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GAZE ESTIMATOR FOR UNITY GAME ENGINE

By

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ABSTRACT

The Brain Game Center at the University of California, Riverside develops brain training games in Unity for the improvement of memory, vision, hearing, attention, and cognition. This software aims to approximate user engagement during gameplay to enhance training outcomes. A key metric of user engagement is determined by estimating where one's gaze is directed while they play. Gaze estimation is an application of computer vision technology that captures images from a user-facing camera to predict where one is looking. Gaze Estimator is an implementation of gaze estimation algorithms for use in Unity. Gaze estimation data collected by Gaze Estimator provides researchers and developers at the UCR Brain Game Center with an actionable means to inform their game development strategy. This report details the design considerations and methodologies employed in the development of this gaze estimation software.

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I would also like to acknowledge my roommate Zachary Ruiz. He is a talented Unity game developer and highly capable computer programmer. His knowledge and prior experience in Unity were a great resource to me in my efforts to develop my gaze estimation software.

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INTRODUCTION

The Brain Game Center (BGC) at the University of California, Riverside creates brain training games that aim to improve human cognition and perception. Research is directed by Dr. Aaron Seitz, Professor of Psychology at UC Riverside. The BGC's brain training games are publicly available for download on the Apple App Store and Google Play Store. They also have multiple applications available for download for Mac or PC on their website, <http://braingamecenter.ucr.edu>.

The applications are created by an interdisciplinary team of scientists, researchers, artists, and engineers. To create effective brain training games, the team leverages computational and neuroscience methodologies. Their catalog of cognitive training apps includes Polyrules, Recollect, Recall, and Remember Bee. Each app is designed to train a set of specific cognitive functions. Polyrules trains executive function skills by challenging its players to sort objects by characteristics that change dynamically. For the improvement of working memory, Recollect trains working memory by presenting players with specific cognitive tasks, like n-back and item span. During gameplay, players train by collecting specific resources as they navigate through space-themed levels. Recall shares a similar theme and is also based upon the n-back task. Similarly, Remember Bee challenges players to accomplish a specific set of tasks whose proper completion relies on the player's working memory.

BCG's perceptual training apps include Listen and Sightseeing. Listen trains the auditory cortex of the brain. During gameplay, it plays specific sound cues that become harder to discern as the player makes progress through the level. Sightseeing operates in a similar fashion, displaying objects that become more difficult to discern from one another as gameplay progresses.

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