Neeloy Chakraborty

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Goal: Pursuing career advancement in the field of human-centered autonomy and safe autonomous systems.

Education:

- **University of Illinois at Urbana-Champaign** — Exp. May 2026
  MS/PhD in Electrical and Computer Engineering (Robotics and Artificial Intelligence Discipline) — GPA 3.83/4.00
  Bachelor of Science in Computer Engineering — GPA 3.75/4.00

Current Research Projects:

- **Koopman Models for Reinforcement Learning** — Summer 2022 – University of Illinois
  Advisors: Dr. Kaushik Balakrishnan, Dr. Devesh Upadhyay, and Professor Katherine Driggs-Campbell
  Exploring benefits of combining Koopman theory with model-based reinforcement learning in complex environments.

- **Co-operative Congestion Mitigation** — Spring 2022 – University of Illinois
  Advisors: Professor Cathy Wu and Professor Katherine Driggs-Campbell
  Evaluating human-in-the-loop traffic congestion mitigation policies with real users in a car simulator.

- **Attenuated Stochastic Graph Model for Highway Vehicle Anomaly Detection** — Fall 2021 – University of Illinois
  Advisor: Professor Katherine Driggs-Campbell
  Designing framework for identifying anomalies on the road conditioned on latent vehicle behaviors and lane structure.

- **Decentralized Vision-Based Robot Crowd Navigation** — Fall 2019 – University of Illinois
  Advisor: Professor Katherine Driggs-Campbell
  Developing a novel network to guide a robot to reach a goal state while avoiding colliding with other agents. [website]

Publications:

- S. Liu*, P. Chang*, Z. Huang, **N. Chakraborty**, K. Hong, W. Liang, D. L. McPherson, J. Geng, K. Driggs-Campbell, — Preprint
  "Intention Aware Robot Crowd Navigation with Attention-Based Interaction Graph" [arXiv:2203.01821]
  Submitted to IEEE International Conference on Robotics and Automation (ICRA), 2023.

- S. Liu, P. Chang, H. Chen, **N. Chakraborty**, K. Driggs-Campbell, — ICRA 2022
  "Learning to Navigate Intersections with Unsupervised Driver Trait Inference" [arXiv:2109.06783]
  IEEE International Conference on Robotics and Automation (ICRA), 2022. [website] [video]

- S. Liu*, P. Chang*, W. Liang†, **N. Chakraborty**†, K. Driggs-Campbell, — ICRA 2021
  "Decentralized Structural-RNN for Robot Crowd Navigation with Deep Reinforcement Learning" [arXiv:2011.04820]
  IEEE International Conference on Robotics and Automation (ICRA), 2021. [website] [video]

- **N. Chakraborty,** K. Driggs-Campbell, — Undergraduate Thesis
  "Hierarchical Self-Imitation Learning in Single-Agent Sparse Reward Environments" [paper]
  Illinois Digital Environment for Access to Learning and Scholarship (IDEALS), 2021.

Soft Skills: Innovative, Leader, Adaptable, Collaborative, Open-Minded and Communicative
Languages: Python, C/C++, MATLAB, System Verilog, x86 Assembly
Tools: PyTorch, Git, ROS, OpenCV, CARLA, Raspberry Pi, Simulink, Altera FPGAs & Quartus Prime, Autodesk Fusion 360
Coursework: Artificial Intelligence, Deep Learning, Reinforcement Learning, Robotics, Safe Autonomy, Control Systems, Algorithms

Past Research Projects:

- **Geometry-based Video Prediction with Visual Odometry Prediction and View Synthesis** Fall 2021 – Spring 2022
  Advisor: Professor Katherine Driggs-Campbell University of Illinois
  Combining visual odometry with view synthesis to perform future video frame prediction.

- **Hierarchical Self-Imitation Reinforcement Learning with Sparse Rewards** Fall 2020 – Spring 2021
  Advisor: Professor Katherine Driggs-Campbell University of Illinois
  Applying hierarchical and self-imitation learning to long horizon single agent environments with sparse rewards. [website]

Industry Experience:

- **Research and Advanced Engineering Intern in Core AI/ML at Ford Motor Company** Summer 2022
  Designing sample efficient model-free + model-based RL methods Ford Motor Company
  Outperforming classical PID controllers by 41% in complex autonomous vehicle use case
  Conducting both independent and collaborative research and guiding experimental design according to quantitative results

- **Perception Engineering Intern in Autonomy Team at Brunswick i-Jet Lab** Summer 2021
  Localizing swimmers around boats using filtering, tracking, and computer vision techniques Brunswick
  Researching sensors and communicating with sensor companies to increase autonomy stack capabilities
  Analyzing functional safety standards practiced at company and presenting findings to global senior management team

