Ali Hamza Abidi, Syed

https://www.linkedin.com/in/ali-hamza-abidi-syed/
Department of Mathematics, Blocker Building, College Station, TX 77840
saabidi1@tamu.edu

EDUCATION

- **B.Sc., Mathematics with Computer Science and Data Science Minor,** University of Houston, *(August 2019-2022)*
  GPA:3.99
- **PhD in Applied Mathematics,** Texas A&M University**,** (August 2022-Current)
  GPA: 4.0
  Expected Graduation: August 2027
  Advisor: Dr. Jonathan W. Siegel

Concentrations: Approximation theory, probability theory, Optimization, finite element method and theoretical deep learning.
Relevant Coursework: Measure theory, functional analysis, PDE theory and finite element methods, probability theory, dynamical systems and approximation theory.

RESEARCH EXPERIENCE

Texas A&M, Research Assistant

August 2024-Current
Research Themes: Approximation theory and Optimization theory

Research Projects:

- **Approximation theory of Invariant Neural Networks (Dr. Jonathan Siegel)**
  - Proving approximation rates for invariant neural networks and extending the work onto transformers without the positional encoder, graph neural networks and tensor field networks.
- **Sparseness Aware Minimization/Optimization (Dr. Abhishek Roy)**
  - Proving generalization errors and bounds, in relation to the geometry (specifically curvature) of the loss landscape and extending the work onto ICL (In Context Learning) to understand generalizability of transformers better.
- **Reduced Order Modelling(Dr. Suparno Bhattacharya)**
  - Building a python based library(sci-kit-rom) for data driven modelling for engineers to solve PDE problems. A python based package built on sci-kit fem module.

University of Houston, Research Assistant

January 2020 – August 2024

Projects:

- **Acoustic Systems and ODE Modeling**
  Conducted an initial research project under Dr. Daniel Onofrei analyzing spring-mass

systems in basic acoustics. Utilized numerical methods and Laplace transforms to solve ODE-based models, with solutions implemented in MATLAB and presented in technical reports.

- **Inverse Problems and Machine Learning**
  Worked with Dr. Andreas Mang to explore linear inverse problems with applications in deep learning. Developed solvers in MATLAB (shared via GitHub), applied gradient descent and least-squares methods, and analyzed the stability of neural networks with a focus on the vanishing gradient issue.
- **Minimal Surfaces and Differential Geometry**
  Studied the Bernstein theorem in the context of minimal surfaces under the mentorship of Dr. Min Ru. Engaged in an independent reading of *A Survey of Minimal Surfaces* by Robert Osserman to gain a deeper theoretical understanding of the field.
- **Dynamical Systems and Entropy in Sinai Billiards**
  Conducted research with Dr. Vaughn Climenhaga on the Sinai Billiards system. Developed numerical methods to estimate Lyapunov exponents and topological entropy, with an effort to formulate bounds and conjectures linking system geometry to entropy behavior.

WORK EXPERIENCE

- **Machine Learning Engineer and Researcher at Switchless**
  January 2025-May 2025(Spring)
  - Developed and trained ML audio models for noise detections including the data pipeline, data preprocessing, and data collection. Implemented code in Python and used Jenkins for the data pipeline processing.
- **Data driven engineer at Texas A&M Institute of Data Science(TAMIDS)**
  June 2025-August 2025(Summer)
  - Created an open-source python based library(sci-kit-rom) for data driven modelling for engineers to solve PDE problems. A python based package built on sci-kit fem module. To see more details, check out the library website and documentation: sci-kit rom documentation.

TEACHING EXPERIENCE

- **Teaching Assistant, Texas A&M,**
  2022-2025
  - Math 151(Calculus I) + Python Workshops
  - Math 152(Calculus II) + Python Workshops
- **Grader, Texas A&M,**
  2023-2024
  - Real Analysis I
- **Tutor, University of Houston (Math Club),**
  2019-2022
  - Courses: Freshmen to senior level math courses. Specifically, Linear Algebra, Statistics and Analysis.
- **Goober Tutor,**

2019-2025

- Tutored all kinds of STEM subjects such as mathematics, physics, computer science coding etc.

GRANTS AND FELLOWSHIPS

- Provost's Undergraduate Research Scholarship Program (Spring 2021)
- SURF Undergraduate Research Scholarship (Summer 2021)

AWARDS AND HONORS

- Charles P. Benner Scholarship, *2021-2022*
- Academic Excellence Scholarship, *2021-2022*
- Academic Excellence Scholarship, *2020-2021*
- Dean's List at University of Houston, *2020-2021*
- Academic Excellence Scholarship, *2019-2020*
- Dean's List at University of Houston, *2019-2020*
- UIL district 1st place in Physics, *2018-2019*

PROFESSIONAL MEMBERSHIPS

- AMS(American Mathematical Society)
- SIAM(Society for Industrial and Applied Mathematicians)
- Math Honor Society (Pi Mu Epsilon)
- Cougar Mathletics (Secretary and Founding Member)
- Theology and Philosophy Academic Club (Founding Member)

CONFERENCES/WORKSHOPS/MEDIA

- Jonathan Siegel, Nadav Dym, Hannah Lawerence, Snir Hordan, Ali Syed(2025) "Optimal approximation rates for Invariant Learning on Point Clouds.", Research in AI for Science and Engineering(RAISE) Workshop 2025
- Ali Syed(2024) Midwest Machine Learning Symposium(MMLS)
- Andreas, Mang, Ali Syed(2021) "Optimization and Optimal Control in Machine Learning"
- Presentation at the Pi Mu Epsilon Conference (August 2021)
- Andreas Mang, Ali Syed (2021) "Optimization and Optimal Control in Machine Learning" , poster presented at the SACNAS Conference (October 2021)
- Andreas Mang, Ali Syed (2021) "Optimization and Optimal Control in Machine Learning", poster presented at the University of Houston Undergraduate Research Conference (September 2021)
- Featured in the University of Houston Natural Science and Mathematics newsletter for excellent research contribution. Link: 94 NSM Students Participate in 2021 Undergraduate Research Day - University of Houston (uh.edu)

SUMMER SCHOOLS

- University of Houston Dynamical Systems Summer School (Summer 2023)

- Scientific Machine Learning (SciML) Summer School 2025

RELEVANT SKILLS/INTERESTS

- Proficiency in C++, C#, JAVA, MATLAB, RStudio, Julia and Python.
    - Preferred Language for coding: Python
- Fluent in reading and writing: English, Urdu, Hindi and Arabic.
- Fluent in speaking: English, Urdu, Hindi

UPCOMMING PAPERS/PREPRINTS

- Optimal approximation rates for Invariant Learning on Point Clouds.
  Dr. Jonathan Siegel, Dr. Nadav Dym, Hannah Lawerence, Snir Hordan, Ali Syed(2025)
  Upcoming in Journal Of Machine Learning Research(JLMR) 2025
- Duelling Feedback with sharpness aware minimization, convergent gurantees.
  Dr. Abhishek Roy, Ali Syed(2025)
  Upcomming in International Conference on Learning Representations.(ICLR) 2025
- Sci-kit ROM a low-dependency python based library for reduced order modelling.
  Dr. Suparno Bhattacharya, Ali Syed(2025)
  Upcomming in Journal of Open Source Software(JOSS) 2025