RIJUL DIMRI

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EDUCATION

PhD University of Houston, Earth and Atmospheric Science **Aug 2022-Going on**
Grades: 3.94 GPA
Dissertation: "Applications of GNN and Advance Deep Learning in Improving predictions and Understanding of Air Quality and Weather"
Committee: Yunsoo Choi (Supervisor), Jiajia Sun, Honghai Zhang, Youngsoo Choi

M.Sc NIT Rourkela, Atmospheric Science **2018-2020**
Grades: 8.64 CGPA
Thesis: "An Analysis on Translation Speed of Tropical Cyclones over North India Ocean"
Advisor: Krishna Kishore Osuri

B.Sc HNBGU, Physics, Mathematics, Geology **2014-2017**
Grades: 70.9%

RESEARCH EXPERIENCE

University of Houston, Texas Fall 2024-On Going
Advisor: Prof. Yunsoo Choi
Title: An advection and diffusion operator for Graph Neural Network for forecasting $PM_{2.5}$ concentrations.

- Developed **physics-informed GNN** that integrates explicit **advection and diffusion operators** over graph structure.
- Implemented Variational model decomposition (**VMD**) to improve model performance.
- Designed **directional edge weights to accurately** model advection-driven pollutant transport across monitoring stations using **WRF-simulated wind features**.
- Engineered learnable diffusion coefficients that optimized spatial smoothing in the **graph Laplacian-based operator.**
- Achieved computational efficiency, that enables **real-time applications** for urban air quality management and public health protection.

University of Houston, Texas Fall 2024
Advisor: Prof. Yunsoo Choi
Title: AGATNet: An Adaptive Graph Attention Network for Bias Correction of CMAQ-Forecasted $PM_{2.5}$ Concentrations Over South Korea

- Developed an **Adaptive Graph attention** network for $PM_{2.5}$ concentration forecasting.
- Achieved **51.56% reduction in forecast error** compared to traditional CMAQ model across South Korea.
- Implemented adaptive learning for node connectivity, **eliminating the need for predefined graph structures in air quality forecasting**.
- **Integrated temporal convolution network with graph attention** mechanisms to capture complex spatiotemporal relationships.
- Conducted comprehensive performance analysis.

National Institute of Technology, Rourkela 2019 to 2020
Thesis: An Analysis on Translation Speed of Tropical Cyclones over North India Ocean
Dataset used: IMD best track data, TRMM precipitation data (TRMM 3B42-V7), Solar influences Data Analysis Center (SIDC).

- Analyzed tropical cyclone characteristics (1990-2018) **revealing correlation between sunspot numbers and storm intensity.**
- Examined TRMM precipitation data within the 100km storm cores.
- Developed **LSTM** model to estimate **tropical cyclone's translation speed.**

Internship, PRL Ahmedabad, Department of Space and Atmosphere May-July 2019
Topic: Langmuir Probe for Ionospheric studies: Geometry and Theories

- Reviewed Langmuir probe designs from **MAVEN and SWARM mission**.
- **Analyzed SAL/OMI theories** for ion/electron current.
- Modeled probe **shape/size optimization for various ionospheric conditions**.

TEACHING EXPERIENCE

University of Houston, Texas Fall 2022 to Spring 2023
Teaching Assistant, Introduction to Climate Change Lab (Fall 2022) and Numerical Modelling lab (Spring 2023)

- I taught climate change labs of around 30-40 students and numerical modelling lab of around 40 students.
- Developed quizzes, exams, and homework
- Revised the syllabus to meet accreditation standards.
- Coordinated grading and labs.

JOB EXPERIENCE

Genesis Ray Energy, Senior Associate (Climate Modelling) Feb 2021 to Feb 2022
Dataset Used: ERA5, ERA-interim, FNL/GFS, NIWE Station dataset, MEERA-2, NOAA Station data, JRA-25, IMD best track data, NOAA IBTrACS dataset, WRF output data.

- Bias-correction and Downscaling using Machine Learning (**Project Lead**): Bias correction of ERA5 solar data (SSRD) using Deep Learning algorithms like DNN and RNN. Maximum bias reduced is up to **45%.**

- Data cleaning and validation.
- Tropical Cyclone: **Dynamical downscaling** of **43 TCs using WRF to get Hi-res (3 km)** gridded wind intensity. For the validation, NOAA Ibtracs and IMD best track data were used.
- Re-gridding using CDO and python.
- Created wind energy estimation for the wind farms.

HONORS AND AWARDS

Sheriff EAS Student Poster Competition 2024
Title: "Simplifying atmospheric chemistry models using sparse nonlinear dynamics identification."

PUBLICATIONS

1. **Dimri, Rijul** & Choi, Yunsoo & Salman, Ahmed & Park, Jincheol & Singh, Deveshwar. (2024). AGATNet: An Adaptive Graph Attention Network for Bias Correction of CMAQ-Forecasted PM2.5 Concentrations over South Korea. Journal of Geophysical Research: Machine Learning and Computation. 1. 10.1029/2024JH000244.
2. Khan, Ahmed & Choi, Yunsoo & Singh, Deveshwar & Kayastha, Sagun & **Dimri, Rijul** & Park, Jincheol. (2024). Temporal CNN-Based 72-hour Ozone Forecasting in South Korea: Explainability and Uncertainty Quantification. 10.1016/j.atmosenv.2024.120987.
3. Singh, Deveshwar & Choi, Yunsoo & **Dimri, Rijul** & Ghahremanloo, Masoud & Pouyaei, Arman. (2023). An intercomparison of deep-learning methods for super-resolution bias-correction (SRBC) of Indian Summer Monsoon Rainfall (ISMR) using CORDEX-SA simulations. 10.1007/s13143-023-00330-8.

LANGUAGES

English and Hindi

COMPUTER SKILLS

Programming: Python, MATLAB, R, Java

Applications: Weather Research and Forecasting (WRF) model, Climate4R, CDO (Climate Data Operators), PyTorch, TensorFlow, Keras, Xarray, NetworkX, cf-pyhton, MetPy, ESMF, Cartopy, Torch Geometric, Hy-split

Platforms: Ubuntu, Windows, Virtual Machines, Microsoft Azure, NERSC supercomputing environment, Carya server (University of Houston)

High-Performance Computing: Multi-GPU training, Distributed multi-node computing, Parallel model training, Resource optimization.

OTHER

Hobbies: Judo **|** Reading **|** Travelling**.**

Date of Birth: 02/02/1997
I hereby declare that all the information furnished above is true, complete, and correct to the best of my knowledge and belief and will be supported by original documents whenever required.

Place: Houston, Tx
Rijul Dimri