Policy-Driven, Multimodal Deep Learning for Predicting Visual Fields from the Optic Disc and Optical Coherence Tomography Imaging

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PURPOSE: To develop and validate a deep learning (DL) system for predicting each point on visual fields (VF) from disc and optical coherence tomography (OCT) imaging and derive a structure-function mapping.

DESIGN: Retrospective, cross-sectional database study PARTICIPANTS: 6437 patients undergoing routine care for glaucoma in three clinical sites in the UK.

METHODS: OCT and infrared reflectance (IR) optic disc imaging was paired with the closest VF within 7 days. Efficient-Net B2 was used to train two single modality DL models to predict each of the 52 sensitivity points on the 24-2 VF pattern. A policy DL model was designed and trained to fuse the two model predictions.

MAIN OUTCOME MEASURES: Pointwise Mean Absolute Error (PMAE) RESULTS: A total of 5078 imaging to VF pairs were used as a held-out test set to measure the final performance. The improvement in PMAE with the policy model was 0.485 0.533 dB compared to the IR image of the disc alone and 0.060 0.073 dB compared to the OCT alone. The improvement with the policy fusion model was statistically significant (p CONCLUSIONS: The multimodal, policy DL model performed the best; it provided explainable maps of its confidence in fusing data from single modalities and provides a pathway for probing the structure-function relationship in glaucoma.

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