Sumadhu Rubaiyat (Genie)

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EDUCATION

University of California, San Diego — Expected Graduation: June 2026
B.S. Mathematics - Computer Science, Minor in Data Science – Provost Honors
Relevant Coursework: Machine Learning, Recommender Systems, Natural Language Processing, Algorithms, Data Structures, Computability Theory, Numerical Linear Algebra, Abstract Algebra, Probability, Statistics, Calculus, Differential Equations, Real Analysis, Graph Theory, Logic, Optimization
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

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
- Conducted original research in Group Theoretic Symbolic Dynamics
- Proved novel results on embedding free groups within normal subgroups of automorphism groups
- Collaborated intensively (10+ hours weekly) on advanced problem sets at the research frontier
- Awarded **Honors with High Distinction** for 20-minute thesis defense before faculty committee
- Explored advanced topics including Cayley graphs, quasi-isometries, amenability, and Grigorchuk groups

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

UC San Diego Mathematics – Directed Reading Program — Aug 2024 – Sept 2024
- Implemented GraphSage algorithm for classification on protein-protein interaction, Reddit, and citation networks
- Presented findings covering algorithm theory, implementation, and experimental results

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"
- "Scalable Deterministic Smallest Enclosing Ball Algorithm in High Dimensions"
- "Decision Forests to Shallow Multiway Trees"
- "Sample Complexity of Sample-and-Bound"

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 15 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.

3D Medical Image Automatic Segmentation Model – *SegmentAnything, MatPlotLib*
- Created image scroller with SAM, wherein segmenting a jaw in 3D brain MRI takes 10 seconds

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