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DEEP-LEARNING PREDICTION OF GEOGRAPHIC ATROPHY PROGRESSION: A MODEL-FREE, TRANSFORMER-BASED APPROACH TO FUNDUS AUTOFLUORESCENCE IMAGING

Oral

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Purpose:

To develop a model-free, deep-learning algorithm capable of predicting the pointwise spread of geographic atrophy (GA) on fundus autofluorescence (FAF) images, and to validate its accuracy at different predicted time intervals.

Methods:

Areas of atrophy were semiautomatically labelled on sequential FAF images and exported along with binarized masks identifying the areas of GA. For each visit, registered sequential FAF images were pre-processed, stacked in sequences of different lengths and fed to a deep neural network tasked with estimating the FAF segmentation in the next visit. A convolutional encoder extracted feature maps from the sequence; then, a multi-head self-attention module integrated the feature map from each visit in the sequence into a final attended map, that was ultimately fed to a convolutional decoder that predicts the GA segmentation in the forthcoming visit.

Results:

A total of 464 FAF images from 100 eyes of 88 patients (69% females) were employed. Mean (SD) age at baseline was 77 (12) years. 32 (53%) eyes presented with diffuse hyperautofluorescence at the margins of atrophy, 15 (26%) with focal and 14 (23%) with banded patterns. Mean (SD) follow-up was 3.9 (1.8) years. Mean (SD) overall growth rate was 1.7 (1.0) mm2/year. The Dice coefficient for the prediction of the last GA image in the sequence was 84.1%, while accuracy was 96.1%.

Conclusions:

Our model-free, transformer-based network predicted the enlargement of GA with satisfactory accuracy, without the need for the extraction of specifically engineered or a priori features.