Ekagra Gupta

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Profile

Master's student at Universität Stuttgart, specializing in machine learning, perception models, and signal processing. I have gained practical experience through projects at Bosch, DaimlerTrucks AG, and Fraunhofer IPA, where I focus on perception models, data-driven analysis, and API integration. My recent research involves a thorough evaluation of adversarial robustness in machine learning classifiers. I thrive in dynamic environments and am passionate about tackling new challenges in computer vision and artificial intelligence.

Areas of Expertise

Machine Learning - Research and Evaluation - Software Development - Simulation and Modeling - Data Analysis - Autonomous Systems - Engineering Tools - Platforms and Systems

Professional Experience

Praktikum, *(Bosch Center for Artificial Intelligence)* **Renningen, DE** *11/2023 - 04/2024*

- Evaluation and analysis of tools for perception models.
- Applied common corruptions and instance manipulations, including consistent object scaling, to the nuScenes dataset for autonomous driving.
- Ensured instance manipulation maintained consistency with one object per scene, based on provided masks for all objects.
- Evaluated the altered nuScenes dataset using StreamPETR, FAR3D, and both static and temporal configurations of FIERY models to analyze their behavior and identify corner cases.

Werkstudent im bereich (e)Powertrain, *(DaimlerTrucks AG)* **Stuttgart, DE** *02/2023 - 10/2023*

- 08 hours/week.
- Improving the simulation software, focused on MoLaSim, an in-house tool utilized for fundamental engine mount analysis.
- Through VBA scripting to enhance analysis capabilities and user interface, the software was upgraded, resulting in a more sophisticated and user-friendly tool that has brought tangible benefits to the team.
- The data and model export process in Simpack (a multi-body simulation tool) was streamlined and optimized through the creation of custom Python scripts, enhancing efficiency and data accuracy in daily operations.

Studentische Hilfskraft, *(Fraunhofer IPA)* **Stuttgart, DE** *04/2023 - 09/2023*

- 12 hours/week.
- Utilized public data sources for model training and collaborated on Python-based dashboard implementation for transport route monitoring using Google Maps API, expanding its functionalities, and documenting results comprehensively.
- Independently developed an innovative approach for route planning.

Studentische Hilfskraft, *(Greenteam Uni Stuttgart)* **Stuttgart, DE** *11/2022 - 03/2023*

- 20 hours/week.
- As a part of the collegiate Formula Student Electric Team, I contributed to the development of a driverless race car for international competitions.
- My responsibilities included estimating the vehicle poses using perception data, developing the vehicle's localization using C++ and ROS2, and mapping using the landmark-based pose-graph method.

Studentische Hilfskraft der Universität, *(Universität Stuttgart IPV)* **Stuttgart, DE** *01/2022 - 09/2022*

- 20 hours/week.
- Designing Equivalent Circuit Models of Li-ion batteries using MATLAB/Simulink.
- Conducted estimation of SOC and SOH degradation of a cell using various algorithms.
- Characterized Li-ion cells at different temperatures and parameterized them using the DRT of synthetic EIS data.

Publications

Towards a Practical Evaluation of Adversarial Robustness of Machine Learning Classifiers
In proceeding IMECE 2024

- Developed a comprehensive method to assess the adversarial robustness of machine learning image classifiers.
- Estimated upper and lower bounds of adversarial distance through iterative attacks and certification approaches.
- Included visualizations and ablation studies to provide insights into evaluation methodologies and parameter settings.
- Demonstrated effective adversarial attack implementation, with noted limitations in the certification method.
- Contributed to more informative evaluations of classifier robustness in real-world applications.

Design of Circularly polarized irregular octagonal shaped and dumbbell slotted planar and conformal patch antenna
SCI 2021

- The paper presents a simulation study on circularly polarized planar and conformal patch antennas with irregular octagonal and dumbbell slot shapes.
- The objective was to achieve a satisfactory impedance mismatch bandwidth and axial ratio bandwidth.

Education

MSc Electrical Engineering *Universität Stuttgart* **Stuttgart, DE** *2021-Current*
Relevant Courses: Detection and Pattern Recognition, Advanced Mathematics for Signal and Information Processing, Deep Learning, Statistical and Adaptive Signal Processing, Software Engineering for Real-Time Systems, Matrix Computation in Signal Processing and Machine Learning, Battery Modelling and Energy Management
Lab: MRT Hardware Design

BTech Electronics and Communication Engineering *GGSIP University (MAIT)* **Stuttgart, DE** *2017-2021*
Relevant Courses: Digital Signal Processing, Signals and Systems, Microwave Engineering, Microwave Engineering Management

Skills

- **Programming Languages:** Python, MATLAB, VBA, C++
- **Software and Libraries:** Git, IBM Spectrum LSF, PyTorch, TensorFlow, Simulink, CST Design Studio
- **Web Development:** Flask, StreamLit
- **Operating Systems:** Linux, ROS2 (Robot Operating System)
- **CAD and Design Tools:** Autodesk Fusion 360, SolidWorks, CubeIDE, SIMPACK, Arduino IDE
- **Data Science:** Image Processing, Object Detection, Feature Extraction, Transfer Learning, Data Augmentation
- **Productivity Tools:** Microsoft Office (all)

Projects

Structured Comparison of Metrics to Evaluate the Robustness of Image Classification Models. (Forschungsarbeit)
github.com/forschungsarbeit

- This project focuses on metrics for image classifier robustness, such as adversarial and corruption robustness, Lipschitz continuity, and formal verification.
- It includes implementing at least two image classifiers on a chosen benchmark dataset to validate the results using Pytorch.

F450 Quadcopter (Major Project)

- The project objective was to construct a stable Quadcopter that possesses F450 traits and has the ability to transport a CO 2 -containing package, such as a fire extinguisher, to the site of an emergency.

Ultra Wideband Antenna (Minor Project)

- Circular polarization was the objective for an ultra-wideband antenna, which was simulated using CST Microwave Studio.

Languages

- **Hindi** [Native]
- **English** [Proficient]
- **German** [Basic] - Learning (A2)