Sumadhu Rubaiyat (Genie)

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EDUCATION

University of California, San Diego Expected Graduation: June 2026
B.S. Mathematics - Computer Science, Data Science Minor – Honors with High Distinction, Provost Honors

Graduate Coursework: Statistical Learning, Logic, Algebra, Probability Theory, Data Science

Other Relevant Coursework: Computability Theory, Machine Learning, Deep Learning, Recommender Systems, Natural Language Processing, Algorithms, Data Structures, Calculus, Linear Algebra, Statistics, Numerical Analysis, Differential Equations, Real Analysis, Combinatorics, Graph Theory, Optimization

RESEARCH EXPERIENCE

ARCLab @ UCSD ECE – Undergraduate Researcher April 2023 – June 2025
Advisor: Professor Michael Yip

- Developed computer vision models achieving up to 95% accuracy for surgical robot tissue simulation, including skin incision detection and breathing lung model alignment
- Adapted 2D ML architectures to 3D medical imaging applications, achieving 85% accuracy
- Managed large-scale GPU computing with 100+ GB datasets on remote cloud infrastructure
- Presented weekly research updates to 30+ graduate students, postdocs, and faculty

UC San Diego Mathematics – Honors Thesis Jan 2024 – June 2025
Advisor: Dr. Joshua Frisch

- Proved novel results in Group Theoretic Symbolic Dynamics, proving embedding of free groups (and ultimately, the commutator of the full shift) within normal subgroups of automorphism groups of shifts of finite type
- Collaborated intensively (10+ hours weekly) on advanced problem sets on topics including Cayley graphs, quasi-isometries, amenability, and Grigorchuk groups
- Awarded Honors with High Distinction for honors thesis defense before senior faculty committee

UC San Diego Mathematics – Directed Reading Program Aug 2024 – Sept 2024
Adivor: PhD student Qihao Ye of Prof. Xiaochuan Tian

- Implemented GraphSage algorithm for classification on protein-protein interaction, Reddit, and citation networks
- Presented findings covering algorithm theory, implementation, and experimental results

Russell Lab @ UCSD CSE – Undergraduate Researcher May 2025 – Present
Advisor: Professor Russell Impagliazzo

- Conducted comprehensive literature review on the smallest enclosing ball problem
- Developed scalable algorithm with promising preliminary results (hardware testing pending)
- Delivered 45-minute technical presentation synthesizing existing research

SpatioTemporalLab @ UCSD CSE – Undergraduate Researcher June 2025 – Sept 2025
Advisor: Professor Rose Yu

- Generated experimental results for symmetry discovery algorithms in KPPF equations
- Designed novel deep learning architecture for equation learning applications

Gao Lab @ UCSD CSE – Undergraduate Researcher June 2025 – Sept 2025
Advisor: Professor Sicun Gao

- Proving complexity bounds for Monte Carlo Tree Search-based "Sample and Bound" optimization technique

ML Interpretability Working Group July 2025 – Present
Advisor: Professor Sanjoy Dasgupta

- Presented technical papers on ML interpretability to 40+ students in 30-minute talks
- Developed algorithm converting random forests to shallow multiway decision trees

PUBLICATIONS & MANUSCRIPTS

Published:

- "Application of Large Language Model in Clustering Low Count Non-Gaussian User Behavior Time Series" – *IEEE Big Data 2024 Conference*
- "Feedback-centric Optimized Time-critical Recommendation of Time Series of Promotional Rewards for User Retention" – *IEEE Big Data 2025 Tutorial*
- "On the Automorphism Groups of Shift Spaces" – *UCSD Math Honors Theses Spring 2025*

Under Review:

- "ProCut: Probabilistic Cutting Topology for Autonomous Electrocautery Tissue Dissection" – *Robotics and Automation Letters*

In Progress:

- "Detecting Emergent Symmetry in KPPF Equations via Deep Learning" with Dr. Rose Yu, Dr. Nigel Goldfield
- "Scalable Deterministic Smallest Enclosing Ball Algorithm in High Dimensions" with Dr. Russell Impagliazzo
- "Decision Forests to Shallow Multiway Trees" with Dr. Sanjoy Dasgupta
- "Sample Complexity of Sample-and-Bound" with Dr. Sicun Gao

Complete (Unpublished):

- "Parameter Optimization for Fine-Tuning Text-to-Image Models on Limited Hardware: Balancing Runtime and Generation Quality"

TEACHING EXPERIENCE

UCSD Department of Computer Science and Engineering – Tutor August 2023 – Present

- Delivered 1000+ tutor hours across Introduction to Machine Learning (CSE151A), Theory of Computability (CSE105), Algorithms (CSE101), and Python (CSE6R)
- Collaborated with other tutors to grade 100,000+ student assignments
- Completed Tutor Apprenticeship program to enhance pedagogical techniques

SELECTED PERSONAL PROJECTS

Sequential Climate Prediction – *Pytorch, U-Net, Transformer, ConvLSTM, DANN, AdaBoost*

- Tested ensemble methods using Transformers, ConvLSTMs and Domain Adversarial Neural Networks
- Ranked 4th in a kaggle competition with 300 students

Institutional Mobile Application Framework – *ReactNative, Firebase*

- No-code app-builder template with display options for upcoming events, news, video announcements, calendars, contacts, bell schedule, interactive map, quick links, etc with an intuitive Firebase backend

Reinforcement Learning Model Predicting Flight Delays – *Tensorflow, NumPy, SKLearn*

- Predicted arrival delays from carrier, expected departure/arrival time, origin, destination, etc.

RentTheRunway Recommendation System – *SKLearn, Tensorflow*

- Collaborated in a team of 4 to create a 68% accurate recommendation system for RentTheRunway

Analysis of UCSD Quarter Progress against Traffic Accidents Data –*NumPy, Seaborn, Pandas*

- Conducted hypothesis/correlation tests on SDPD traffic data categorized by UCSD quarter progress and presented findings in an annotated Jupyter notebook and slideshow

AI Game Agent – *2048, Sudoku, Gomoku*

- Created AI Game Agents for 2048, Sudoku and Gomoku

TECHNICAL SKILLS

Languages: Python, Java, C/C++, MATLAB, R, Ruby, SQL, JavaScript, React, Swift, HTML, ARM
AI Frameworks: PyTorch, TensorFlow, TorchIO, OpenCV, SegmentAnything, NLTK, scikit-learn, patsy, scipy.stats, statsmodels.api, SimpleITK, Torchvision, OpenAI/GPT, NumPy, Pandas, TorchHub
Tools: Docker, Firebase, XCode, Android Studio, Arduino, Blender, 3D Slicer, Raspberry Pi, NodeJS