

Abstract Title: **LOW-COST AND PORTABLE TOOL FOR MEASURING EYE REFRACTIVE DISORDERS USING ACTIVE PARTICIPATION**

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**Purpose:** We propose a handy and inexpensive refractometer that assess for myopia, hyperopia, astigmatism and presbyopia and is particularly suited for developing countries and at-home assessment.

**Methods:** Our system is based on Schaefer principle and Spatially Resolved Refractometers but uses mobile displays as light sources to create the dual of Shack-Hartmann-based techniques. The patient looks at a programmable display through a pinhole array or a microlens array and aligns displayed patterns. The required refractive correction is computed based on the pattern displacements for eight meridians. We also simulate a virtual moving object, forcing the patient to accommodate, and compute the patient's nearest focal point. We built four prototypes with resolution varying from 0.16 to 0.71 diopters, and estimated cost varying from USD 100.0 to 0.50.

**Results:** We evaluate our solution with a group of 13 volunteers (ages 21 to 57). For each subject, we estimate their spherical and cylindrical refractive errors, as well as the corresponding cylindrical axis without the use of cycloplegic drugs. The average absolute errors were under 0.5 diopter ( $\sigma = 0.2$ ) for both cylindrical and spherical powers and under 6 degrees for the axis of astigmatism. Six of those volunteers also undertook the accommodation test. The results match the closest reading point with an average error of 5.28 +/- 3.4cm. The average time for each eye test is 1.5 minutes, with little training.

**Conclusions:** Our portable low-cost system evaluates eye refractive disorders based on programmable high-quality displays, currently available in consumer mobile phones and head mounted displays, using active participation. Since it is a subjective method, it should not be used by individuals who cannot reliably perform the alignment task. The accuracy of the system is limited by the ever-increasing pixel density of the underlying display. The same way that other digital technologies have transformed health awareness, we hope our new solution can spur research in affordable technologies for eye care.

Additional  
Comments:

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Consents and Disclosures

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