- **Interim Engineering Intern in Global CAD Team at Qualcomm** Summer 2020
  Building generalized data gathering solutions to support Design for Test pipeline Qualcomm
  Leading design process of a base framework for data gathering tool [website]
  Collaborating and adapting with international teams to consider multiple perspectives

- **Global Management Trainee Intern in Solutions at Anheuser Busch** Summer 2019
  Implementing short- and long-term process solutions leveraging technology with an annual ROI of $1.5M Anheuser Busch
  Identifying the root causes of a multi-million-dollar annual problem via Six Sigma LEAN exercises [website]
  Pitching solutions to multidisciplinary teams in the People department including Managers & Directors

- **Global Management Trainee Intern in Logistics at Anheuser Busch** Summer 2018
  Increasing productivity of critical decision-making team by developing clear visualizations Anheuser Busch
  Creating effective data visualizations through Qlik Sense and SQL databases [website]
  Connecting with multidisciplinary logistics teams and interns

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Teaching Experience:

- **Lab Teaching Assistant for Introduction to Robotics (ECE 470)** Aug 2021 –
  Guiding students to program a UR3 arm with ROS and implement kinematics and computer vision University of Illinois

- **Undergraduate Course Assistant for Digital Systems Laboratory (ECE 385)** Aug 2019 – May 2021
  Providing impactful assistance to students on TTL & System Verilog hardware labs University of Illinois

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Workshop Papers:

- A. Hasan, **N. Chakraborty**, C. Wu, K. Driggs-Campbell, SAPHRI 2022
  "Towards Co-operative Congestion Mitigation" [paper]
  Shared Autonomy in Physical Human-Robot Interaction: Adaptability and Trust, ICRA 2022 Workshop

Coursework:

- **Artificial Intelligence**
  - **Intro to Artificial Intelligence** search, classification, natural language understanding, computer vision, robotics
  - **Intro to Deep Learning** linear classifiers, multi-layer networks, CNNs, RNNs, generative networks, deep RL
  - **Intro to Reinforcement Learning** RL foundations, model-free, policy gradient methods, exploration/exploitation
  - **Pattern Recognition** nearest neighbor, regression, optimization primal/dual, SVM, learning theory
  - **Generative AI Models** normalizing flows, VAEs, GANs, RNNs, transformers, applications, explainability
  - **Random Processes** measure theory, convergence of sequences, estimators, random walks, martingales

- **Robotics**
  - **Intro to Robotics** robot fundamentals, rigid motion, forward/inverse kinematics, motion planning, control, vision
  - **Human-Centered Robotics** graduate course focusing on tools to design robots that interact with people safely
  - **Principles of Safe Autonomy** path planning, localization, lane detection, safety verification
  - **Control Systems** dynamic models and response, root locus/frequency response techniques, state space design
  - **Control System Theory & Design** state space models, stability, controllability, observability, tracking, rejection

- **Hardware/Software Systems**
  - **Digital Systems Lab** logic types, storage, I/O, design tradeoffs, FPGAs, microprocessor design
  - **Computer Systems Engineering** operating system design, I/O, synchronization, interrupts, virtualization

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Additional Projects:

- **Efficient FPGA Smart Home Security Camera System (Project Watchdog)** Apr 2019 – Oct 2019
  Leading hardware design of accelerated IoT security system Student Group Project
  Regional Finalist in InnovateFPGA 2019 [website]

- **Brain Computer Interface Platform for IoT Applications (Project HackMe)** Feb 2019
  Leading data analytics and storage team Student Group Project
  HackIllinois 2019 Runner-up and Sponsor Award Winners [website]

- **Human Interactive Balancing Security Robot (Project at Carnegie Mellon University)** Aug 2016 – Jun 2017
  Advisor: Dr. George Kantor Carnegie Mellon University
  Engineering a human interactive segway security robot to roam halls of an institution for safety [website]

- **Robotics Project at ZeGoBeast LLC Pittsburgh** May 2016 – Jun 2017
  Advisors: Mr. Daniel Goncharov and Mr. Alex Thomson ZeGoBeast LLC Pittsburgh
  Building & improving the wooden ZeGoBeast Electric robot and presenting final work at New York Maker Faire [website]

Organizations & Extracurriculars:

- **Eta Kappa Nu (HKN): Electrical Engineering Honor Society** Aug 2019 –
  Dedicated to serving the ECE & Engineering student body by providing services to help students succeed Member
  Holding course review sessions and sharing university experience with other students

- **iRobotics Combotics & Projects Student Organization** Aug 2017 – May 2018
  Collaborated on the mechanical design team by developing CAD designs that model the real robot Member
  Considering strengths & weakness and identifying revisions to be made to mitigate damage

- **Children's Library of Pittsburgh** Jun 2012 – Jun 2017
  Shelved, counted, & organized books in the Children's section of the Main Library Volunteer
  Supported in the planning & development of tech programs to introduce children to programming