

# Aniruddha Mukherjee

Graduate Student

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## Education

### M.S. in Computer Science

(Fully Funded)

Aug 2022 – Present

#### Purdue University – West Lafayette

Focus: Machine Learning Applications & Quantum Computing.

**Research Advisor: Professor Aniket Bera, Ph.D.**

**Lab. Webpage:** <https://ideas.cs.purdue.edu>

**Research Topic:** Social Network Analytics for Emotions, Videos and Multimedia Content.

### B.S. in Computer Science and

Statistics (GPA:

3.68/4.00)

Aug 2018 - May 2022

#### University of Illinois – Urbana Champaign

- Graduated with High Distinction
- Minor in Econometrics
- Minor in Computational Science & Engineering
- Minor in Business Administration
- Data Science Certification.

## Awards and Recognition

- 3<sup>rd</sup> Place in Ashby Prize in Computational Science
- Machine Learning Certification from Stanford University Instructor: Andrew Ng
- Financial Markets Certification from Yale University Instructor: Robert Shiller
- Dean's Merit List: Spring 2022, Fall 2021, and Fall 2020

## Industry Experience

### Mercury Systems, Torrance, CA.

May 2023 – Aug 2023

(In person)

Aug 2023 – Current

(Remote)

#### Software Development Engineer (part-time), Manager: Jeffrey Paek (Aug 2023 – Current)

- Designing and building the architecture, code, and other related components for the black box system for aerial vehicles used by the U.S. military.
- Implementing and optimizing both industry-standard and custom Machine Learning models such as Multi-layer Perceptron Neural Network (MLPNN), C5.0 Decision Tree, Bayesian Networks (BN), and Ensemble Models for system monitoring and predictive maintenance.
- Utilizing ML models to analyze system data and predict potential failures, enhancing the reliability and safety of the aerial vehicles. Implementing real-time data processing and analytics to monitor the status of the black box and the aerial vehicle.
- Leading the presentation for the black box project, explaining the design and functionality to other members of the Mercury Systems' team.

#### Software Developer Intern, Manager: Michael Sorensen (May 2023 – Aug 2023)

- Developed embedded software for aerial vehicles using C/C++, assembly, Python, and Green Hills Software's products, such as Integrity RTOS and MULTI IDE.
- Designed and implemented the controller system architecture for an Arduino-based test platform, using best practices and industry standards.
- Created an automated code validation system using Python, LDRA, Bitbucket, and Jenkins, that detected code changes, identified the user and branch, and applied LDRA tools to ensure code quality and compliance.
- Created an automated hexadecimal to voltage converter for Arduino systems, using Python and serial communication protocols.
- Lead the presentation for many projects that were undertaken in the team I was a part of, demonstrating my leadership and communication skills.

## Research & Teaching Experience

### Research Project

Transformer (BERT) models.

Aug 2022 - Current

#### Purdue University – West Lafayette, Department of Computer Science

**Advisor: Aniket Bera, Associate Professor in Computer Science**

Development of a new and novel architecture using Bidirectional Transformers for contextual sentiment analysis and information diffusion over geographic and online graphical network. Our model incorporates an emotion detection layer, and a graph transformer layer with the following properties: (i) the attention mechanism is a function of the temporal emotion vectors, as well as the

spatial weighted neighborhood influence for each node, (ii) the positional embedding is a Kernel distance weighted vector, (iii) a generalized attention mechanism that uses a vector-attention over a weighted matrix of neighborhood node embedding, and (iv) incorporates a mechanism to model a graph transformer to contexts where the edge weights are unobserved through an affinity matrix and a unique weighted sampling scheme. We evaluate our model on a proprietary Twitter dataset related to COVID-19 that we collected and contains 10 million unique tweets that have been re-tweeted 40 million times.

