

# Machine Learning Classifiers In The Diagnosis And Follow-up Of Glaucoma Using Short-wavelength Automated Perimetry (SWAP)

C Boden<sup>1,A</sup>, K Chan<sup>1,B</sup>, M Goldbaum<sup>1,A</sup>, TW Lee<sup>1,B</sup>, T Sejnowski<sup>2</sup>, AG Boehm<sup>1,A</sup>, M Aihara<sup>1,A</sup>, RN Weinreb<sup>1,A</sup> and PA Sample<sup>1,A</sup>

<sup>A</sup> Glaucoma Center Ophthalmology<sup>B</sup> Institute for Neural Computation<sup>1</sup> University of California San Diego La Jolla CA

<sup>2</sup> Computational Neurobiology Laboratories Salk Institute La Jolla CA

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## Abstract

**Purpose:** To evaluate the performance of machine classifiers in diagnosing glaucoma from short-wavelength automated perimetry (PHASE 1) and to evaluate the ability of machine classifiers to predict the development of abnormal fields at follow-up in eyes with a normal baseline field (PHASE 2).

**Methods:** *PHASE 1* Raw thresholds and ages from 158 eyes with glaucomatous optic neuropathy (GON) and 186 normal eyes served as training input to a linear discriminant function (LDF) and two types of support vector machine (SVMl and SVMg), a mixture of Gaussian classifier (MoG), a constrained MoG (QDF) and a multilayer perceptron (MLP). *PHASE 2* Serial SWAP fields from 68 eyes with IOP greater than 24, a normal baseline field, at least 4 fields and optic disc stereophotographs were included. Machine classifiers from Phase 1 categorized fields as normal or abnormal. Specificity was set at 95% for the machine classifiers using longitudinal data from 94 normal eyes, matching the specificity of the statpac-like analysis (STAT). Specificity cut-offs required confirmation of abnormality on two successive visual fields.

**Results:** *PHASE 1.* Areas under the ROC were 0.77 for LDF, 0.80 for MLP, 0.82 for SVMl, and 0.83 for QDF and SVMg. *PHASE 2.* A mean±SD of 5.99±1.93 visual fields were completed over 6.67±2.40 years. 19% (13/68) of eyes converted by STAT. Of those eyes, 6 to 9 eyes were found to have converted by SVM (SVMl and SVMg). However, 20 eyes converted by at least 1 machine classifier that did not convert by STAT and 15 of these had GON. LDF identified the most converts (22 eyes) of which 17 had GON.

**Conclusion:** The sensitivity in Phase 1 was not as good as our previous results with SAP. It is possible that SWAP may be influenced to a greater extent by generalized depression than SAP. We are currently pursuing this hypothesis. However, in Phase 2 the machine classifiers identified a larger number of GON as converts than STAT.

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