Hossein Naderi

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SUMMARY

Innovative Machine Learning researcher with a proven track record of developing advanced ML models for complex systems. Published in top-tier journals with over 350 citations, demonstrating deep learning and data-driven modeling expertise. Proficient in Python, JAX, and TensorFlow, with the ability to translate complex mathematical concepts into efficient, scalable solutions.

EDUCATION

Ph.D. Computational Modeling and Simulation Aug 2021 - Present
University of Pittsburgh, USA | GPA = 4.0
Relevant Courses: Probabilistic Machine Learning, Bayesian Signal Processing, Tensor Networks, and Reduced Order Modeling

M.Sc. Aerospace Engineering - Aerodynamics Sep 2016 - Sep 2019
University of Tehran, Iran | GPA = 4.0
Relevant Courses: Computational Fluid Dynamics, Turbulence, Advanced Deep Learning and Engineering Mathematics

B.Sc. Aerospace Engineering Sep 2012 - Sep 2016
K. N. Toosi University of Technology, Iran

RESEARCH EXPERIENCE

University of Pittsburgh Aug 2021 - Present

- **Reinforcement Learning (RL) for Chaotic Systems Control**
  - *Developed RL models that improved control accuracy of chaotic systems by 34% over baseline*
  - *Utilized Trust Region Policy Optimization (TRPO) and Proximal Policy Optimization (PPO)*
- **Evolutional Deep Neural Networks (EDNN) for PDE Solutions**
  - *Successfully implemented the Evolutional Deep Neural Network method using JAX*
  - *Applied this approach to solve dynamical systems, achieving 90% accuracy in long-term predictions*
- **Scalable Reduced-Order Modeling for Nonlinear Stochastic PDEs**
  - *Developed innovative approaches for efficient reduced-order modeling of complex nonlinear stochastic PDEs*
  - *Utilized JAX for automatic differentiation in implementing implicit time integration methods*
  - *Applied GPU parallelization to accelerate models by a factor of 1000 without requiring offline computations*
- **Implicit Time Integration of Random PDEs on Low-Rank Matrix Manifolds**
  - *Formulated a novel computational approach to efficiently solve challenging nonlinear stochastic PDEs*
  - *Used a CUR-based low-rank approximation method to reduce calculation time and memory usage*

Vehicle, Fuel, and Environment Research Institute Sep 2016 - Sep 2019

- **Deep Learning-Based Reduced Order Modeling of Dynamical Systems**
  - *Developed a novel reduced-order modeling technique for dynamical systems using deep neural networks*
  - *Combined an autoencoder for dimensionality reduction with an LSTM network for future state prediction*
  - *Utilized TensorFlow for training and achieved predictions 100 times faster than conventional methods*
- **ML-Driven Dynamic Mode Decomposition (DMD) for Flows over Moving Structures**
  - *Combined DMD with machine learning methods to analyze unsteady fluid flows over moving structures*
  - *Achieved a mean coefficient of determination of at least 0.92 across three diverse test cases*
- **Advanced Optimization and Analysis of Wind Turbines**
  - *Designed an advanced optimization approach for Savonius wind turbines and achieved a 27% increase in power*
  - *Applied DMD for wake prediction and reduced simulation time by 52% while maintaining accuracy*
  - *Significantly enhanced both turbine efficiency and computational speedup*

PUBLICATIONS

- **M. H. Naderi**, et al., "*CUR for Implicit Time Integration of Random Partial Differential Equations on Low-Rank Matrix Manifolds*," Proceedings of the Royal Society A (2024)
- M. Donello, G. Palkar, **M. H. Naderi**, et al., "*Oblique projection for scalable rank-adaptive reduced-order modeling of nonlinear stochastic PDEs with time-dependent bases*," Proceedings of the Royal Society A (2023)
- **M. H. Naderi**, H. Babaee, "*Adaptive sparse interpolation for accelerating nonlinear stochastic reduced-order modeling with time-dependent bases*," Computer Methods in Applied Mechanics and Engineering (2023)
- H. Eivazi, H. Veisi, **M. H. Naderi**, V. Esfahanian, "*Deep Neural Networks for Nonlinear Model Order Reduction of Unsteady Flows*," Physics of Fluids (2020)
- M. Masdari, M. Tahani, **M. H. Naderi**, N. Babayan, "*Optimization of Airfoil Based Savonius Wind Turbine Using Coupled Discrete Vortex Method and Salp Swarm Algorithm*," Journal of Cleaner Production (2019)
- **M. H. Naderi**, et al., "*New Method for Dynamic Mode Decomposition of Flows over Moving Structures Based on Machine Learning (Hybrid Dynamic Mode Decomposition)*," Physics of Fluids (2019)
- **M. H. Naderi**, et al., "*Dynamic Mode Decomposition Analysis for Savonius Wind Turbine*," Journal of Renewable and Sustainable Energy (2019)

PROJECTS

- **Scalable Social Content Recommendation Engine**
  - *Implemented an end-to-end recommendation system using collaborative filtering and deep learning in JAX.*
  - *Achieved a 20% boost in engagement metrics through strategic feature engineering and hyperparameter tuning.*
- **Real-Time Social Data Classification & Sentiment Analysis**
  - *Developed a real-time classification system that integrates deep neural networks with rule-based models.*
  - *Attained 95% accuracy in detecting trending topics and sentiments.*

ACHIEVEMENTS & CONTRIBUTIONS

- Research publications have garnered **over 350 citations**, demonstrating significant impact in the field
- Author of **"Scientific ML Notes"** on GitHub, a repository on Scientific Computing and Machine Learning
- Awarded **CMS Fellowship** by the Swanson School of Engineering, University of Pittsburgh
- Recipient of **Monash Graduate Scholarship** for Ph.D. studies at Monash University
- Received **Best National Master's Thesis Award** in Aerospace Engineering
- **Ranked 1st** among students in the Aerodynamic Engineering Department, University of Tehran

WORK EXPERIENCE

Graduate Teaching Assistant Jan 2022 - Apr 2024
University of Pittsburgh, PA, USA

Lab Manager at Computational Fluid Dynamics Lab Jun 2018 - Dec 2018
University of Tehran, Tehran, Iran

SKILLS

Programming

- Python
- JAX
- TensorFlow
- Julia
- C++
- Git

Software

- Ansys SpaceClaim
- Ansys Meshing
- Ansys Fluent
- OpenFOAM
- ParaView

Specializations

- Machine Learning
- Deep Learning
- Optimization
- Linear Algebra
- Scientific Computing
- Reduced Order Methods

Soft Skills

- Teamwork
- Self-motivation
- Communication
- Project Management
- Scientific Writing