Akshay Anand

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akshay-anand 🔗 akshay-anand-fluid-dynamics

Tallahassee, Florida - 32304, USA (**Graduating: Fall 2025 - Avaialable from 12/2025**)

OBJECTIVE

PhD researcher specializing in ML/AI and computer vision with expertise in developing neural network algorithms for accelerating physics-based modeling with advanced AI for industrial and life science applications. An invited speaker at the National AI Research Resource (NAIRR) program, eager to leverage my interdisciplinary background to solve real-world, complex problems through collaborative research.

KEY ACHIEVEMENTS

- Developed visual AI framework processing 200,000+ geometric configurations of facial features, integrating deep learning and computer vision techniques to analyze how facial morphology impacts respiratory dynamics and mask efficacy across diverse populations.

- Reduced computational costs by 85% (compared to traditional engineering approach such as computational fluid dynamics simulations) through innovative ML & physics hybrid approaches, demonstrating ability to create efficient solutions for complex computational problems.

- Implemented GPU-accelerated visualization and deep learning pipeline for complex fluid dynamics problems, using CUDA and distributed computing to process large-scale visual data, transforming domain expertise into novel AI applications with practical impact through cross-disciplinary collaboration.

- Collaborated with multidisciplinary teams from leading research institutions and industry partners, disseminating research findings at international conferences such as the European Aerospace Conference and AIAA conferences.

EDUCATION

- **Florida State University** *Tallahassee, FL, USA*
  Ph.D in Mechanical Engineering (Extensively on Computational Physics & Scientific Computing) 05 2021 – Present*
  Focus: Fluid Dynamics, Computational Modeling, High-Performance Computing, Machine Learning
- **École Centrale de Lille & ISAE - ENSMA** *Lille, France*
  Masters in Aeronautics and Space, Major: Turbulence & Applied Mathematics 09 2017 – 08 2019
  Focus: Unsteady Simulations, Numerical Modeling, Computational Fluid Dynamics
- **Bansal Institute of Research & Technology** *Bhopal, India*
  Bachelor of Engineering, Major: Mechanical Engineering 06 2013 – 05 2017

SKILLS

- **Programming & Scripting Languages:** Python (95%), C++ (80%), Java (75%), FORTRAN (95%), MATLAB (95%), Julia (70%), R (85%)
- **AI & Machine Learning:** TensorFlow, PyTorch, JAX, Computer Vision, Deep Learning, Visual Language Models, Generative AI, LLMs
- **High Performance Computing:** CUDA, OpenMP, MPI, GPU Programming, Distributed Computing
- **Data Science & Analytics:** NumPy, Pandas, Scikit-learn, Large-scale Data Processing, Real-time Analytics
- **DevOps & Version Control:** Git, GitHub, Doxygen, Jenkins, Docker
- **Development Tools:** Linux/Unix, VS Code, Jupyter
- **Documentation & Technical Writing:** LaTeX, LibreOffice, MS Office

RESEARCH PROJECTS

- **Project A: [Physics-Informed AI Framework for Respiratory Disease Modeling and Prevention]** *09 2024 - Present*
  Tools: [Python, PyTorch, Computer Vision, CUDA, GPU], Advisor: [Dr. Kourosh Shoele] at FSU (USA) PhD Ch 3
  ○ Developed innovative physics-informed AI framework for epidemiological modeling, integrating fundamental fluid dynamics principles with machine learning to analyze 200,000+ geometric configurations of facial features, creating interpretable and physically consistent models that predict respiratory disease transmission with 85% reduction in computational cost while maintaining scientific rigor and addressing critical public health challenges

  ○ Architected end-to-end collaborative machine learning pipeline integrating visual language models with computer vision algorithms, enabling automated feature extraction and semantic understanding of complex visual patterns across large-scale datasets

- Implemented GPU-accelerated visual processing system using CUDA, achieving real-time 3D reconstruction and visualization through distributed computing, with optimized performance across multi-node GPU clusters for processing high-resolution image data

