Shortened Perimetry for Glaucoma With Top 10 Locations Derived by Feature Selection With Machine Learning Classifiers

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Abstract

Purpose: We propose to simplify and shorten automated perimetry for glaucoma by using the best 10 out of 52 visual field locations of 24-2 standard automated perimetry (SAP).
Methods: Feature selection by forward selection and backward elimination with Gaussian kernel Support Vector Machine (SVM) derived the rank of the visual field locations from 3 permutations of the development data (189 normals and 156 glaucomatous optic neuropathy (GON) based on masked photographic assessment). SVM was trained to separate standard full-threshold normal fields from glaucoma fields for the 3 derived sets of the top 10 locations and for all 52 locations + age. Trained classifiers were tested on an independent data set (158 normals and 161 GON) and compared with each other and to PSD and GHT by ROC area and by sensitivity and specificity in the new data set for threshold values at specificity=0.95 in the original developmental data set.
Results: The top 10 locations had similar sensitivities, specificities, and ROC areas compared to standard 24-2 perimetry (Table). Classification with the 3 sets of the 10 best perimetry locations did not significantly alter correct performance compared to SVM, PSD, and GHT applied to all 52 locations + age. Top 10 feature derivations varied and still performed equally well.
Conclusions: Shortened automated perimetry can simplify the test and reduce time without loss of diagnostic accuracy for a single field test.

Comparison best 10 locations (backward selection) v all field locations, PSD, GHT

	SVM sensitivity	SVM specificity	SVM ROC area	PSD sensitivity	PSD specificity	GHT sensitivity	GHT specificity

All locations	0.47	0.94	0.798	0.40	0.97	0.43	0.99
Top 10 permutation1	0.44	0.94	0.786				
Top 10 permutation2	0.43	0.94	0.778				
Top 10 permutation3	0.45	0.95	0.785				

Keywords: visual fields • computational modeling