Abdul Jawad

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PhD candidate at UCSC's Augmented Design Lab specializing in Generative AI and Reinforcement Learning. Expert in Python/C++ with proven experience in cognitive modeling and behavior simulation for autonomous vehicles. Skilled in procedural content generation, VR development, and containerization (Docker, Kubernetes). Combines technical mastery with innovation to advance computational media research.

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

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 portal**

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 model in **UE4** and **Carla** to generate critical (e.g. cut-in) emergent AV testing scenarios leveraging **reinforcement learning**
- 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**

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, **reduced load times by 35%**, and improved overall stability

Heroes of 71 | Third-person shooter game on Android

- Led the design of **enemy AI**, **NPC management**, **grenade mechanics**, and **level design tools** in **Unity**
- Integrated game **analytics tools**, **ad modules**, and **in-app purchases** in the subsequent versions of the game

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

Skills

- **Programming Languages:** Python, C, C++, C#, Java, JavaScript, SQL, Bash, PowerShell
- **Tools & Frameworks:** Kubernetes, Docker, Flask, Git, Grafana, Linux, .Net, HTML5, CSS, Flutter, Vue.js
- **Machine Learning & Data Science:** PyTorch, Scikit-learn, Keras, Matplotlib, Pandas, NumPy, OpenCV,
- **Game Engines & Development:** Unreal, Unity, MuJoCo, PyBullet, Phaser.js, GDevelop, Blender, Twine, Construct, OpenGL
- **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

Publications

- WaveFormer 3D Transformer with Wavelet-Driven Feature Representation for Efficient Medical Image Segmentation; *MICCAI 2025*
- Accident Scenario Generation using Driver Behavior Model; *IEEE ITSC 2024*
- CogMod: Driver Model for Augmenting Scenario Criticality; *IEEE ITSC 2023*
- PedGrid-A Simple yet Expressive Simulation Environment for Pedestrian Behavior Modeling; *IEEE ITSC 2023*
- Procedural Generation of High-Definition Road Networks for AV Testing and Traffic Simulations; *SAE IJCAV 2023*
- CogMod: Simulating Human Information Processing Limitations While Driving; *IEEE IV Symposium 2022*
- A Modular Architecture for Procedural Generation of Towns, Intersections, and Scenarios for Testing AV; *IEEE IV Symposium 2020*

Activities & Awards

- Reviewer: IEEE IV 2025, IEEE IV 2024, IEEE ITSC 2024, IEEE IV 2023, IEEE ITSC 2022, IEEE TOG 2021, CVPR 2020
- Organized the 1st SceGen workshop (IEEE IV 2023), rallying 50 + scholars and engineers to standardize AV scenario generation
- Founded the “Collaborative Research with BUET Alumni” forum, delivering webinars that link Bangladeshi students to global labs
- Mentored high-school and BUET undergrad researchers, guiding projects that earned IEEE publications and grad-school offers
- Recipient Bangladesh National ICT Award 2016, Campus2Career Youth Award 2016