Virtual Eye Fundus Examination

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Abstract

Proper eye examination may help identify and treat ocular disorders associated with the visual system in time to prevent or treat lifelong visual impairments. Direct ophthalmology (DO) is an examination procedure that allows inspecting the fundus of the eye by employing a direct ophthalmoscope, while adjusting the lenses, light, and filters within a proper viewing angle. Eye examination competence requires extensive training to properly interpret the visualized 2D fundus images from the 3D eye anatomy. Moreover, eye disorders where veins and arteries are inflamed are very difficult to detect and typically only detectable by expert examiners. Furthermore, the structure of a traditional ophthalmoscope makes it difficult for an instructor and student to experience a shared experience when using the device, resulting in assessments based on descriptions of what is being observed through the examination device.

We employed immersive technologies to provide a medical trainee an augmented and virtual reality eye examination tool. And in particular, ongoing work in converting an Android-based smartphone into a portable ophthalmoscope simulator to provide trainees with an interactive, engaging, and cost-effective eye fundus examination tool. To develop the virtual and augmented reality systems we defined the user interactions based on the manipulation of the ophthalmoscope to view the eye fundus.
For the augmented reality solutions, we employed printed markers on a piece of paper and over a Styrofoam head, where the smartphone serves as the ophthalmoscope. For the virtual reality approach, we chose to use the HTC Vive headset over the OculusVR, as it provides a greater tracking area (4.5 x 4.5 m Vs. 1.25 x 3.3 m).

Future work will focus on the addition of multiple examination scenarios, improved user interface and online functionality to keep track of the user progression and interactions. Additionally, we will work on a large-scale validation to assess the effects of AR when compared to traditional means of eye examination training.
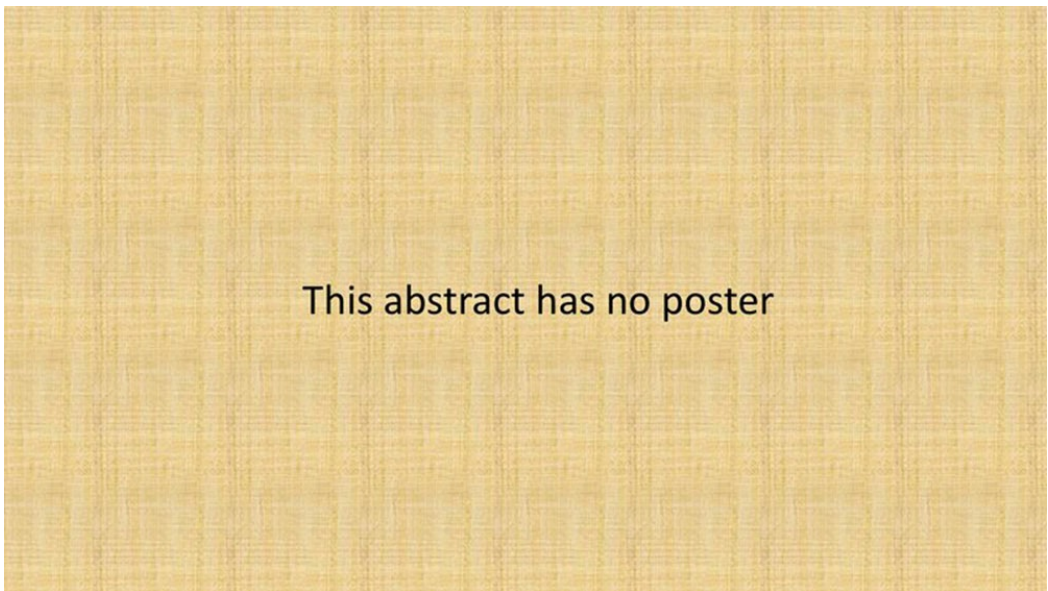
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