Glaucoma Diagnostic Aid Software for the Visual Field Test

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Visual field (VF) test is a widely used, noninvasive technique for evaluating pathology or dysfunction in the visual pathways. The VF test, in conjunction with other diagnostics, is used for detection of glaucoma and for following its progression. Early detection is critical as blindness from glaucoma is preventable in nearly all cases, provided treatment is administered early in the progression. There is a need for an automated decision aid tool that will facilitate and standardize the interpretation task.

The aim of the SBIR project described here is to design and implement a software program for automatic interpretation of visual field (VF) test. The program will aid the general eye care practitioners (ophthalmologists and optometrists) in the diagnosis and treatment of glaucoma and other eye diseases. The main application of the program is as a screening tool for glaucoma. As there is no generally accepted standard for diagnosis of glaucoma, our goal is to create a neural network based expert system that will approximate the expertise of an experienced, trained glaucoma specialist. Thus, the system is trained on the data (visual field and other) for patients whose diagnosis has been determined by a team of experts. Such a system will help in an earlier diagnosis and treatment of glaucoma, prevent misdiagnosis of normal individuals as glaucomatous and reduce the risks and costs of unnecessary treatment, and will provide an objective, standardized interpretation of the data.

The Phase I research concentrated on a development of machine learning methods and demonstrated the feasibility of accurate detection of glaucoma and suspect glaucoma from the visual field data, only. As in the clinical practice the glaucoma diagnosis is based on analysis of a larger set of diagnostics (cup-to-disk ratio, intra-ocular pressure, and visual field), these results indicate that the information content of visual field data is richer than usually considered. In particular, we were able to accurately detect cases of suspect glaucoma, which are usually associated with visual fields that are considered normal. This somewhat unexpected, although still preliminary, result indicates far superior performance of our models as compared with those previously reported in the literature. The proposed Phase II effort will provide further validation of the automated interpretation tools on a larger set of clinical data.