- **Project B: [Deep Learning-Driven Analysis of Speech-Based Respiratory Pathogen Transmission]** *01 2024 - 08 2024**
  Tools: [Python, TensorFlow, Computer Vision, Rhino/Grasshopper], Advisor: [Dr. Kourosh Shoele] at FSU, (USA) PhD Ch 2
  - Created real-time virus transmission risk assessment system using deep neural networks, analyzing 1000+ video sequences to quantify how facial movements during speech contribute to respiratory pathogen spread, with applications for public health policy and intervention strategies
  - Pioneered an integrated deep learning framework for transmission risk analysis, employing advanced facial dynamics tracking to identify aerosol and droplet generation patterns during various speech activities with 95% accuracy
  - Engineered a novel multi-modal signal processing solution combining visual and acoustic data, revealing that plosive-initiated words (/p/, /b/, /t/) generate 3x higher pathogen transmission risk through increased peripheral leakage, providing critical insights for mask design and social distancing protocols

- **Project C: [Population-Scale Anthropometry: Integrating Facial Dynamics and Interface Flow]** *05 2021 - 12 2023**
  Tools: [Python, Grasshopper, C++, HPC], Advisor: [Dr. Kourosh Shoele] at Florida State University (USA) PhD Ch 1
  - Devised novel geometric modeling framework using Geometrically Weighted PCA for human facial analysis, implementing Sigmoidal weighting functions to precisely analyze complex datasets across 6 critical interface regions across 7000+ diverse facial configurations, demonstrating innovative computational solutions for challenging problems
  - Developed high-performance analytical framework combining fluid dynamics and facial soft tissue anthropometry, achieving 85% reduction in computational cost while maintaining anatomical accuracy for interface analysis across diverse populations
  - Build an end-to-end pipeline for wearable device optimization, integrating parallel computing for collaborative evaluation of fit and comfort across 7000+ unique facial configurations, with findings published in high-impact public health journals

- **Project D: [Large-Scale Data Analysis and Pattern Recognition in Complex Non-Linear Systems]** *05 2023 - 12 2024**
  Tools: [FORTRAN, C++, PyTorch], Advisor: [Dr. Kourosh Shoele] at Florida State University (USA) PhD - Side Project
  - Implemented high-performance simulation framework coupling physical models with pattern recognition algorithms, enabling real-time collaborative analysis of complex system dynamics and automated feature detection across distributed computing environments
  - Developed innovative graph neural network and spectral clustering algorithms to process 5TB+ of high-dimensional data, achieving automated pattern recognition and relationship extraction with 90% accuracy compared to manual analysis, demonstrating capability to advance state-of-the-art research
  - Created scalable feature extraction pipeline combining dimensionality reduction with machine learning, enabling real-time pattern detection and visualization of complex system behaviors, published in AIAA SciTech 2025

PROFESSIONAL EXPERIENCE

- **Research Engineer for Clean Sky 2 Project of European Union** *12 2019 - 11 2020*
  Tools: [Python, TensorFlow, CUDA, GPU], Advisor: [Dr. Turab Zaidi] at Georgia Tech Lorraine (France)
  - Developed an innovative approach to forecast the demand for future aviation vehicles, including urban air mobility (UAM) and commercial supersonic airliners, within the 2035 to 2050 timeframe
  - Created a deep learning-based algorithm (A*) to analyze the demand for commercial supersonic aircraft
  - Collaborated with a multidisciplinary team from the German Aerospace Lab (DLR, Germany), French Aerospace Lab (ONERA, France), European Union (Belgium), and Georgia Tech (USA)
  - Disseminated research findings at the European Aerospace Conference and AIAA conferences

- **Computational Aerodynamics Intern (Masters Thesis)** *03 2019 - 09 2019*
  Tools: [Fluid Dynamics, HPC, StarCCM+, Python], Advisor: [Dr. Thierry-Jardin] at ISAE-SUPAERO (France) [O]
  - Conducted high-fidelity 3D URANS CFD simulations to analyze aerodynamic efforts on propellers at varying incidence angles and freestream velocities
  - Performed in-depth flow analysis to identify asymmetric force and moment generation patterns, and investigated the impact of blade geometry variations on propeller performance

- **Research Intern: Investigating Transition to Turbulence in Oscillating Flows** *11 2018 - 02 2019*
  Tools: [Python, Matlab], Advisors: [Dr. Islam Ramadan & Hélène Bailliet] at University of Poitiers (France) [O]
  - Developed a numerical tool to investigate the transition to turbulence in oscillating flows, comparing velocity measurements at varying Reynolds numbers
  - Analyzed and compared data from two optical measurement techniques: Particle Image Velocimetry (PIV) and Laser Doppler Anemometry (LDA), to evaluate their effectiveness in capturing turbulence transition

