Suraj Pawar

+1 (206) 931 9902 - supawar@okstate.edu - linkedin.com/in/surajp92 - github.com/surajp92

SUMMARY

- Accomplished AI researcher with 25+ peer-reviewed publications and 1000+ citations, experienced in translating research innovations into product applications. Recognized for extraordinary ability in sciences through EB1A visa approval.
- Pioneered large-scale deep learning models using CNNs, LSTMs, neural operators, and transformer-based architectures, achieving 1000X computational speed-ups for scientific problems.
- Lead developer of CFD-Julia (400+ GitHub users), an open-source library for solving PDEs in CFD, and PAR-RL, a scalable deep reinforcement learning framework for scientific environments and scaled it up to 512 nodes on ALCF's supercomputers.

EDUCATION

Oklahoma State University — **Stillwater, Oklahoma, USA**
Doctor of Philosophy in Mechanical Engineering — *January 2019 - August 2022*

Virginia Polytechnic Institute and State University — **Blacksburg, Virginia, USA**
Master of Science in Mechanical Engineering — *August 2016 - December 2018*

TECHNICAL SKILLS

Programming Languages: Python, C/C++, Julia, Fortran, MPI, MATLAB, CUDA
Libraries: PyTorch, TensorFlow, MLFlow, DVC, Huggingface, Ray, PySpark, Sklearn, NumPy, SciPy, Pandas, Optuna
DevOps Tools: Git, Singularity, Docker, Azure, AWS, Vscode, Linux, Jupyter, Colab, Streamlit
ML Architectures: CNN, LSTM, GANs, Transformers, Diffusion model, VAE, GNN, LLMs, SAM

WORK EXPERIENCE

AI Researcher, *Shell Global Solutions Inc, Texas, USA* — *August 2022 - Present*
Responsible for developing AI solutions for advancing Shell's energy transition strategy as part of the digital innovation team.

- Spearheaded the development of large-scale **neural operator** models for PDE-based numerical simulations, achieving a remarkable 1000X computational speed-up with an R2 correlation coefficient exceeding 93%. Link
- Collaborated with multi-disciplinary teams for **performance optimization**, incorporating techniques such as distributed data parallel (DDP), efficient data pipelines, and gradient checkpointing, reducing training time by 30% and GPU usage by 20%.
- Developed **large foundation model** based on **vision transformer** for seismic data segmentation, resulting in a 7% improvement in the dice score coefficient and enhancing geological interpretation capabilities.
- Created novel **latent diffusion model** for the reconstruction of wind fields from sparse measurements and for weather forecasting, aiding Shell's wind and trading businesses to accelerate decision-making.
- Developed cVAE model solve seismic inversion problem leading to a quick turnaround in the exploration stage.
- Led the creation of an end-to-end machine learning solution from data pre-processing pipeline to model serving, resulting in a carbon capture storage site screening tool for probabilistic risk assessment.
- Authored technical papers and presented findings at international conferences, contributing to Shell's reputation as an industry leader in applied AI research. Mentored interns and junior data scientists, advancing a culture of innovation and continuous learning.

Graduate Research Assistant, *CFD Lab, Oklahoma, USA* — *January 2019 - August 2022*
Led scientific ML research for Earth system modeling, achieving significant contributions and technological advancements.

- Proposed an **equivariant CNN** model for turbulence closure modeling by incorporating physical symmetries as constraints, achieving a 32% reduction in loss and improved correlation compared to a CNN, along with stable deployment. Link
- Integrated **Kalman filtering** and **transformer neural operator** to learn closure models for large eddy simulation of turbulent flows, reducing run time by 40% in the a posteriori deployment. Link
- Engineered a novel **probabilistic surrogate model** using **deep-ensembles** for turbulent flow reconstruction tasks, improving prediction accuracy by up to 20% and reducing uncertainty by up to 10%. Link
- Implemented a **nonintrusive ROM** framework using an **LSTM** network for data-driven autoregressive forecasting of geophysical flows, achieving a 100X computational speedup in the data assimilation loop. Link
- Developed a multi-objective evolutionary strategy algorithm for hyperparameter optimization and automatic pruning of CNNs used in surrogate modeling of geophysical flows, reducing the model's computational complexity by 50%.

AI Research Intern, *National Renewable Energy Laboratory, Colorado, USA* — *May 2021 - August 2021*

- Designed a **multi-fidelity physics-informed neural network** framework for wake modeling of a wind turbine, attaining a maximum relative percentage error for the kinetic energy flux of less than 1%. Link
- Worked with a cross-functional team of engineers and data scientists to integrate the model into NREL's wind farm optimization toolkit.

AI Research Intern, *Argonne National Laboratory, Illinois, Chicago* — *May 2020 - August 2020*

- Led the development of a **distributed reinforcement learning** library for scientific simulation on supercomputers, contributing to a 30% computational acceleration in the convergence of steady-state CFD simulation. Link
- Deployed and analyzed the scalability of the Ray library coupled with OpenFoam on 512 nodes with 8 CPUs each.