Abdul Jawad

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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

Work Experience

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

- Developed **open-source** simulation and modeling tools for **autonomous vehicle** (AV) development and testing
- Authored behavior modeling framework named **CogMod** for surrounding vehicles to create realistic **simulated driver agents**
- Designed an emergent **critical scenario generation** tool, realistic procedural roads, and agents for AV testing using **RL** in **Unreal**
- Developed a procedural **HD road network** generation tool in **ASAM OpenDRIVE** format, facilitating city-scale AV simulations
- Mentored high school and undergraduate students, leading **research initiatives** and **two workshops** on AV simulation techniques

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

- Served as a teaching assistant in over ten 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
- Helped students with troubleshooting and bug fixing in **Unreal**, **Unity**, and **Phaser** game engines

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

- Published four **mobile games** with total of **30 million+** downloads, featured in national and international news
- Assited in securing **$1M** in **angel investments** and led programming teams on two projects
- 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.**, & 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)

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 arts students
- Introduced GitHub for collaboration, achieving 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

Skills

- Python, C++, C#, JavaScript, CUDA, SQL, Git, Linux, Kubernetes, Docker
- Unreal, Unity, Phaser.JS, GDevelop, Blender, Twine, Construct
- OpenDRIVE, OpenSCENARIO, Carla, ApolloAuto, SUMO
- PyTorch, Scikit-learn, Keras, Matplotlib, Pandas, NumPy, OpenCV
- PHP, CodeIgnitor, Flutter, .Net, Flask, HTML, CSS
- Computer Vision, Machine Learning, Deep Learning, Reinforcement Learning, Data Structure & Algorithm, Linear Algorithm

Activities and Awards

- Organizer 1st SceGen workshop in IEEE IV 2023
- Reviewer: IEEE IV 2023, IEEE ITSC 2022, IEEE TOG 2021
- Created "Collaborative Research with BUET Alumni." forum 2022

Projects

WaveFormer | Benchmarking Multi-Scale Object Understanding with Wavelet Decomposition

- Proposed a novel **transformer** architecture that controls **high and low-frequency** image components for **object recognition**
- Introduced **Waveformer** that enhances **multi-scale segmentation** by **wavelet-transformed feature space**
- Implemented the **visualization** tool to realize the importance of the high/low frequency component for **computer vision tasks**
- Implemented **Distributed Data Parallel (DDP)** training for large datasets (e.g., Imagenet) 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 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