

# Bibek Poudel

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## Research

- **EnduRL: Enhancing Safety, Stability, and Efficiency of Mixed Traffic Via RL** *IROS 2024*  
Measures the Safety, Stability, and Efficiency of car-following models under real-world driving behaviors. Devised an RL vehicle that incorporates neural network classifier to predict congestion early, **improving safety and efficiency up to 54%**.
- **AutoJoin: Efficient Adversarial Training against Gradient-Free Perturbations for Robust Maneuvering** *IROS 2024*  
Augmentation technique for natural corruptions (rain, snow, fog etc.) in Computer Vision based perception in autonomous cars (models: ResNet50, end-to-end CNN from Nvidia) with **improvement in steering angle prediction upto 300%**.
- **CARL: Congestion-Aware RL for Imitation-based Perturbations in Mixed Traffic Control** *IEEE CYBER 2024*  
Addresses the *sim-2-real* gap in modeling real-world human driving behaviors in traffic simulation by combining imitation learning and probabilistic sampling. **Nominated to "Best paper in the conference" award.**
- **Mixed Traffic Control and Coordination from Pixels** *ICRA 2024*  
Simplified observations in autonomous cars by using bird's-eye view camera, instead of road sensor networks. In mixed traffic control, demonstrated performance similar to perfect observations with **8% improvement in highway merging.**
- **Can ChatGPT Enable Intelligent Transportation Systems? The Case of Mixed Traffic Control via RL** *ITSC 2023*  
User study with 70 participants to determine the efficacy of OpenAI's GPT-4 in assisting novices in RL. **GPT-4 increases new metrics utilization by 363%**, and in certain scenarios performance of Novices + GPT-4 is better than expert.
- **Efficient Quality-Diversity Optimization through Diverse Quality Species** *GECCO 2023*  
A **novel genetic algorithm with state-of-the-art sample efficiency** in simulated quality-diversity robotic environments. Eliminates the need for maintaining computationally expensive predefined data structures.
- **Learning to Control DC Motor for Micromobility in Real Time with Reinforcement Learning** *ITSC 2022*  
Steering angle control of DC motor in simulation and in hardware (attached to a golf-cart). Used NFQ algorithm to learn a **control policy from scratch in 1 minute 35 seconds** in simulation and in 10 minute and 35 seconds in hardware.
- **Black-box Adversarial Attacks on Network-wide Multi-step Traffic State Prediction Models** *ITSC 2021*  
Demonstrated adversarial vulnerabilities of deep learning based network-wide traffic state prediction models, **degrading their performance upto 54%**. Demonstrated that traditional modeling techniques offer higher robustness.

## Skills

**Programming:** Python, Java, C++, Ruby on Rails

**Libraries & Frameworks:** PyTorch, TensorFlow, Keras, HuggingFace, Weights & Biases, NumPy, Scikit-Learn, Pandas, Matplotlib, Seaborn

**Data Science:** Data cleaning, exploration, visualization, and statistical analysis

**Tools:** Git, Docker, Conda, LaTeX

## Education

**Ph.D. in Computer Science**

University of Tennessee

GPA: 3.83/4.0

Coursework: Foundations, Advanced Software Engineering

2023–Present

Knoxville, TN

**M.S. in Computer Science**

University of Memphis

GPA: 4.0/4.0

Coursework: Artificial Intelligence, Machine Learning, Reinforcement Learning, Software Engineering

2019–2023

Memphis, TN

## Projects

- **DocuMint: Docstring Generation for Python using Small Language Models** (*Report*) *2024*  
Benchmarked small language models on the quality of their generated docstrings, created a fine-tuning dataset using the FOSS ecosystem, and fine-tuned Google's CodeGemma. Released the dataset and the fine-tuned model in HuggingFace.
- **Artificial Intelligence Assignments** (*Repository*) *2023*  
Developed and conducted programming assignments for graduate level AI and ML courses at University of Memphis and University of Tennessee. Topics include Deep Q Networks, Proximal Policy Optimization and Finetuning of a Transformer.
- **BarterBaron** (*Demo*) *2022*  
Engineered an eBay-like commerce platform based on barter system using Ruby on Rails with features like chat, search, and secure user authentication. **Won "Best project in the class" award**, Software Engineering, University of Memphis.
- **Robustness to Input Corruptions and Adversarial Examples in Steering Angle Prediction** (*Video*) *2022*  
Used self-supervised learning to enhance robustness of computer vision models in steering angle prediction, under natural disturbances to camera such as rain, snow, fog, frost, pixelation, and blur.
- **Distributed Hyperparameter Tuning of Neural Networks.** *2021*  
Accelerated the hyperparameter tuning (grid and random search) of Multi Layered Perceptrons by upto 80%. Paralellized search objective using Distributed Hash Table, utilizing computational resources in multiple nodes.
- **Latent Representation of Inputs: A Defense Against Adversarial Examples in Deep Q Networks.** (*Report*) *2021*  
Used feature squeezing to improve the adversarial robustness of DQN algorithm trained to play Atari Pong.