

## Introduction:

I am a graduate student in the 5th Ph.D. program at UCSC. My research focus is on autonomous vehicle testing. More specifically, my research focuses on building robust test procedures for autonomous vehicle systems. I obtained my undergraduate degree in computer science and engineering from Bangladesh. I co-founded a game studio in Bangladesh and published several games for Android and iOS, receiving international and national recognition. I personally received the Campus2Career award for extraordinary entrepreneurial skills.

My passion for games brought me to UCSC, which has one of the world's best game design programs. Because of my expertise in game simulators and game programming, I found a research scope in a Ford-funded project at UCSC, which eventually shaped my research focus and brought me to the autonomous vehicle domain. Due to its significant impact on society, I am deeply passionate about my current research.

In my current research, I have built complex simulation tools for Autonomous vehicle training and testing. My background in game development greatly helps me in research and development. Along with my research, I also teach and mentor undergraduate and high school students to shape the next generation of researchers and educators. I aspire to become a prominent researcher in the Autonomous Vehicle testing domain, which has the capacity to save countless lives with technological intervention. Visit the website for a detailed description of my projects and publications.

## Education

**University of California, Santa Cruz** | PhD, Computational Media 09/2018 - Present

- Dissertation topic: "Simulating accident scenarios with realistic driver behavior model to test Autonomous Vehicles"
- Two research papers already published at the Intelligent Transportation Society's (ITS) organised academic and industry conferences
- I am currently working on the final journal paper as the requirement for PhD Degree

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

- Thesis topic: "[CogMod: Simulating Cognitive & Perceptive Limitations in Human Drivers](#)"
- Published research papers on Society of Automotive Engineers (SAE) on developing simulation tools for testing and training Autonomous Vehicles

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

- Thesis topic: "[An Improved Dead Reckoning Approach for 2D Top-Down Multiplayer Car Racing](#)"
- I received the Campus2Career Award for contribution in youth entrepreneurship

## Work Experience

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

- Developed simulation tools (CogMod, CruzWay, and JunctionArt) for modular Autonomous Vehicle testing
- Developed model of driver behavior capable of simulating human-like driving and validated using naturalistic driving dataset
- Published the research in prestigious journal and conferences, including SAE IJCAV, IEEE ITSC, and IEEE IV
- The research will make robust AV testing procedure in the future

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

- Delivered lectures on various game design courses to undergraduate students, including Game AI, Game Design Capstone projects, Game Music Generation, Game Technology
- Participated in voluntary mentoring of high school students during the summer to shape next generation researchers
- Designed exams and assignments for students majoring in Game Design

**Co-founder** | Portbliss Inc., Bangladesh 10/2015 – 05/2018

- Launched first ever game based on Bangladesh Liberation War named 'Heroes of 71' with 7 million+downloads and 300K+ monthly active users

- Received a national award for the top 10 startups of the year in 2016 from the Information and Communication Technology Department of the Bangladesh Government and raised \$500K in investment from Singapore and the USA right after our first game.
- The game was featured in the Economist due to its cultural and historical implication
- Published a sequel in later years and two more games under the same theme; each of them have 1 million+ downloads
- The studio was later acquired by a bigger game studio from Singapore

#### Game Developer & Level Designer | Portbliss Inc., Bangladesh

10/2015 – 05/2018

- Published Heroes of 71 on the 45th Victory day of Bangladesh, where I worked as a gameplay designer and programmer
- Published the sequel of Heroes of 71 with more levels and characters
- Published 'Mukti Camp', a strategy based game under the theme of the liberation war

#### Web Developer | Shapla IT, Bangladesh

02/2015 – 10/2015

- Developed a responsive multi-device website using PHP, C#, .Net, and MySQL.
- Created 'Tukhor', a web-based coaching center management system, using the CodeIgnitor framework for class schedule management, registration, and section assignments.
- Worked on a garage management system for a Bangladesh Air Force officer's quarter, utilizing the .Net framework and MySQL database.

## Skills

- **Software Development:** C++, C#, C, Python, Java, Javascript, Unit testing, Kubernetes, Docker, Design Pattern, Clean code, Distributed Systems, HTML, CSS, .Net, PHP, Git, Linux systems
- **Game Engines:** Unreal 4, Unity 3D, Phaser.JS, GDevelop, Godot, Blender, Construct, GameMaker Studio, Twine, Carla Simulator
- **Machine Learning:** PyTorch, Matplotlib, Pandas, NumPy, OpenCV, Anaconda, Keras, Tensorflow, Computer Vision, SciPy, Reinforcement Learning
- **Management:** Agile development, Scrum, MindMap, Test-driven development, Jira, Git

