

# Muhammad Saud Ul Hassan

🌐 [msaudulhassan.github.io](https://msaudulhassan.github.io) | 🌐 [github.com/msaudulhassan](https://github.com/msaudulhassan)

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## EDUCATION

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### Florida State University

MS Mechanical Engineering (Robotics)

Deep & Reinforcement Learning (A), Intro to AI (A), Optimal Control (A), Adv. Dynamics (A)

Tallahassee, FL

Aug 2019 – Apr 2021

### University of Engineering & Technology, Lahore

BSc Petroleum & Gas Engineering

First Position in Bachelor's Thesis ("Oil Field Optimization through Gas Lift Optimization")

Lahore, Pakistan

Oct 2013 – Aug 2017

## ACADEMIC AWARDS AND FELLOWSHIPS

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Adelaide Wilson Fellowship	2020
US Navy's \$45,000 award for 2nd position in AI Tracks at Sea Challenge	2020
Chief Minister Laptop Award	2015
Punjab Group of Colleges Merit Scholarship	2011 – 2013
Punjab Education Commission Merit Scholarship	2006 – 2009

## RELEVANT PROFESSIONAL EXPERIENCE

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### Advanced Micro Devices Inc. | Python, PyTorch, Tensorflow, C++, Git, MySQL, Linux

Nov 2021 – Present

Software Development Engineer II

Austin, TX

- Developed and trained a transformer-inspired sequence classification network for convolution kernel selection in MIOpen.
  - Achieved up to 3x speed-up in evaluating convolutions in PyTorch and Tensorflow with MIOpen-backend on AMD Instinct MI100.
- Designed a system to collect and analyze benchmarking data for convolution kernels and present it in a Groovy dashboard
  - Allowed for early detection of redundancies and regressions in MIOpen's convolution kernels.
- Developed a seq2seq model for kernel tuning. Treated parameters describing convolution problems as constituting the source "language", and the parameters defining optimal kernels as constituting the target "language".
- Develop and maintain MITuna – an open-source distributed tuning and data collection infrastructure centered around MIOpen.
- Prepare documentation and assist with code reviews.

## RESEARCH EXPERIENCE

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### Rice University | Python, PyTorch, Tensorflow, LaTeX

July 2023 – Present

Visiting Researcher with Dr. Laura Schaefer

Houston, TX

- Reviewed literature on the application of machine learning to predict interfacial tension (IFT) in CO<sub>2</sub>-brine systems. Identified how modern deep sequence processing methods can be used for IFT estimation.
- Formulated direct normal irradiance forecasting for concentrated solar power applications as a multiclass classification problem. Developed and investigated various deep neural network models for the task.

### Rowan University | Python, PyTorch, Linux, LaTeX

June 2021 – Nov 2021

Research Intern with Dr. Ghulam Rasool

Glassboro, NJ

- Established that variance estimates from Bayesian deep neural networks (BDNNs) provide a well-calibrated measurement of predictive confidence.
- Used predictive confidence estimates to propose manual and learnable approaches for detecting performance degradation and failure in neural networks.
- Demonstrated the proposed approaches and accuracy improvement on medical imaging tasks subject to various adversarial attacks.

- Mathematically posed open-loop stability of legged robots as a trajectory optimization problem.
- Implemented support for complex variables and their arithmetic & calculus in COALESCE – a MATLAB library for direct collocation. Used COALESCE to transcribe open-loop stability optimization into a nonlinear program and solved it with IPOPT.
- Demonstrated the proposed approach on various robotic systems through MATLAB simulations.

## TEACHING EXPERIENCE

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Florida State University | *C, Arduino*  
Teaching Assistant for Mechatronics I

Aug 2019 – Apr 2021  
Tallahassee, FL

- Conducted labs on C and Arduino programming for the Mechatronics I course.
- Held office hours, & helped with designing and grading assignments and exams.
- Guided & mentored students in open design projects.

## RELEVANT PROJECTS

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**Georeferenced Tracking with Uncalibrated Camera** (2020): Implemented a novel object tracking system for GPS trajectory generation from webcam video in real-time. Featured in Florida State University's news.

**Gradily** (2019): Created a social media platform to connect prospective students applying abroad. Shortlisted among 130 top startups by Plan9 – Pakistan's largest & most prestigious tech incubator.

**AI-Assisted Inertial Dead Reckoning** (2020): Designed a Kalman filter augmented with a 1D-CNN to model process non-linearity as an additive term in the filter's output. Applied this approach for dead reckoning in autonomous cars.

**Multi-Agent Path Planning** (2020): Conducted a comparative analysis of Prioritized Planning and Conflict-based Search algorithms for path planning in fully observable multi-agent environments.

**Stable Gait Generation in Quadruped Robots** (2021): Developed a control algorithm to produce stable running in quadruped robots. Simulation results showed dynamic stability even with up to 10% error in landing state observations.

**Haptic-interface Solar Panel Polishing Robot** (2020): Developed a virtual haptic panel polishing robot to train new polishers in a virtual environment. The haptic trainer responded to the user as if the polishing head were constrained to move only along the panel's surface.

## PUBLICATIONS

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1. Ahmed, S., Dera, D., *Hassan, S. U.*, Bouaynaya, N., & Rasool, G. (2022). Failure Detection in Deep Neural Networks for Medical Imaging. *Frontiers in medical technology*, 4, 919046. <https://doi.org/10.3389/fmedt.2022.919046>
2. "A comprehensive review of characterizing CO<sub>2</sub>-brine interfacial tension using machine learning algorithms." Under review at *Renewable and Sustainable Energy Reviews*.

## PRESENTATIONS

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1. *Hassan, S. U.*, & Hubicki C. (2021). Tractability of Stability-Constrained Trajectory Optimization. *Dynamic Walking 2021*
2. "The Mathematics of Deep Neural Networks for Software Engineers." A tutorial series presented at AMD.

## WORKS IN PROGRESS

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1. "Modern deep neural networks for estimation of Direct Normal Irradiance in the absence of meteorological data." Finalizing manuscript with Dr. Laura Schaefer. To be submitted for publication in November 2023.
2. "Adarmer: An adaptive transformer for Direct Normal Irradiance forecasting in the absence of meteorological data." Finalizing manuscript with Dr. Laura Schaefer. To be submitted in 2023.
3. "Optimization of open-loop stable limit cycles with direct collocation and smooth, symbolic derivatives." Finalizing manuscript with Dr. Christian Hubicki. To be submitted in 2023.
4. "Reformer: A compute-efficient transformer for runtime selection of convolution kernels." Data collection and write up in progress.

## LANGUAGES

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Urdu (*Native*), Punjabi (*Native*), English (*Fluent*), Hindi (*Oral Proficiency*), Dari/Farsi (*Basic*), Arabic (*Basic*)