Erdem Murat

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Responsible and innovation-driven Computer Scientist with expertise in virtual reality, deep learning, and computer graphics. Visionary developer that combines engineering fundamentals with science and research.

Education

George Mason University **Fairfax, VA**

Ph.D. in Computer Science *August 2023 (Scheduled)*

M.S in Computer Science *January 2022 - May 2023*

- Advisor: Prof. Craig (Lap-Fai) Yu.
- Member of the Design Computing and eXtended Reality (DCXR) research group.
- Leading member and Secretary of the Computer Science Graduate Students Association (CSGSA).

Bachelor of Science in Computer Science *August 2018 - Decemeber 2021*

Experience

Design Computing and eXtended Reality (DCXR) Lab **January 2022 – Present**

Researcher, Lab Member *George Mason University*

- Advisor: Prof. Lap-Fai (Craig) Yu
- Led 3 research projects in various domains, including Virtual Reality, Machine Learning, Game Development & Engineering, Systems Analysis, and Deep Learning.
- Received mentorship from Prof. Yu, collaborated with lab members on research, and attended seminars, conferences, and related events.

Reviewer **January 2023**

IEEE VR 2023

Publications

Understanding User Experience of Online Education in Metaverse: A Systems Perspective **November 2022**

Ruizhi Cheng, ***Erdem Murat****, Lap-Fai Yu, Songqing Chen, Bo Han* Under review

- Proposed a novel analytic method that combines qualitative and quantitative analysis with end-to-end network measurements to understand user experience in VR education and detect bottlenecks in system performance.
- Deployed a Mozilla Hubs server-client system with custom JavaScript scripts to record client-side performance through an API.
- Used Python and Jupyter Notebook to compute, visualize and analyze systems data.
- Gave a VR lecture to 23 Graduate students and later assisted a Meta researcher in using my platform for a seminar.

Machine Learning Automation for Virtual Reality - Master's Thesis **December 2022**

- Developed a system to address a limitation in VR development research and proposed a solution that improves user experience through machine learning to automate the manipulation of experience-affecting parameters in VR.
- Deployed a testing system to record the effect of parameter manipulation on user experience based on a 10-point rating scale of difficulty, fun, and stress.
- Used collected data to train a machine learning regressor the relations between game parameters and perceived difficulty with low prediction error (26%).
- Obtained IRB certificate for social and behavioral research and conducted user studies with over 50 participants.

Projects

Lightweight Solution for Road Sign Detection | *Pytorch, Keras, Computer Vision, Deep Learning* **January 2023**

- Proposed an improvement to the state-of-the-art in computer vision by designing a lightweight solution that detects road signs and classifies them with over 98% accuracy.
- Developed a lightweight architecture by designing a neural network that is able to work with a limited dataset, using data augmentation and continual learning to improve accuracy from 59% to 98%.

VR Athletics - Foot Tracking VR Simulation System | *Unity, C#, Plastic SCM, VS Studio* **January 2023**

- Developed a VR foot-tracking system enabling enhanced human-computer interaction for athletes in sports research.
- Implemented a sophisticated physics system by formulating a script-based solution enhancing Unity physics to create a realistic interaction system with the foot and virtual objects like ground, sports balls, and environment objects.
- Used VS Studio Debugger and Diagnostics tools to debug code and improve performance.

Motion Planning for A Multi-Robot System | *ROS, Gazebo, Python, A.I, SLAM* **November 2022**

- In a team of 3, used Gazebo and ROS to create a multi-robot environment with obstacles and motion-planning to allow for autonomous robot movement.
- Used Continuous Conflict-Base Search to build a motion planner's pipeline for multi-robot navigation without collisions.

Virtual Reality Education | *JavaScript, Distributed Systems, AWS, Code Profiling* **October 2022**

- Utilized Amazon Web Services to deploy a private Mozilla Hubs server on an Amazon AWS EC2 instance (t3.medium) to conduct user studies. Used Glances to monitor its resource utilization and tcpdump to capture and analyze the network traffic on the server side.
- Modified open-source Mozilla Hubs client code and injected custom scripts to track user data and client-side performance.
- Created an API to collect client-side data sent by scripts and used collected data to detect and debug performance bottlenecks as well as devise solutions for better performance.

Why Did the Chicken Cross the Road? - Virtual Reality Game | *Unity, C#, VS Studio* **November 2021**

- Researched numerous PC, mobile, and VR games to design and develop a VR game that is addictive and fun to play.
- Implemented procedural-level design and game development techniques like 3D noise, environmental triggers, and motion sensing to create a well-rounded, and functional game.
- Recorded human motion, medical wristband (E4) data, gameplay progress data, and user ratings to train a machine learning algorithm.
- Proposed a system that uses trained data to generate and accurately predict the difficulty of levels and use MCMC optimization to manipulate parameters tailored to the intended user experience.

Test the Heights - Virtual Reality Game | *Unity, C#, VS Studio* **November 2021**

- Utilized interactive systems to craft a thrilling and immersive experience.
- Performed user-testing to get feedback from 14 users in various stages of the game to make improvements continuously.

OpenGL Raytracing | *C++, OpenGL, VS Studio* **May 2021**

- Developed C++ code that generates a 3D image by effectively using raytracing.
- Applied Phong's reflection model to accurately calculate a scene's reflections, lighting, and shading.

Technical Skills

Languages: Python, C#, C++, C, Java, SQL, HTML/CSS, JavaScript, R, SAS, MATLAB, Assembly
Developer Tools: Unity, Unreal, Spoke
Softwares/Tools: Visual Studio, OpenGL, Git/GitHub, Eclipse, Blender, Microsoft 365, Photoshop, Plastic SCM

Teaching Experience

Global Co Lab Network **July 2022 – Present**
Virtual Reality Director *Arlington, VA*

- Created virtual reality hubs for the Co Lab to host conferences and enable remote attendees to virtually view and engage with projects and fieldwork addressing social issues.
- Optimized the prior build by 70% by utilizing functionalities in Blender, Spoke and Photoshop to reduce rendering workload.
- Instructed and mentored 3 teams towards developing innovative and educational VR environments for the UN Sustainable Development Goals (SDG) Metaverse Competition.

Cyber Bytes Foundation **June 2022 – July 2022**
Building in VR Camp Instructor *Stafford, VA*

- Developed a comprehensive, 5-day curriculum with 30 hours of educational content to teach virtual reality development concepts to 20 students.
- Harnessed knowledge based on emerging VR technology through attending lectures, conducting research, and attending seminars & conferences to construct content from the field of VR.