INNOVATION PARTNERSHIPS
UNIVERSITY OF MICHIGAN

Deep Learning CV System for Pupil Analysis

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Category
Digital Health
Software

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OVERVIEW

Deep learning for accurate pupil analysis during cataract surgery

- Improves upon existing technologies with higher accuracy under variable conditions
- Enhances surgical outcomes, automated surgical monitoring, and improved patient safety

BACKGROUND

Cataract surgery is a common procedure aimed at restoring vision by replacing the clouded natural lens with an intraocular lens (IOL). Traditionally, the success of the surgery has been reliant on the surgeon's expertise and manual methods of monitoring pupil reactions, which are critical for optimizing surgical parameters and ensuring patient safety. Conventional methods often suffer from inefficiencies due to variability in illumination and obstructions caused by surgical instruments. These factors can degrade the accuracy of pupil analysis, leading to suboptimal surgical outcomes. Additionally, manual analysis is time-consuming and prone to human error. Therefore, there is a significant need for an improved method that can provide reliable, real-time analysis of the pupil to enhance surgical precision and safety.

INNOVATION

Researchers have created a deep learning-based segmentation model that automatically recognizes the pupil region in extracted frames during cataract surgery. This approach

addresses the limitations posed by variable illumination, obstructions from surgical instruments, and changes in the appearance of the pupil region due to the cataractous lens and its replacement with an IOL implant. The two-stage process involves initial pupil recognition followed by the analysis of pupil characteristics, such as size. This innovative framework improves the accuracy and efficiency of pupil analysis, ensuring better real-time monitoring and decision-making during surgery. Potential real-world applications include enhanced surgical outcomes, automated surgical monitoring systems, and improved patient safety through accurate and timely pupil response assessments.

ADDITIONAL INFORMATION:

REFERENCES:

B. D. Giap, K. Srinivasan, O. Mahmoud, S. I. Mian, B. L. Tannen and N. Nallasamy, "Adaptive Tensor-Based Feature Extraction for Pupil Segmentation in Cataract Surgery," in IEEE Journal of Biomedical and Health Informatics, vol. 28, no. 3, pp. 1599-1610, March 2024, doi: 10.1109/JBHI.2023.3345837