI Gym to enable seamless multimodal navigation behavior learning, improving model performance by 20%.
- Designed and implemented scalable infrastructure for large-scale data collection, enabling the collection of over 1 million data points for training and validation.

Business Analyst
Quantiphi Analytics
07/2019 - 02/2020 Mumbai, MH, IN

- Collaborated with dedicated regional teams to implement computer vision technology, reducing customer complaints by 25% and increasing overall satisfaction.
- Conducted A/B testing on pricing strategies using user behavior findings, resulting in a 3% increase in revenue for the company.

EDUCATION

M.Sc. Informatics
Technische Universität München 2020 - 2023
Computer Vision, Machine Learning, Motion Planning for Autonomous Vehicles,
Crowd Modelling & Simulation, Autonomous Driving, Math for Imaging and Visualization

B.E. Computer Engineering
Mumbai University 2015 - 2019
Analysis of Algorithms, Data Structures, Machine Learning, Structured Programming Approach,
Software Engineering, Operations Research, Artificial Intelligence, Cloud Computing

PROJECTS

Master-Thesis: Unraveling Topology of Dynamic Neural Networks
Keywords: Control Theory, Differential Calculus, Deep Learning, PyTorch, Python

- Conceptualize Dynamic Neural Networks (DNNs) to represent a system of nonlinear differential equations whose parameters are to be tuned. These equations represent the state space of any LTI system.
- Introduce a mapping from the state space matrices to the topology of the DNNs and to train the network using reverse mode differentiation

Crowd Modelling and Simulation of the extended SIR model using OpenAI and Unity3D
Keywords: Unity3D, Dynamical Systems, Linear Algebra, C#, Reinforcement Learning, OpenAI, Gym

- Created a compartmental model in Unity3D implementing an extended SIR model (with vital dynamics + biological factors)
- Modeled different urban environments and simulated movement of population in different scenarios
- Used OpenAI Gym to train a RL-model to get the agents in the environment to learn social distancing

Trajectory Extraction and Pose Estimation of moving traffic using Detectron2 (Meta)
Keywords: Object Detection, Tracking, Computer Vision, Python, Detectron2, Trajectory Extraction

- Configured and Trained a deep learning model (detectron v2) for object detection and tracking (trajectories of cars, buses, trucks, motorcycles, bicycles and unknown objects)
- Ran benchmark tests on the Munich Highlight Tower Dataset with state-of-the-art accuracy
- Added a trailer/double-detection processor to improve generated trajectories for vehicles with trailers and container cargo based on relative position and velocity.

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PUBLICATIONS

P. Sonawane, K. Shah, P. Patel, S. Shah and J. Shah, "Speech To Indian Sign Language (ISL) Translation System," 2021 International Conference on Computing, Communication, and Intelligent Systems (ICCCIS), Greater Noida, India, 2021, pp. 92-96, doi: 10.1109/ICCCIS51004.2021.9397097.

SKILLS

Product Design, Storytelling, Machine Learning, Deep Learning, Driving Simulators, Game Engines.
My research interests include crowd modelling and simulation, dynamical systems, chaos and number theory.
I am fascinated by the distribution of prime numbers and the Goldbach's conjecture.