Farzan Mirza

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AI Research and Development

Neural Networks | NLP | Supervised and unsupervised machine learning | Transformers, tokenization, and embedding strategies | Evaluation techniques | Custom model development | Generative models & 2D contextual learning | Ensemble learning | Visualization & reporting | Linear algebra | Calculus | Statistics | Probability | Evaluation metrics | Hypothesis testing | Sampling techniques

Python, PyTorch, Hugging Face, Pandas, NumPy, OpenPyXL, scikit-learn, Matplotlib, SVMs, Random Forests, CNNs, RNNs, Transformers, GANs, Git, Hadoop, SQL, AWS, Bayesian Inference

Education

Master of Science, Artificial Intelligence and Machine Learning, Drexel University, College of Computing and Informatics, June 2025 (Expected), Current GPA: 4.0

Masters projects include:
- *Spreadsheet 2D Context Model*, in progress, [project description](#)
- *Adversarial Abstractive Summarizer with BART and CNN Models*[, Git](#), [Research Paper](#)
- *Time-Series Stock Movement Classification (Comparative Analysis) using intra-day temporal windows*, [Git](#)
- *Music Genre Predictor Multi-Layer Perceptron(MLP),* developed model from scratch achieving training accuracy of 88.92% after convergence and testing accuracy of 85.47%

Bachelor of Science in Computational Modelling and Data Analytics, Computer Science and Mathematics minor, Virginia Tech, May 2022

Experience

Drexel University   August 2023 – Present
AI Researcher, Spreadsheet 2D Context Model, *Advisor [Dr. Jake Williams](#), co-developer of the SAFFU Model*
PyTorch, Hugging Face, Pandas, NumPy, and OpenPyXL
- Develop a Transformer-based model optimized for spreadsheet data analysis by leveraging advancements in efficiency-driven architectures (Microsoft SpreadsheetLLM and SAFFU layers) with the goal of automating advanced data analyst functions i.e. data analysis, anomaly detection, forecast analysis, and data wrangling
- Create a comprehensive research framework encompassing concept development, motivation, dataset curation and parsing, data representation and preprocessing, batch loading, parallel processing, model implementation, customized loss function design, and evaluation using perplexity metrics tailored for complex use cases.
- Engineer a batch-optimized tensor representation for spreadsheet processing (e.g., 100x100 cells, 32 tokens per cell), achieving computational processing efficiency = (batch size*rows*columns*tokens efficiency spreadsheets processed concurrently) with no loss in model performance
- Integrate GeLU non-linearity into a simplified neural network, passing averaged GloVe50 embeddings through a feed-forward layer. Achieved 0.99 F1 score in bold cell detection on a manually curated dataset.
- Adapte SAFFU and BERT models with byte-pair encoding (BPE) tokenizers for reduced vocabulary size and enhanced 2D context capture. Improved model performance through self-attentive feed-forward layers and optimized training pipelines.

Optium, *seed-stage ERP SaaS startup*
CTO and Founder   June 2022 – August 2023
- Led the 0-1 intelligent, real time, cross-platform ERP product from vision through prototype, MVP, and first customer install
- Implemented a cross-platform ERP system for web and Android, leading a team of 10+ developers to streamline modules across procurement, manufacturing, HR, accounting, and sales
- Orchestrated integration of Laravel APIs with Angular for web and Java for Android, utilizing a robust MySQLDB and AWS services (EC2, RDS, S3) to ensure a dynamic system
- Established Agile practices by creating CI/CD pipelines on GitLab to ensure seamless cloud deployments

Postdoctoral Scientist Dr. Aamir Abbasi   October 2020 – December 2020
Data Science/ML Research Intern
- Developed a highly optimized Python-based linear regression model aimed at illuminating the relationship between average neuronal firing rates and the average Fourier power of Local Field Potentials (LFPs) within specific frequency bands
- Employed NumPy and Pandas for comprehensive data preprocessing, coupled with the transparency of Matplotlib and Seaborn for insightful data visualization
- Masterminded the model's optimization through Scipy's stepwise regression techniques, ultimately attaining a remarkable accuracy rate exceeding 90%

Indian Institute of Technology, Computer Science Department, COVID-19 fluctuation analysis
AIML Research Intern   August 2020 - September 2020
- Conducted a rigorous time series analysis in Python to forecast fluctuations in COVID-19 cases within Uttarakhand.
- Employed Pandas and Numpy extensively for the preprocessing and storing of sequential data, encompassing daily reported cases, patient vitals, and symptoms
- Trained recurrent neural networks, leveraging simple RNN and LSTM models with TensorFlow. This choice was driven by the task's inherent temporal dependencies and LSTM's ability to address the vanishing gradient problem, ultimately resulting in accurate predictions of daily case changes, achieving an impressive 82% accuracy rate.

Skills and Knowledge Areas

Artificial Intelligence & Machine Learning
- Supervised and unsupervised learning, deep learning architectures (Transformers, RNNs, GANs, MLPs).
- Proficient in optimization techniques: gradient descent, policy gradient, and Adam optimizer.
- Expertise in evaluation metrics: F1-score, ROUGE, perplexity, and custom loss functions.

Natural Language Processing (NLP)
- Abstractive summarization with Transformers (BART), tokenization, and embedding strategies (GloVe).
- Textual metadata analysis, sentiment analysis, and custom tokenization pipelines.

Data Processing & Feature Engineering
- Advanced feature engineering for structured, time-series, and categorical/textual data.
- Preprocessing and normalization techniques: Z-score, temporal sampling, statistical metrics.
- Handling large datasets from diverse sources (data.gov, CNN/Daily Mail, yfinance).

Custom Model Development
- Designing and implementing task-specific architectures: RNN2dSquare, custom BERT models.
- Building neural layers: FullyConnectedLayer, SoftmaxLayer, and loss functions for class imbalance.
- Developing tailored pipelines for 2D contextual learning and ensemble methods.

Generative Models & 2D Contextual Learning
- Generative Adversarial Networks (GANs) for text generation and adversarial setups.
- Innovating with 2D positional embeddings and leveraging advanced compression techniques (SpreadsheetLLM).

Ensemble Learning
- Building robust models using weighted voting, random forests, and custom ensembles for prediction.

Programming & Tools
- Languages: Python (primary), NumPy, Pandas, Scikit-learn.
- Frameworks: PyTorch, Hugging Face, and custom neural network implementation.
- Data handling: Openpyxl, yfinance, JSON processing, and custom parsing functions.

Visualization & Reporting
- Data storytelling with Matplotlib and Seaborn for insights and progress monitoring.

Mathematics & Statistics
- Linear algebra, calculus, and probability for AI modeling.

- Statistical techniques for feature engineering and analysis (class separability, Z-score normalization).

Big Data Management
- Efficient handling of large-scale datasets, augmentation, and preprocessing pipelines.

Research & Optimization
- Academic research expertise, experimental design, and publication-quality reporting.
- Continuous improvement through hyperparameter tuning, ablation studies, and early stopping

Professional Certifications

- AWS Certified AI Practitioner (AIF-C01)
- HuggingFace Fundamentals of Agents
- Coursera Deep Learning Specialty (DeepLearning.AI)

Related Coursework

- Natural Language Processing
- Advanced Artificial Intelligence
- Reinforcement Learning
- Deep Learning
- Computer Vision
- Social Network Analytics
- Recommender Systems
- Applied Cloud Computing
- Applied Artificial Intelligence