

Efficacy for Differentiating Nonglaucomatous Versus Glaucomatous Optic Neuropathy Using Deep Learning Systems

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PURPOSE: To assess the performance of deep learning approaches for differentiating nonglaucomatous optic neuropathy versus glaucomatous optic neuropathy (GON) on color fundus photographs by the use of image recognition.

DESIGN: Development of an Artificial Intelligence Classification algorithm **METHODS:** Setting: Institutional.

SUBJECTS: An analysis including 3,815 fundus images from the PACS system of Seoul National University Bundang Hospital consisting of 2,883 normal optic disc images, 446 nonglaucomatous optic neuropathy with optic disc pallor (NGON) and 486 GON.

OBSERVATIONS: The presence of NGON and GON was interpreted by two expert neuro-ophthalmologists and had corroborate evidence on visual field testing and optical coherence tomography. Images were preprocessed in size and color enhancement before input. We applied the convolutional neural network (CNN) of ResNet-50 architecture. The area under the Precision-Recall curve (average precision, AP) was evaluated for the efficacy of deep learning algorithms to assess the performance of classifying nonglaucomatous optic disc pallor and GON.

RESULTS: The diagnostic accuracy of the ResNet-50 model to detect GON among NGON images showed a sensitivity of 93.4% and specificity of 81.8%. The area under the Precision-Recall curve for differentiating NGON vs GON showed an AP value of 0.874. False positive cases were found with extensive areas of peripapillary atrophy and tilted optic discs.

CONCLUSION: Artificial intelligence-based deep learning algorithms for detecting optic disc diseases showed excellent performance in differentiating nonglaucomatous and glaucomatous optic neuropathy on color fundus photographs, necessitating further research for clinical application.

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