Jacob Mantooth

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RESEARCH EXPERIENCE

Mean First Passage Times for Transport Equations August 2023 –

- Develop a general theory for the mean first passage time (MFPT) for velocity jump processes
- Utilizing computational simulations to visualize and analyze how diffusing particles respond to radial directional cues within these constrained environments
- Comparing analytical solutions to numerical simulations in predicting the outcomes of radial directional guidance on diffusion

Exploring Tetrahedral Meshes in Finite Element Research May 2023 – August 2023

- Conducted detailed finite element analysis using tetrahedral meshing
- Applied tetrahedral meshing techniques to solve structural problems in Brunille beams, enhancing the precision and reliability of stress and deformation predictions under various load conditions

Understanding Reinforcement Learning Through Games August 2022 – May 2023

- Investigated reinforcement learning strategies within various game environments, focusing on continuous, single-discrete, and multi-discrete action spaces to determine optimal models for different scenarios.
- Designed and developed three unique game simulations tailored to test the effectiveness of reinforcement learning algorithms in diverse settings.
- Conducted comparative analyses of four distinct reinforcement learning methods across each game, documenting performance metrics to evaluate and refine each algorithm's efficiency and accuracy.

Generalizing the Boltzmann Equations August 2022 – May 2023

- Explored the dynamic interactions between two colliding rarefied gases composed of monatomic molecules, aiming to understand fundamental kinetic behaviors
- Sought to derive the the Boltzmann Equation utilizing the Edgeworth series expansion instead of the traditional Maxwellian distribution, enhancing the theoretical framework for non-equilibrium statistical mechanics

Mathematics of Deep Learning, and SVD May 2021 – December 2022

- Examined the mathematics of deep learning
- Explored the PCA dimensional reduction and linear regression and how these work when interchanged
- Provided a proof for the interactions of PCA and linear regression
- Using Python, Jupyter notebooks, TensorFlow, NumPy, and Pandas, created deep learning models to examine the mathematical tools utilized

Comparing RL to OC Methods on the Continuous Mountain Car Problem May 2022 – July 2022

- Compared three methods in solving the continuous mountain car problem
- Investigated the trade-off between data-driven RL methods and model-driven optimal control methods on the continuous mountain car problem
- Used Hamilton-Jacobi-Bellman (HJB) equation to train an approximating neural network for the value function

Temperatures Affect on Ultra Sonic Waves January 2021 – May 2021

- Investigated the relationship between temperature changes and the propagation characteristics of ultrasonic waves, focusing on practical implications in various mediums.
- Conducted experiments using multiple oil types to demonstrate that increasing temperatures lead to a measurable decrease in sound velocity, thereby validating theoretical predictions.

Covid-19 and Travel June 2020 – December 2020

- Analyzed Google travel data to uncover diverse relationships between travel patterns and Covid-19 transmission rates, providing insights into pandemic dynamics.
- Developed and deployed multiple interactive models to visually represent the impact of Covid-19 on U.S. travel trends; hosted online to facilitate accessible public and academic review
- Employed statistical methods to identify correlations between travel activities and virus spread, enhancing the predictive accuracy of Covid-19 outbreak models.

Operation Research January 2020 – May 2020

- Assigned to a local oil trucking business named Cantrell Jackson to manage and evaluate data to improve their operations
- The primary goal was to optimize truck efficiency and evaluate each customer to determine their value to the company

EDUCATION

East Central University   August 2019 – May 2023
B.S., Mathematics, Physics   Ada, OK

Lindsay High School   August 2015 – May 2019
High School Diploma   Lindsay, OK

POSTER PRESENTATIONS

Understanding Reinforcement Learning Through Games
Oklahoma Research Day   March 2023

Comparing RL to OC Methods on the Mountain Car Problem (1st Place Winner)
2022 Computational Mathematics REU at Emory University   July 2022

Temperatures Affect on Ultra Sonic Waves
McNair Intern Poster Display   April 2022

Mathematics of Deep Learning, and SVD
Oklahoma Research Day at the Capital (Chosen to be my school only representative)   March 2022
Oklahoma Research Day   March 2022
Oklahoma Academy of Science   November 2021

Covid-19 and Travel
Oklahoma Research Day   March 2021
Oklahoma Academy of Science   November 2020

Cantrell Jackson
Oklahoma Research Day   March 2020

ORAL PRESENTATIONS

Understanding Reinforcement Learning Through Games (2nd Place Winner)
OK-AR MAA   March 2023

Mathematics of Deep Learning, and SVD
Oklahoma Academy of Science   November 2021

Covid-19 & Travel
Oklahoma Academy of Science   November 2020

CONFERENCE ATTENDED

30th Annual UMBC McNair Scholars Research Conference   October 2022

OK-LSAMP 28th Annual Research Symposium   October 2022

SKILLS

Languages : Python, Matlab, HTML, Git, R, Linux, C , Excel
Skills : Computer skills, Leadership experience, Communication skills, Collaboration talent, People skills, Problem-solving abilities

PROFESSIONAL EXPERIENCE

ECU Tutor   2021-2022
Tutor   Ada,OK

- One-on-one tutoring in Mathematics, Biology, and Physics
- Adapted teaching style to the unique needs of students
- Prepared weekly lesson plans to help students prepare for their courses
- Recognize the primary role of helping students become more confident, more successful, self-directed learners

TH Rogers Lumber Co. Lindsay   2020-2021
Yard Foreman   Lindsay, OK

- Manages yard operations and works in yard to assist customers
- Managed dry wall delivers to customer
- Maintained yard and warehouse upkeep and repairs
- Ensure safe and effective use of forklift machines
- load products, and deliver and transport materials to customer sites

Super C   2019-2020
Manager   Lindsay, OK

- Ensure that grocery shelves are maintained clean and organized
- Provide excellent customer services for sales growth
- Unload/load delivery trucks
- Ensure safe and effective use of forklift machines
- Manage daily operations of grocery store to meet store goals

RECOGNITION'S & SCHOLARSHIP'S

- 2nd Place Winner of the 2023 Research Presentation at OK-AR MAA
- 1st Place Winner of the 2022 Research Poster Competition in the Undergraduate Math/Computer Science Category at Emory REU
- NASA Fellowship
- Ronald E. McNair Research Fellowship
- LSMAP Scholar
- McNair Scholar
- President honor roll(x3)
- Dean honor roll (x2)
- Lance Fenton Math Scholarship
- Higginbotham Family Scholarship
- Charles & Lila Acker Math Scholarship
- Oklahoma Teacher's Promise Scholarship