Rafat Ashraf Joy
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RESEARCH INTERESTS

Causal Discovery, Biomedical Applications of ML, Network Science, Scientific ML, Deep Generative Models

STANDARDIZED TEST SCORES

GRE

Quant	Verbal	AWA
169/170	159/170	4.5/6.0

IELTS

Total	Listening	Reading	Writing	Speaking
8/9	9/9	8/9	7.5/9	7/9

EDUCATION

PhD, Computer Science ***Aug/2023 - May/2028***
University of Illinois Chicago
Chicago, IL, USA
Courses: Causal Inference, Algorithms, Machine learning, Database Systems
GPA: 4.00

Bachelor of Science, Computer Science and Engineering ***Jan/2018 - Dec/2022***
Shahjalal University of Science and Technology
Sylhet, Bangladesh
Selected Courses: Digital Signal Processing, Laplace Transform, Complex Analysis, Calculus, Machine Learning, Computer Graphics, Linear Algebra, Numerical Analysis, Probability and Statistics
GPA: 3.59

EXPERIENCE

Graduate Teaching Assistant, University of Illinois Chicago ***Jan/2024 -Present***
Chicago, IL, USA

- Teaching Assistant in CS 301: Languages and Automata, CS 480: Database Systems, CS 251: Data Structures
- Holding office hours, grading assignments and projects

Graduate Research Assistant, University of Illinois Chicago ***Aug/2023 - Dec/2023***
Chicago, IL, USA

- Research on improving the convergence of Physics-Informed Neural Networks for solving partial differential equations by deep generative models (energy-based model, diffusion model)

Junior Software Engineer, Dynamic Solution Innovators ***Apr/2023 - Jul/2023***
Dhaka, Bangladesh

- Participated in the backend development of an Internet service provider's subscription website utilizing Ruby on Rails framework
- Created invoice PDFs utilizing ‘Prawn’ and ‘receipts’ gem.

SKILLS

- Machine Learning: Supervised and unsupervised learning which includes:
    - Linear and non-linear regression/classification models, Support Vector Machine, Gradient Boosting, Random Forest
    - Neural networks: Multi-Layer Perceptron (MLP), Convolutional Neural Networks (CNN), Recurrent Neural Networks (RNN), Long short-term memory (LSTM) networks, Transformers.
    - Deep Generative models: Autoregressive models, GANs, VAEs, Diffusion models, Energy-based models, Score-based models.
- Programming Languages: Python, Java, Ruby, C++
- Optimization: LP, MILP, MIQP
- Databases: MySQL, MongoDB
- Libraries: PyTorch, Numpy, Scipy, Pandas, Tensorflow, SciKit-Learn
- Web Development: React, Express, Flask, Ruby on Rails
- Others: SQL, Git version control, Linux, Google Cloud Platform (GCP), Docker

PUBLICATIONS

- Fine Tuning the Prediction of the Compressive Strength of Concrete: A Bayesian Optimization Based Approach, in IEEE Xplore. doi:10.1109/INISTA52262.2021.9548593
- An Interpretable Catboost Model to Predict the Power of Combined Cycle Power Plants, in IEEE Xplore. doi:10.1109/ICIT52682.2021.9491700

PROJECTS

- **Keshik:** A pip package designed to address class imbalance problem in tabular data using Denoising Diffusion Probabilistic Model (DDPM), a cutting-edge deep generative model. Leveraging PyTorch deep learning framework, the package provides APIs for oversampling imbalanced datasets, enhancing predictive model performance. This software streamlines the process allowing data scientists to make informed decisions in class imbalance problems like fraud detection, anomaly detection and churn prediction.

- **Super Resolution GAN for precipitation downscaling:** Developed an approach using a super-resolution Generative Adversarial Network (GAN) to upgrade low-res precipitation data (16x16) for the South Asia region to high-res quality (64x64). This method enhanced the precision and fidelity of meteorological data, thus enabling more insightful analysis and improved forecasting capabilities.

- **Temporal Causal Graph Discovery in Complex HPC Network Traffic Simulations:** This project intends to provide insight into improving surrogate model forecasting of HPC network traffic data from Argonne lab by identifying causal relationships driving variations in simulated multivariate temporal data. Neural Additive Vector Autoregression (NAVAR) has been employed to capture non-linear causal influences. CausalFormer, a framework combining multi-kernel causal convolution and attention layers, is explored, with Regression Relevance Propagation (RRP) used to analyze temporal causal relations and construct a causal graph.

- **Snap the leaf:** This web-app lets the users diagnose the disease of plants just by uploading the image of an infected leaf. Four deep learning models run in the backend of this web app, which will perform the prediction task. They are baseline CNN and Transfer learning based DenseNet, ResNet, ImageNet models. The deep learning models were trained using Keras API on TensorFlow Backend.