Abdul Jawad

abjawad@ucsc.edu
jawadefaj.xyz
Santa Cruz, CA
+1 831-419-3654

PhD candidate at UCSC's Augmented Design Lab, specializing in developing algorithms for Generative AI, Deep Learning, and Reinforcement Learning, with a strong background in deep learning frameworks like TensorFlow and PyTorch. Extensive experience in cognitive modeling, behavior simulation, and procedural content generation for games and vehicle simulation.

Work Experience

Graduate Researcher | Computational Media, UCSC 09/2018 – Present

- Developed **open-source** simulation and modeling tools for **autonomous vehicle** (AV) development and testing
- Designed critical **scenario generation** tools, **procedural roads**, and **agents** for AV testing using **reinforcement learning** in **Unreal**
- Developed **Waveformer**, a **Transformer**-based network optimized for the **wavelet domain** for **volumetric computer vision** tasks
- Created a procedural **HD road network** generation tool in **ASAM OpenDRIVE** format, facilitating **city-scale AV simulations**

Teaching Assistant | Computational Media, UCSC 09/2018 – Present

- Served as a teaching assistant in over fifteen classes focused on **game design**, **game technology,** and **game AI**
- Advised game teams, delivered lectures, and designed lab exercises in my capacity as a TA and instructor
- Assisted students in troubleshooting and resolving bugs in **Unreal**, **Unity**, and **Phaser** game engines

Co-founder & Game Developer | Portbliss Inc., Bangladesh 10/2015 – 05/2018

- Published four **mobile games** with a total of **30 million+** downloads, featured in national and international news
- Secured **$1M** in angel investments and led the coordination of three mobile games from concept to deployment across multiple teams
- Created a **code obfuscation** tool for **Unity** to counteract MonoDevelop's vulnerability to reverse engineering
- Improved **cross-platform** game performance by optimizing asset management, achieving a **30% reduction** in load times

Web Developer | Shapla IT, Bangladesh 04/2013 – 09/2015

- Developed 5+ multi-device responsive websites using **PHP**, **C#.Net**, and **MySQL**, improving client engagement and satisfaction
- Designed and implemented a DBMS for an educational institute, improving data management and access for 2000+ students and staff

Research Domain

Dissertation Topic: CogMod - Cognitive Modeling of Human Driving Behavior

- Developed the CogMod driver behavior model to incorporate cognitive and perceptive limitations, addressing research gaps
- Created a framework using CogMod to adjust the criticality of autonomous vehicle testing scenarios to create critical scenarios
- Developed an automated framework for generating realistic accident scenarios for AV testing with CogMod

Publications

- **Jawad, A.,** Zaman, M., (2025). **"WaveFormer:** A 3D Transformer with Wavelet-Driven Feature Representation for Efficient Medical Image Segmentation" MICCAI, 2025
- **Jawad, A.**, & Whitehead, J. (2024). "**Accident Scenario Generation using Driver Behavior Model**" In 2024 IEEE 27th International Conference on Intelligent Transportation Systems (ITSC)
- **Jawad, A.**, & Whitehead, J. (2023). "**CogMod: Driver Model for Augmenting Scenario Criticality**" In 2023 IEEE 26th International Conference on Intelligent Transportation Systems (ITSC)
- Muktadir, G. M., Huang, T., Ikram, Z., **Jawad, A.**, & Whitehead, J. "**PedGrid: A Simple yet Expressive Simulation Environment for Pedestrian Behavior Modeling**" In 2023 IEEE 26th International Conference on Intelligent Transportation Systems (ITSC)
- Muktadir, G. M., **Jawad, A.**, Paranjape, I., Whitehead, J., & Shepelev, A. "**Procedural Generation of High-Definition Road Networks for Autonomous Vehicle Testing and Traffic Simulations**" SAE Int. Journal of Connected and Automated Vehicles
- **Jawad, A.**, & Whitehead, J. (2022). "**CogMod: Simulating Human Information Processing Limitation While Driving**" In 2022 IEEE Intelligent Vehicles Symposium (IV)
- Paranjape, I., **Jawad, A.**, Xu, Y., Song, A., & Whitehead, J. (2020). "**A Modular Architecture for Procedural Generation of Towns, Intersections and Scenarios for Testing Autonomous Vehicles**" In 2020 IEEE Intelligent Vehicles Symposium (IV)

Education

University of California, Santa Cruz | PhD degree, Computational Media 09/2018 – 12/2024

University of California, Santa Cruz | MSc degree, Computational Media 09/2018 – 06/2023

Bangladesh University of Engineering and Technology | BSc degree, Computer Science and Engineering 05/2012 – 02/2017

Projects

WaveFormer: A 3D Transformer with Wavelet-Driven Feature Representation for Efficient Medical Image Segmentation

- **WaveFormer** outperforms SOTA **medical image segmentation** models (3D UX-Net, SwinUNETR) by **80% fewer** parameters
- Implemented a **visualization** tool to highlight the significance of **high/low-frequency** components in computer vision tasks
- Implemented efficient **distributed parallel** training for medical datasets (**BraTS, FLARE, KiTS**) in the **NRP Kubernetes porta**

