NEURODIAB 2015

Title: Assessing Corneal Nerve Morphology with Visual Analytics

Authors: Martin Röhlig[1], Martin Luboschik[1], Mitra Tavakoli[2], Heidrun Schumann[1]

[1] Computer Graphics Group, Institute of Computer Science, University of Rostock, Rostock, Germany
[2] Centre for Endocrinology & Diabetes, Institute of Human Development, University of Manchester, Manchester, UK

Aim: Corneal confocal microscopy has enabled recent advances in the diagnosis of nerve damage for a range of peripheral neuropathies, in particular diabetic neuropathy. However, analyzing the multivariate microscopic values in association with other clinical and neurological data remains challenging. To this end, we propose a visual analysis approach to show the data in comprehensible manner and in this way, to support experts in understanding and assessing complex relationships.

Method: We demonstrate our approach with a normative data set from a multinational study, including four common attributes for judging corneal nerve morphology (fiber length (CNFL), tortuosity (CNFT), density (CNFD), branch density (CNBD)) from 343 healthy volunteers. We analyzed different aspects of the data set using four dedicated visualizations techniques. Coordinated interaction helped exploring correlations between patients' attributes and generate meaningful overviews. In addition, we applied automated computations to support the visual analysis with aggregations and quantitative assessments of the data.

Results: Visual analysis confirms recent findings such as age-dependent decrease in CNFL, which can be directly observed, but also reports several new patterns. Particularly, we identify deviations in the value distributions of the four corneal nerve attributes induced by different protocols used for the microscopic image acquisition in participating centers of the study.

Conclusion: Visual analysis supports experts in assessing multivariate corneal nerve morphology values obtained using corneal confocal microscopy and will facilitate to apply this technology at clinical settings in the study of diabetic and other peripheral neuropathies.