

Jinal Soni

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Location: New York, NY, USA

Research Interests

Primary research interests in Quantum Error Correction and Information Theory, with a focus on noise aware code optimization. Aiming to refine the transition from theoretical thresholds to practical fault tolerance by developing robust codes that mitigate hardware specific imperfections in large scale quantum systems.

Education

M.S. in Computer Science (2016 - 2018)

State University of New York, University at Albany - Albany, New York, USA

Relevant Coursework: Algorithms and Data Structures, Cryptography, Bayesian Data Analysis, Distributed Systems

B.Tech in Computer Science (2012 - 2016)

Marwadi University - Rajkot, Gujarat, India

Relevant Coursework: Calculus, Linear Algebra, Advanced Engineering Mathematics, Microprocessor and Interfacing, Digital Logic Design, Design and Analysis of Algorithms, Physics

Independent Study & Research Preparation

- Developed a rigorous foundation in classical and quantum mechanics, including Hamiltonian and Lagrangian formalisms, Poisson brackets, Hilbert space theory, quantum states and operators, time evolution, and entanglement, to support advanced study in quantum information science.
- Systematically studied core areas of quantum computing, including quantum circuit models, quantum algorithms (Deutsch - Jozsa, Bernstein - Vazirani, Simon's, Shor's, and Grover's), and quantum complexity theory.
- Explored quantum communication protocols, including quantum teleportation and the BB84 quantum key distribution protocol, to understand the role of entanglement, measurement, and information transfer in quantum systems.
- Investigated foundational concepts in quantum error correction and fault tolerance, including noise models, decoherence, and encoding strategies for reliable quantum computation.
- Complemented theoretical study with hands-on simulation and verification of quantum circuits using tools such as Qiskit, Quirk, and SageMath, strengthening my understanding of multi-qubit unitary operations and quantum state evolution.
- Key References:
 - The Theoretical Minimum by Leonard Susskind
 - The Theoretical Minimum: Quantum Mechanics by Leonard Susskind
 - Introduction to Classical and Quantum Mechanics by Thomas G. Wong
 - (Currently Studying) Quantum Computation and Quantum Information by Isaac Chuang and Michael Nielsen

Research Experience

Graduate Research Assistant

SUNY, University at Albany - Albany, New York, USA

Supervisor - Dr. Yelin Kim

Fall 2017

- Conducted research on multimodal human interaction analysis using the IEMOCAP dataset to model emotional and social signals from speech, facial expressions, and body gestures.
- Applied dimensionality reduction techniques, including PCA and ZCA, to preprocess high-dimensional behavioral data and improve feature representation.
- Developed a Softmax-based classification model for affective state prediction using multimodal inputs.
- Evaluated model performance and explored the effectiveness of multimodal feature integration for emotion recognition tasks.
- Supplemented research work by completing the Deep Learning tutorial developed at Stanford University to strengthen understanding of neural networks and representation learning.

Teaching Experience

Teaching Assistant - CSI 535: Artificial Intelligence
SUNY, University at Albany - Albany, New York, USA
Instructor: Dr. Ming-Ching Chang
Fall 2017

- Collaborated with the instructor to design and grade assignments and examinations aligned with course objectives in artificial intelligence.
- Supported student learning by conducting office hours, clarifying core concepts, and guiding problem-solving approaches.

Selected Technical Projects

Quantum Computation Projects | Qiskit, Quirk, SageMath

- Implemented and analyzed foundational quantum algorithms, including Deutsch, Deutsch - Jozsa, Bernstein - Vazirani, and Simon's algorithm, to study quantum speedups and the role of interference in distinguishing problem structures.
- Developed and examined Shor's factoring algorithm, with particular focus on the period-finding subroutine, combining classical implementation with conceptual analysis of the Quantum Fourier Transform and its role in integer factorization.
- Implemented Grover's search algorithm and analyzed amplitude amplification to understand quadratic speedup in unstructured search problems.
- Designed and verified Quantum Fourier Transform (QFT) and inverse QFT circuits, analyzing phase rotations and their role in quantum interference and frequency extraction.
- Simulated quantum circuits using IBM Qiskit and Quirk to study multi-qubit state evolution, measurement outcomes, and the effects of circuit depth and gate composition.
- Utilized SageMath for symbolic and linear algebraic verification of multi-qubit unitary operations, reinforcing the mathematical structure underlying quantum circuits.

Deep Learning Performance Study | Python, NumPy, PyTorch

- Implemented a neural network from scratch for MNIST classification to study the mathematical foundations of deep learning and tensor operations.
- Optimized training performance using NumPy vectorization, achieving significant speed improvements over iterative Python implementations.

Professional Experience

Full Stack Software Engineer
BlocPower - New York, New York, USA
2019 - 2022

- Developed an energy simulation system by implementing a distributed task queue (Celery/RabbitMQ) to manage long-running, compute-intensive tasks, improving system reliability and reducing average processing time by 40%.
- Designed and implemented the core API and data model for a complex scoring engine, ensuring real-time, high-throughput data integration within a scalable microservice environment.
- Designed and developed a scalable map-based platform to visualize energy consumption data for over 3 million buildings, providing the technical validation necessary to secure Series B funding and critical government contracts.

Data Engineer Intern

BuildingFootprintUSA (now LightBox) - Albany, NY
Summer 2018

- Operated and maintained a high-throughput ETL pipeline for processing large-scale LIDAR datasets and generating spatial data products for major U.S. cities.

Skills

Quantum Information Science

• *Theory & Foundations*

Hamiltonian and Lagrangian Dynamics, Hilbert Spaces, Unitary Operations, and Symmetries, Superposition, Entanglement Theory, and Quantum Measurement

• *Algorithms & Complexity*

Simon's Problem, Grover's Search, Shor's Factoring, Quantum Circuit Model, and Quantum Complexity Concepts

- *Quantum Error Correction & Fault Tolerance*

Surface Codes, Stabilizer Formalism, Fault-Tolerant Gate Construction, Decoherence Models, and Noise Mitigation strategies

- *Quantum Programming*

Qiskit (Circuit Design & Pulse), Quirk (Prototyping), and OpenQASM

Mathematical Foundation

- *Linear Algebra & Analysis*

Matrix Analysis, Tensor Products, and Vector Calculus (Differentiation and Integration)

- *Discrete & Computational Math*

Foundations of Probability Theory, Numerical Methods, Graph Theory, and Complexity Theory

- *Symbolic Computation*

SageMath for algebraic structures and cryptographic modeling

Technical Skills

- *Python Ecosystem (Expert)*

Django, Pytest, Celery, Airflow, Numpy, Pandas, PyTorch, Scikit-learn, SymPy

- *Databases*

MySQL, PostgreSQL, MongoDB, Amazon Redshift

- *Infrastructure*

Docker, AWS

- *Software Engineering*

Software Design Principles, CI/CD, and Version Control

Certifications & Professional Engagement

- [Neural Networks and Deep Learning](#)

- [Machine Learning Foundations: A Case Study Approach](#)

- Member - Quantum Computing Meetup, New York City (2025 - Present)