Abdul Jawad

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PhD candidate at the Augmented Design Lab, UCSC, developing simulation tools for self-driving cars

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 a total of **30 million+** downloads, featured in national and international news
·   Secured **$1 million** 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

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**

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
·   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

· 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, Computer Architecture

Publications 🔗

· 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 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
· Recipient Campus2Career Youth Award 2016 and National ICT Award 2016