Shashwat Bhatnagar

Undergraduate Student
B Tech in Computer Science Engineering with specialization in Bioinformatics

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Education

VIT Vellore *Vellore, Tamil Nadu*
Btech in Computer Science engineering with specialization in Bioinformatics *2025*
- 8.74 CGPA

Gyanodaya Public School *Sikar, Rajasthan*
Senior Secondary School Certificate *2021*
- 90 percentile VIT entrance exam

St Mary's Senior Secondary School *Sikar, Rajasthan*
Secondary School Certificate *2019*
- 91.3% ICSE

Projects and Research work

Single-Cell RNA Sequencing Analysis for COVID-19 Pathogenesis

- Employed **log normalization**, **Principal Component Analysis (PCA)**, and **Uniform Manifold Approximation and Projection (UMAP)** to reduce dimensionality and cluster cells effectively.
- Utilized state-of-the-art techniques such as **scVI (single-cell Variational Inference)** for integration analysis.
- Investigated lung tissues from **COVID-19** deceased individuals and controls, revealing significant alterations in cellular composition and transcriptional profiles.

BitTanh activation function

- Pioneered **BitTanh** activation function for deep neural networks, enhancing performance and reducing computational overhead.
- **Bit manipulation** techniques have been leveraged and implemented in the **C** programming language for this purpose.
- Engineered BitTanh as a **specialized C library**, wrapped with **SWIG** for seamless integration into **Convolutional Neural Networks** initialized with **Xavier intialization**.

Comparative Analysis of Vision Transformers and Convolutional Neural Networks

- Developed a comprehensive study comparing **Vision Transformers (ViT)** and **Convolutional Neural Networks (CNNs)** for image recognition tasks.
- Explored the enhanced performance of Vision Transformers in capturing **global dependencies** and contextual understanding in images, albeit with larger model sizes and higher memory requirements.

Graph Neural Network Analysis of Protein Co-Expression Networks for Alzheimer's Disease Diagnosis

- Utilized **Graph Neural Networks** to analyze protein co-expression networks for **Alzheimer's Disease** (AD) diagnosis, focusing on data from the Alzheimer's Disease Neuroimaging Initiative (ADNI).
- Leveraged protein co-expression networks to uncover proteins and biological pathways relevant to AD
- Implemented a patient-centric approach, representing each patient as a graph with proteins as nodes and expression levels as features.
- Employed **hierarchical clustering** to identify communities of proteins potentially crucial in AD pathology.

- Developed a **non-permutation invariant** graph representation, incorporating **positional encodings** to preserve node-specific characteristics.
- Utilized **NetworkX graphs** and **PyTorch Geometric** objects for transforming NumPy arrays.

Image Captioning with Attention Mechanism

- Developed an image captioning system using a **Seq2Seq model** with **attention** mechanism.
- Implemented **Bahdanau Attention** Decoder with **LSTM** cells for generating captions.
- Employed **Spacy** for tokenization and segmentation.
- Achieved high-performance caption generation for various image datasets.

Noise Filtering with Fast Fourier Transform (FFT)

- Identified frequencies with significant power by thresholding the **Power Spectral Density (PSD)**
- Utilized **inverse FFT** to obtain the denoised time signal

Ongoing Projects

Quantum Annealing and Graph Neural Networks for Solving Optimal Power Flow (OPF) problem with QUBO

Developing a Graph Neural Network (GNN) with Quadratic Unconstrained Binary Optimization (QUBO) as the loss function to solve the Optimal Power Flow (OPF) problem efficiently. This approach aims to find approximate solutions to OPF, impacting energy cost, system stability, and grid performance positively.

Hyperbolic Graph Convolutional Networks

Mapping the Euclidean input features to embedding in hyperbolic space

Skills

Programming Languages: C++, Java, Python, MatLab

Tools and Technologies: AWS Cloud Services, Swig, PostgreSQL, Redis, Pandas , Numpy, Seaborn, Matplotlib, Machine Learning Model, Nmap, Scikit-learn, Socket Programming, TensorFlow, Flask, Rest API.

Certifications

AWS Certified Cloud

AWS Certified Solutions Architect

Elite Certified in Advanced Quantum Mechanics with Applications from IIT Guwahati via NPTEL.

Experience and Development

Presented a research paper titled ”Bitwise Optimization for Rapid tanh Function Evaluation” at the prestigious **15th Zayed University Undergraduate Research Conference in Dubai** on April 25th, 2024.

Ranked top 5 in Vit-YANTRA’s ”Hackstory” Algorithmic Coding Challenge

Participated in the **Post-Quantum Cryptography Conference** organized by the PKI Consortium, engaging with cybersecurity engineer Mr. Bill Newhouse from the National Cybersecurity Center of Excellence (NCCoE) on the application of AI in cryptography.

Participated in the event Astro Symposium organized by ASTRONOMY CLUB- VIT STELLAR on September 2022, engaging with Manish Purohit, Space Scientist (Ex-ISRO)

Participated in the event ’Yantra: IdeoZen ’ organized by INSTITUTION OF INDUSTRIAL AND SYSTEMS ENGINEERS (IISE) in association with FEP - SI (CLUB) on March 2024.

References available upon request