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Improving perimetric examination of the macular visual field using structural information

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Abstract

Purpose : To integrate structural information in testing strategy for macular visual field in glaucoma.

Methods : one eye of 17 healthy and 31 glaucoma subjects was analysed. Macular OCT scan (Spectralis, Heidelberg Engineering) and 10-2 perimetric test with the Compass fundus perimeter (CenterVue) were performed.
We matched fundus images to precisely place tested locations on the OCT maps (Figure 1).
Stimulus reactions (button pressing) were extracted and probability of seen curves at different values of local structural damage estimated. The curves were used to build priors for a structural ZEST (S-ZEST) strategy (Figure 1).
We compared S-ZEST and ZEST simulating reliable (false positive rate = 0.03) and unreliable subjects (false positive rate = 0.13).
For simulations, to accurately estimate true input thresholds in glaucoma subjects, we tested 12 patients with 8 points at 1 and 3 degrees from fixation with 4-2 strategy, three times, taking the average. Data from fellow eye were used for healthy subjects.
Mean absolute deviation (MAD) from input thresholds was calculated.
Mean difference ± standard error is reported.

Results : S-ZEST reduced the number of presentations in normals (reduction per 68-locations test; reliable: 144.57 ± 0.27, 31%; unreliable: 166.75 ± 0.27, 33%) and glaucomas (reduction per 8-location test; reliable: 6.28 ± 0.10, 13%; unreliable: 7.05 ± 0.10, 14%).
Error was reduced in S-ZEST in glaucomas (MAD reduction per test; reliable: 0.13 ± 0.01 dB; unreliable: 0.33 ± 0.01 dB, Figure 2) and normals (MAD reduction per test; reliable: 0.07 ± 0.002 dB; unreliable: 0.33 ± 0.002 dB). All $p < 0.001$.

Conclusions : We used fundus perimetry to accurately model mean and variance of structural priors. S-ZEST efficiently allocates more presentations for diseased locations, increasing precision and reducing overall test time.

This is an abstract that was submitted for the 2018 ARVO Annual Meeting, held in Honolulu, Hawaii, April 29 - May 3, 2018.

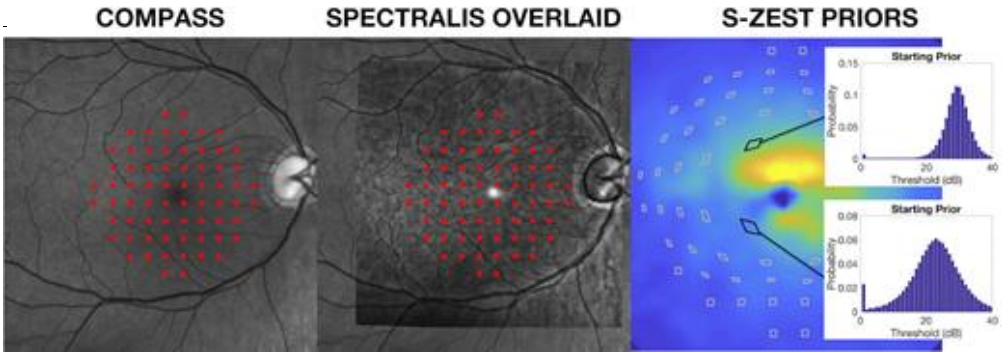

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Figure 1. Compass fundus image (left) and overlaid Spectralis fundus image after matching (middle). Red dots indicate tested locations. On the right, an example of the starting priors for S-ZEST of two locations with different ganglion cell damage. Tested locations were moved on the ganglion cell map to account for Henle fibre displacement.

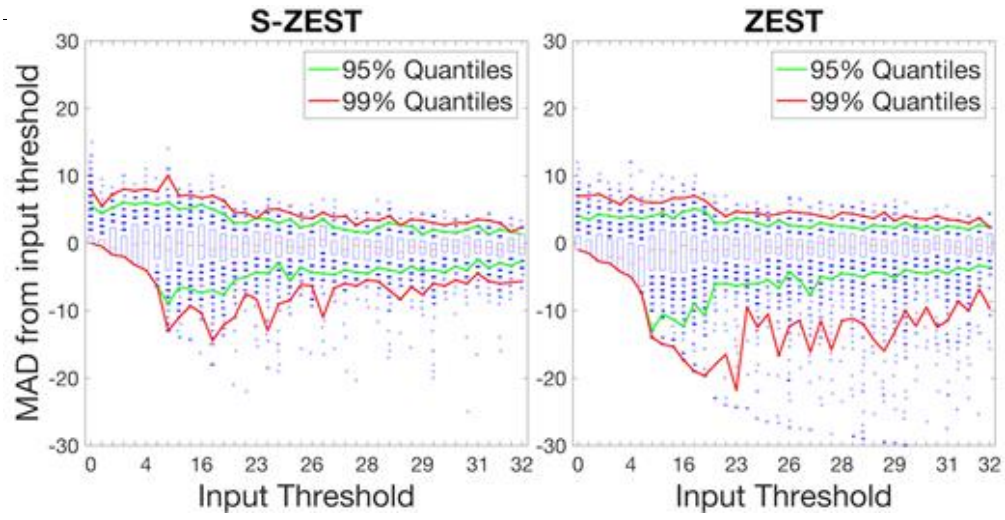

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Figure 2. MAD error (vertical axis) at different input thresholds (horizontal axis) for unreliable glaucoma subjects. Boxes enclose the interquartile range, the green and red lines enclose the 95% and 99% quantiles respectively.