CogMod | Cognitive modeling of human driving behavior

- Developed a **driver model** that simulates human behavior to create realistic **driving agents** for **Scenario-based AV testing**
- Employed the model in **UE4** and **Carla** to generate critical (e.g. cut-in) emergent AV testing scenarios leveraging **RL**
- CogMod models human **perceptive and cognitive limitations**, augmenting regular driving scenarios into **critical scenarios**

VIM-RL | Expert guided autonomous driving

- Created a multi-agent reinforcement learning framework to guide a general driving agent using multiple specialized agents
- Multi-agent setup provides **44%** safer driving without retraining the generic agent in challenging pedestrian and occlusion scenarios

JunctionArt | Procedural road network generation tool

- Developed a toolset for a Ford-funded project that generates **synthetic roads** with **complex intersections** to test **AV path planners**
- Generated roads are importable in different simulation tools, such as **Carla**, **SUMO**, and **RoadRunner**

CruzWay | A modular architecture for AV simulation

- Created **behavior-tree-based pedestrian** and **driver** for NPC agents to generate **emergent critical scenarios** for AV testing
- Developed **modular simulation framework** for AV, authored two open-source **UE4 plugins** for **road** and **behavior generation**

3D Saqqara | An Immersive and Interactive Experience

- Historical visualization in **VR**, focusing on the ancient site of Saqqara across different timelines covering 3000 years of history
- Designed **navigation system**, **UI**, and **3D immersive sounds** for **Microsoft Mixed Reality Headset** in **Unity**

MuktiCamp | A strategy-based Mobile game

- Designed a **level and terrain design tool**, a **code obfuscator**, and an inventory module in **Unity**
- Optimized game **performance** and **memory usage, reducing load times** by **35%,** and improving overall game stability

Heroes of 71 | Third-person shooter game on Android

- Designed the **game's enemy AI**, **NPC manager**, **grenade-throwing mechanics**, and **level design** tool in **Unity**
- Integrated **game analytics** tools, **Ad modules**, and **in-app purchases** in the subsequent versions of the game

Skills

- **Programming Languages:** Python, C, C++, C#, Java, JavaScript, SQL, Bash, PowerShell
- **Tools & Frameworks:** Kubernetes, Docker, Flask, Git, Linux, .Net, HTML5, CSS, Flutter, Vue.js
- **Machine Learning & Data Science:** PyTorch, Scikit-learn, Keras, Matplotlib, Pandas, NumPy, OpenCV,
- **Game Engines & Development:** Unreal, Unity, Phaser.js, GDevelop, Blender, Twine, Construct
- **Autonomous Vehicle Simulation:** OpenDRIVE, OpenSCENARIO, Carla, ApolloAuto, SUMO, RoadRunner
- **Algorithms & Mathematics:** Data Structures, Algorithms, Linear Algebra, Computer Architecture, 3D Math, Vectors, Matrices, Quaternions, Physics
- **LLM tools and frameworks:** LangChain, LangGraph, LM Studio, Ollama

Teaching Experience

Game Design Studio

- Mentored eight-game teams from concept to final completion in a three-quarter capstone project
- Offered targeted feedback that refined game mechanics and narratives for better player engagement
- Facilitated peer reviews to promote collaboration and knowledge sharing across disciplines

Game Technologies

- Taught Unity, Unreal, and Phaser engines to 80+ students in lab settings, integrating real-world practices
- Organized a "Tech Showcase" for students to present projects and gain industry feedback

Game AI

- Delivered interactive lectures on Behavior Trees (BT), A* search, and Path Planning for game development
- Designed AI-driven projects where students applied RL techniques to develop functional game AI
- Introduced a game AI competition for BT-based agents from students, fostering innovation and rewarding the most creative solutions

Algorithmic Music for Games

- Led labs on procedural music creation using PureData, guiding integration into game environments
- Provided feedback on compositions, blending technical precision with creative expression
- Developed tutorials on advanced PureData-Unity integration techniques, enabling independent exploration by students

Game Development Experience

- Taught core programming concepts using GDevelop in an interdisciplinary setting with CS and art students
- Introduced GitHub for collaboration, achieving a high adoption rate by the end of the course

Accessible Games

- Taught best practices for designing games accessible to players with disabilities, focusing on inclusivity
- Mentored teams to develop accessibility features, leading to games praised for user-centered design

Foundation of Video Game Design

- Taught design principles focusing on mechanics, aesthetics, and storytelling for engaging experiences
- Guided students in developing game prototypes, emphasizing iterative design and playtesting
- Created design challenges that encouraged creative problem-solving and innovative thinking

Introduction to Game Programming

- Taught core programming concepts essential for game development
- Introduced GitHub for collaborative coding and project management skills

Introduction to Object-Oriented Programming

- Taught OOP principles, focusing on writing scalable and maintainable code for game development
- Designed projects requiring OOP principles, deepening students' understanding of efficient coding

Activities and Awards

- Organizer 1st SceGen workshop in IEEE IV 2023
- Reviewer: IEEE IV 2024, IEEE ITSC 2024, IEEE IV 2023, IEEE ITSC 2022, IEEE TOG 2021, CVPR 2020
- Created "Collaborative Research with BUET Alumni." forum 2022
- Recipient Bangladesh National ICT Award 2016, Campus2Career Youth Award 2016