Graduate School of Science and Technology Master's Thesis Abstract

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Abstract

The rise in population and aging has led to a significant increase in the number of individuals affected by common causes of vision loss. Early diagnosis and treatment are crucial to avoid the consequences of visual impairment. However, in early stages, many visual problems are making it difficult to detect. Various visual adaptation, involving ocular and behavioral adaptations, can compensate for several visual deficits with adaptive eye movements. These adaptive eye movements may serve as indicators of visual problems.

In this work, we investigate the association between eye movement and blurred vision. By using Electrooculography (EOG) to record eye movements, we propose a new tracking model to identify the deterioration of refractive power. At the same time, we also explored whether eye-tracking, the most widely used method of eye-movement recording at present, contains features that are indicative of refractive power. We verify the technical feasibility of this method by designing a blurred vision simulation experiment. Six sets of prescription lenses were used to modify wearer's refractive power and create different levels of blurring effects. We analyzed eye movements through EOG signals and eye-tracking data. We performed a seven-class classification using the ResNet-18 architecture. Regarding the evaluations on EOG signals, the results revealed an average classification accuracy of 94.7% in the subject-dependent model. However, the subject-independent model presented poor performance, with the highest accuracy reaching only 34.5%. Therefore, the potential of an EOG-based visual quality monitoring system is proven. Concerning the evaluations using eye-tracking data, the results demonstrated an average classification accuracy of 20.9% in the subject-dependent model. Conversely, the subject-independent model exhibited achieved 33.3%. Notably, within the subject-independent scenarios, the task-independent models stood out, with an impressive accuracy of 67.9% compared to other models. While the overall accuracy for eye-tracking was low, the comparatively high accuracy of task-independent models within subject-independent scenarios is intriguing. Eye-tracking remains a promising solution that needs further investigation and study. Furthermore, our experimental design provides a novel approach to assessing blurred vision.