**Paper ready for submission to leading computer science journal. Title. EDIT-BERT: Emotion Detection and Integrated Transmission using Transformer Architecture for Semantic Text and Graph Data.**

**Research Project**  
Developing and  
validating a unique  
dataset for Neural  
Radiance Field  
(NeRF) method  
Aug 2022 – Current

**Purdue University – West Lafayette, Department of Computer Science**

***Advisor: Aniket Bera, Associate Professor in Computer Science***

We develop a unique dataset for research and validation for deep learning based 3D vision applications such as Neural Radiance Fields (NeRF) introduced in 2020. There is no standard large-scale dataset for 3D vision methods. To address this gap, we developed a unique dataset containing 10,510 videos, and 51.2 million frames. We conducted comprehensive testing and validation of the dataset using state-of-the-art deep learning methods for 3D vision. The results obtained in a pilot study provide important insights for automated 3D vision development.

**Published in Conference on Computer Vision and Pattern Recognition (CVPR). Title. DL3DV-10K: A Large-Scale Scene Dataset for Deep Learning-based 3D Vision**  
(<https://dl3dv-10k.github.io/DL3DV-10K/>).

**Research Project**  
Motion planning for  
autonomous vehicles  
Aug 2023 – Current

**Purdue University – West Lafayette, Department of Computer Science**

***Advisor: Aniket Bera, Associate Professor of Computer Science***

This paper focuses on autonomous vehicles operating in diverse traffic conditions, but special emphasis is given to intersection scenarios. We introduce an innovative reinforcement learning approach that leverages local observations to model the intentions of other agents and maintain an egocentric belief system about their capabilities, which is crucial for effective motion planning.

**Title. Intent and Capability Informed Reinforcement Learning for Planning in Dynamic Environments (Working paper).**

**Research Assistant**  
Topic Modeling and  
Sentiment Analysis  
Research Project  
May 2019 - Dec 2019

**University of Illinois – Urbana Champaign, Gies College of Business**

***Advisor: Ramanath Subramanyam, Professor of Business Administration and William N. Scheffel Faculty Scholar at the University of Illinois – Urbana Champaign***

Worked on a Ph.D. research project in the Information Systems Management area using Latent Dirichlet Allocation (LDA) based topic modelling and sentiment analysis. We used employee feedback and opinion on carbon emissions dataset, and transaction datasets related to Ethereum.

**Research Project**  
Bayesian graphical  
methods.  
Sep 2023 – present.

**Bayesian graphical method for sparse clustered graphs with partially observed Markov processes. With Sebastian Souyris, Assistant Professor, Rensselaer Polytechnic Institute (RPI), Shuai Hao, Assistant Professor, Shenzhen University, China, and Ujjal Kumar Mukherjee, Associate Professor, University of Illinois Urbana-Champaign.**

In this paper, we propose a Bayesian latent space graphical model with clustering of nodes for detection of latent communities. We use Gaussian Graphical Model based estimation using a Reversible Jump Monte Carlo Markov Chain based estimation to detect hidden clusters with dense connection within clusters, and sparse connections across clusters. We also incorporate optimal control actions on the model to conduct counterfactual analysis for optimal policy decisions. We validate the model using data from COVID-19 pandemic.

**Research Assistant**  
Predictive Analysis  
Research Project  
June 2021 - June  
2022

**Data Analysis of COVID-19 Hospitalization**

***With Amit Kumar Mitra, Assistant Professor, Auburn University - Harrison College of Pharmacy.***

Worked on developing a causal machine learning based model for predicting hospitalization and ICU admission risk of COVID-19 patients using data from NIH N3C data repository. Specifically, we use causal machine learning based methods to investigate factors associated with long COVID.

**Teaching Assistant**  
EPICS  
Aug 2022 – May  
2023

**Purdue University Graduate Levels Teaching Assistantship Responsibilities**

Responsibilities include providing disciplinary assistantship for four courses, and development and delivery of skill and training sessions throughout the semester for EPICS Program.

