Classification of perimetric results and reduction of number of test locations using artificial neural networks*

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1 Purpose

Implementation of a computer system to improve and automate interpretation of perimetric results with artificial neural networks. Detection of potentially irrelevant test locations in regard to scotoma classification in order to reduce the number of test points.

2 Methods

Different architectures and learning methods for feed-forward neural networks were used to analyze visual field test results of the Tuebingen Automated Perimeter (TAP 30°, threshold-oriented, slightly supraliminal algorithm). The database of 2176 test sets contained 1074 normal and 1102 pathologic perimetric printous with 16 different characterizing scotoma subgroups. We designed a neural network with 191 input units, corresponding to the number of test locations and 16 output units, representing one scotoma classification. In order to find the optimal number of hidden units, we used Cascade Correlation and compared the result with the Skeletonization pruning algorithm. Input data were normalized to the interval [0;1]. For normal patterns, all output values were set to 0. The output unit correlated to the class of visual field loss was set to 1. The network was trained with 2215 data sets. The 1000 unknown test sets were presented to the trained network in a second step in order to test classification accuracy. The Skeletonization pruning algorithm was used to delete input units that have only small effect on the classification results.

* Invest. Ophthalmol. Vis. Sci. 2001;42(4):S846. Abstract nr 4539.

3 Results

Artificial neural networks are capable of learning different patterns of visual field loss. We achieved a classification accuracy of 89% for Cascade Correlation and 81% for Skeletonization. Using Skeletonization for input units we were able to delete 25 insignificant test points without decreasing classification results.

4 Conclusions

Artificial neural networks are able to support visual field analysis. Deletion of potentially irrelevant test points may help to reduce examination time.

Support

Supported by the *f*ortüne-program No. 782-0-0 of the Medical Faculty, University of Tuebingen.