

Title:

Objective evaluation of patients' visual behavioural pattern for cataract surgery planning

Authors:

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Purpose:

VBM is a wearable sensor system which allows surgeons and patients to decide on refractive endpoints of cataract surgery in an objective and non-obtrusive way. The purpose of the investigation is to demonstrate how the data acquired by the VBM prototype can be used to automatically recognise vision-related activities and report classification results for cataract surgery in a comprehensive manner.

Setting:

Healthy volunteers have been enrolled for testing. Measurements were performed in unsupervised settings after training and a supervised familiarisation session performed in the clinic. Volunteers performed measurements during their normal daily routine (e.g. in the office, at home and while commuting).

Methods:

The VBM prototype is mounted on user's prescription or plano glasses. The device is equipped with optical sensors for monitoring the refractive needs in the direction of the user's gaze. Head orientation and motion, ambient light intensity and other ambient conditions are also measured. Users are asked to report activities using the companion smartphone or smartwatch app. Measurements are split into training and test datasets. Measurements from the training dataset are used to develop models for automatic labelling of patients' activities (such as computer work, reading, sport, etc.) and test dataset is used to assess strength of the models.

Results:

Measurements performed in the training regime allow identifying of characteristic statistical signatures of individual activities, which produce a refractive profile for each individual activity. While there is significant variation in the specific refractive patterns for different individuals, activities remain identifiable from the set of signal features. The statistical model developed on the training dataset allowed automatic identification of activities in the test dataset with high predictive power. All volunteers reported high convenience of the device with minimal interference with typical daily routine.

Conclusions:

The VBM provides the measurements which reflect the refractive needs in relation to an individual's behaviour and environment associated with the activities. We have successfully developed an automatic method to label users' activities for various ophthalmic applications, such as planning of refractive endpoints for cataract and refractive surgeries.