## Selected Projects from Undergraduate Studies

<b>Machine Learning Personal Project</b> Jan 2018 - July 2018	<b>Prediction of FIFA Soccer World Cup Matches</b> <b>Personal project with <i>Bhupinder Singh Juneja, Ph.D. student in Bioinformatics at University of Minnesota, Minneapolis</i></b> Collected a large dataset on soccer players and matches. Organized the data and created variables in SQL. Used statistical and Machine Learning Methods for prediction in R and Python. Prediction accuracy: 65% Area Under the ROC Curve. ( <a href="https://aniruddhamukherjeesite.wordpress.com/summary-of-group-stage-matches/">https://aniruddhamukherjeesite.wordpress.com/summary-of-group-stage-matches/</a> ).
<b>Systems Programming</b> Jan 2018 - July 2018	<b>Developed Modified UNIX Shell in C</b> <b>Project for Systems Programming class at the University of Illinois – Urbana Champaign</b> Implemented a modified version of UNIX shell in C that simulated Bash. It supported built in and external commands along with no memory leak. It supported all expected functionality of a shell.
<b>Database Systems Project</b> Jan 2018 - July 2018	<b>Developed Covid-19 Risk Projection Dynamic Website</b> <b>Project for Systems Programming class at the University of Illinois – Urbana Champaign</b> Created a dynamic website for mapping the likelihood of contracting COVID-19 in real time. Using publicly available data, the website would map the severity, and predict the likelihood of contracting COVID-19. Users could also feed personal information such as pre-existing conditions, medical history, and vaccination status, to receive a customized prediction of the likelihood of contracting COVID -19.

## Selected Coursework

<b>Graduate Computer Science</b> Aug 2022 – Current	Quantum Science and Technology, Statistical Machine Learning (theory of machine learning), Advanced Artificial Intelligence, Deep Learning, Quantum Computing, Data Communication and Computer Networks, Algorithm Design – Analysis & Implementation, Cloud Computing, and Computer Vision and Motion Planning.
<b>Undergraduate Computer Science</b> Aug 2018 - May 2022	Introduction to Computer Science in Java, Software Design Studio in Java and C++, Discrete Structures, Data Structures in C++, Computer Architectures using MIPS Assembly and C, Systems Programming in C, Algorithms, and Models of Computation, Programming Languages and Compiler Design in Haskell, Database Systems (DBMS) in SQL and Cloud platforms (GCP), Numerical Methods in Python, Machine Learning in Python.
<b>Statistics and Mathematics</b> Aug 2018 - May 2022	Statistical Analysis in R, Data Science Discovery in Python, Statistical Programming Methods in R, Statistics and Probability I and II, Statistical Modeling I in R, Statistical Modeling II in R, Statistical Computing in R, Advanced Data Analysis in SAS, Stochastic Processes in R, Calculus II and III, Advanced Differential Equation, Applied Linear Algebra.
<b>Economics and Business</b> Aug 2018 - May 2022	Microeconomics, Macroeconomics, Economic Statistics I and II, Intermediate Microeconomic Theory, Macroeconomic Policy with focus on Financial Economics, Management and Organizational Behavior, Principles of Marketing, International Business, Corporate Finance, Accountancy.
<b>Stanford University (Online)</b> May 2022 – Sep 2022	<b>Machine learning</b> – supervised: classification and regression, logistic regression, Bayes classifier, Support Vector Machine, Neural Network; unsupervised: K-Means clustering, Principal Component Analysis (PCA).
<b>Yale University (Online)</b> May 2022 – Sep 2022	<b>Financial markets</b> – basics: securities, insurance, and CAPM; behavioral finance: forecasting, pricing, and inflation; risk management: debt theory, efficient markets, and corporate stocks; financial institutions: banks, investment banks, and exchanges; public and non-profit finance: real estate, monetary policy, and environmental finance.

## Additional Skills

<b>Programming Skills</b>	<b>C/C++, Java, Python, R, SQL, Octave, Haskell, SAS, Matlab, MIPS Assembly, Green Hills, HTML, CSS, JavaScript.</b>
<b>Languages</b>	<b>English</b> – Native fluency, <b>Spanish</b> – Native fluency, <b>Hindi</b> – Native fluency, <b>Bengali</b> – Native fluency.
<b>Hobbies</b>	Reading books, playing and watching soccer, travelling, and photography ( <a href="https://aniruddhamukherjeesite.wordpress.com">https://aniruddhamukherjeesite.wordpress.com</a> )