## Projects

### CogMod | Cognitive modeling of human driving behavior

- Implemented the CogMod model in python for **CARLA** Driving Simulator
- Modeled surrounding vehicles with CogMod for critical AV testing scenario generation
- **Impact:** The technology will create more robust testing methods for partial to fully automated vehicles

### MRA | Multi-scale Region Attention

- Improving computation for Vision transformers (ViTs) in image segmentation task
- Introducing a multi-scale regional self-attention mechanism in each transformer layer, enabling each pixel to attend to multiple scale neighborhoods, which improved state-of-the-art methods with less computation
- **Impact:** This research has provided efficient computation, which is one of the bottleneck for scalable vision task using transformer architecture

### PedGrid | Expressive Simulation platform for Pedestrians

- Created a corridor environment to model bidirectional pedestrian flow.
- Created a two-lane environment to model pedestrian crossing.
- **Impact:** PedGrid runs on low-end laptops and is easy to learn. It will expedite new researchers' careers in autonomous driving.

### JunctionArt | Procedural road network generation tool

- Created tools to generate synthetic roads with complex intersections to test AV path planners
- Performed expressive range analysis to evaluate the complexity of the generated intersections
- **Impact:** JunctionArt streamlines road generation in autonomous vehicle simulations, boosting machine learning efficiency and adaptability.

### CruzWay | A modular architecture for AV simulation

- CruzWay is a comprehensive modular system tailored for creating realistic autonomous vehicle (AV) testing environments, featuring procedurally generated road networks and intersections.
- Authored two open-source Unreal Engine plugins for modular AV simulation
- **Impact:** The tool's ability to generate diverse and complex road configurations for AV testing significantly enhancing the realism and effectiveness of simulation scenarios in the industry.

### Heroes of 71 | Third-person shooter game on Andriod

- Developed enemy AI, NPC manager, gameplay designer and programmer
- Integrated game analytics tools, an ad module and in-app purchases
- The game was featured nationally and internationally, with more than 7 million downloads and 300,000+ active users.
- **Impact:** This was the first ever game produced focusing on the liberation war in Bangladesh, which eventually helped the company raise foreign investment. The game paved the way for more games based on the cultural heritage of Bangladesh.

### 3D Saqqara | An Interactive Egypt

- Developed a VR interactive visualization of Saqqara using Unity and HTC Vive, featuring detailed reconstructions across three different timelines.
- Offers immersive exploration with first-person and bird's eye views, using Blender for texture and component restoration.
- **Impact:** Enhances historical education, research, and engagement, providing an unbiased, sensory-rich journey through Egypt's ancient landscape. The VR game was showcased in annual game show at UCSC

## Activities and Awards

- Organized 1st SceGen workshop in *IEEE IV 2023* where prominent researchers from the Autonomous Vehicle testing domain were present and discussed their state-of-the-art research findings
- Volunteered as reviewer *IEEE ITSC (2022, 2023)*, *IEEE IV (2022, 2023)*, and *IEEE TOG 2021*
- Recipient *Campus2Career Youth Award 2016* and *National ICT Award 2016*
- Volunteer in Summer Internship Program by mentoring High school and college students gain research experience to shape the the next generation researchers

## Publications ↗

- Jawad, Abdul, and Jim Whitehead, "CogMod: Simulating Human Information Processing Limitation While Driving." In 2022 IEEE Intelligent Vehicles Symposium (IV), pp. 1691-1696. IEEE, 2022.
- Jawad, Abdul, and Jim Whitehead. "CogMod: Driver Model for Augmenting Scenario Criticality." In 2023 IEEE Intelligent Transportation Systems Conference (ITSC), IEEE, 2023.
- Jawad, Abdul. "CogMod: Simulating Cognitive & Perceptive Limitations in Human Drivers." PhD diss., University of California, Santa Cruz, 2023.
- Muktadir, Golam Md, Taorui Huang, Zarif Ikram, Abdul Jawad, and Jim Whitehead. "PedGrid-A Simple yet Expressive Simulation Environment for Pedestrian Behavior Modeling.", In 2023 IEEE Intelligent Transportation Systems Conference (ITSC), IEEE, 2023.
- Muktadir, Golam Md, Abdul Jawad, Ishaan Paranjape, Jim Whitehead, and Aleksey Shepelev. "Procedural generation of high-definition road networks for autonomous vehicle testing and traffic simulations." SAE International Journal of Connected and Automated Vehicles 6, no. 12-06-01-0007 (2022): 99-120.
- Paranjape, Ishaan, Abdul Jawad, Yanwen Xu, Asiiah Song, and Jim Whitehead. "A modular architecture for procedural generation of towns, intersections, and scenarios for testing autonomous vehicles." In 2020 IEEE Intelligent Vehicles Symposium (IV), pp. 162-168. IEEE, 2020.