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Adaptive Augmented Reality Visual Filters for Low Vision Users: Extending VR-Based Optimization to Real-World Environments

Open Master Thesis

Background

Previous work has demonstrated that visual enhancement techniques can be optimized for users with low vision by combining shader-based rendering with Bayesian optimization and vision assessment. These approaches, tested in virtual reality (VR), allowed for controlled optimization of user performance and visual comfort during defined tasks. However, transferring this methodology to augmented reality (AR) introduces new challenges. In AR, visual shaders must operate on camera-based input, adapting to dynamic, real-world scenes. Furthermore, physical obstacles and safety-critical spatial awareness become essential considerations that are absent in VR.

Research Goal

The goal of this thesis is to extend an existing VR-based shader optimization framework to augmented reality. This includes developing and implementing camera-based visual filters (shader) tailored to users with reduced vision, integrating real-time environmental awareness, and accounting for physical obstacles in the user's surroundings. The project involves adapting the optimization pipeline to AR constraints, addressing latency and perception issues, and evaluating the system through user studies with low-vision participants in semi-controlled AR scenarios.

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