- Contributed to advancing the understanding of turbulence transition physics in oscillating flows through comprehensive data analysis and interpretation
- **Research Intern: DNS and Data Analysis of Active Turbulence in Ocean** *04 2018 - 08 2018*
  Tools: [C++, Python, HPC], Advisor: [Dr. Enrico Calzavarini] at Université de Lille (France) [○]
  - Developed C++-based large-scale data processing pipeline for turbulent flow analysis, implementing parallel algorithms for processing terabytes of simulation data, demonstrating experience with the scale of data processing relevant to Google's research challenges
  - Created custom analysis tools for extracting and visualizing complex flow patterns from high-dimensional datasets
  - Additional research projects and publications are available at: https://web1.eng.famu.fsu.edu/~aanand/

PUBLICATIONS & PRESENTATIONS C=Conference, J=Journal, A=Abstract, Google Scholar

[A.1] **Anand, A.**, Shoele, K. (2025). **Integrating Large-Scale Data and Physics-Based Modeling to Evaluate Facemask Efficiency Across Populations**. In **National Artificial Intelligence Research Resource (NAIRR) Pilot**, **Invited talk**

[A.2] **Anand, A.**, Shoele, K. (2024). **Integrating Machine Learning and Physics-Based Flow Models for Population-Level Respiratory Disease Simulation**. In **APS Division of Fluid Dynamics Meeting Abstracts**, ZC05.2

[A.3] **Anand, A.**, Tavanashad, V., Shoele, K. (2024). **Sedimentation of Flexible Inertial Particles with Different Aspect Ratios**. In **APS Division of Fluid Dynamics Meeting Abstracts**, T22.5

[J.1] **Anand, A.**, Shoele, K. (2024). **Identifying the effectiveness of face mask in a large population with a network-based fluid model**. Manuscript under review in *PLOS One Global Public Health Journal*

[J.2] **Anand, A.**, Tavanashad, V., Shoele, K. (2024). **Sedimentation of flexible particle suspensions and formation of particle clusters at finite Reynolds number**. Manuscript submitted for publication in *Journal of Fluid Mechanics*

[C.1] **Anand, A.**, Tavanashad, V., Shoele, K. (2025). **Dynamics of Flexible Fiber Sedimentation and Cluster Formation at Finite Reynolds Numbers**. In *AIAA SciTech Forum*, Orlando, Florida, USA

HONORS AND AWARDS

- **Recognized for the "Most Persuasive Op-Ed" (Opposite of Editorial Page)** *2024*
  Florida State University, Featured in FSU News, College of Engineering Newsletter [🌐]
  - Winner of $500 prize editorial competition highlighting significant research impact
- **People's Choice Award in 3-Minute Thesis Competition (Most people voted for the presenter)** *2022*
  Florida State University, Featured in FSU News, College of Engineering LinkedIn [🌐]
  - Won $500 prize for effectively communicating complex research to a broad audiences

LEADERSHIP EXPERIENCE

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  President, Mechanical Engineering Graduate Student Association (MEGSA) *2022 - 2024*
  FAMU-FSU College of Engineering [🌐]
  * Lead organization of 70+ graduate students, organizing ML/AI workshops and technical seminars
  * Created mentorship program connecting students with industry researchers in AI and computational science
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  Research Mentorship & Technical Leadership *2017 - 2022*
  Various Institutions [🌐]
  * Mentored high school students in ML and computational projects through FSU's Young Scholar Program
  * Coordinated computational workshops and technical events at multiple institutions

REVIEWER AND MEMBERSHIP

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  Reviewer, Physics of Fluids Journal (Impact Factor: 4.6) *AIP Publishing*
  Jan 2023 - Present | Reviewed 5+ journal articles [🌐]
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  Reviewer, Journal of Open Source Software
  Jan 2024 - Present | Reviewed journal articles & code implementation (Fortran & PyTorch - FTorch) [🌐]
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  Member, American Physical Society (APS), & AIAA *Division of Fluid Dynamics*
  2020 - Present