# Bibek Poudel

1309 Forest Avenue – Knoxville, TN, 37916 – USA

+1 (901) 550 1546 bibek.poudel@icloud.com poudel-bibek.github.io poudelbibek

## Research

**Summary:** Perception and control of autonomous cars with an emphasis on safety and efficiency. Mixed traffic coordination using Reinforcement Learning (RL) and Computer Vision. Robustness evaluation of deep learning systems in transport.

- EnduRL: Enhancing Safety, Stability, and Efficiency of Mixed Traffic Via RL *In Submission*
  A RL framework that integrates real-world driving behaviors into traffic simulation. By incorporating a neural network classifier that predicts congestion in the near future based on present observations into autonomous cars, demonstrated an **improvement in safety and efficiency up to 55%.**
- AutoJoin: Efficient Adversarial Training against Gradient-Free Perturbations for Robust Maneuvering *In Submission*
  State-of-the-art image augmentation technique against disturbances in Computer Vision based perception (such as rain, snow, and fog) in autonomous cars (models: ResNet50, end-to-end CNN from Nvidia) with **improvement in steering angle prediction upto 300%.**
- 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 Intillegent 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** *2023–Present*
*University of Tennessee* *Knoxville, TN*
GPA: 3.83/4.0
Coursework: Foundations, Advanced Software Engineering

**M.S.in Computer Science** *2019–2023*
*University of Memphis* *Memphis, TN*
GPA: 4.0/4.0
Coursework: Artificial Intelligence, Machine Learning, Reinforcement Learning, Software Engineering

## Projects

- DocuMint *Present*
  Fine-tuned Small Language Models (Gemma from Google and Llama from Meta) for automated docstring generation. Study emergent properties and perform user preference ranking.
- Artificial Intelligence Assignments *(Repository)* *2023*
  Developed and conducted programming assignments for graduate level AI and ML courses at University of Memphis. 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.
  Used the Ruby on Rails framework and implemented features including 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 Hyperparamter 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.