OphthoRuler: a smartphone app for AI-based pupillometry and ocular measurements

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ABSTRACT

Pupil measurements by non-expert users using a pupil gauge card are frequently highly inaccurate, with errors in the range of ±1-2 mm or more being common. Previous studies have also shown up to 50% false negative rates for detecting anisocoria and near chance level performance for correctly identifying pupil light reactivity with pupil size differences under 2mm.

Commercial pupillometers, while highly accurate, are expensive and not routinely available in most healthcare settings. Our objective was therefore to develop an alternative method for low-cost but accurate pupillometry. We developed a novel smartphone application (for iOS and Android devices) capable of automatically segmenting the corneal limbus and pupil using artificial intelligence. Using the population normal average of the white-to-white corneal diameter our app is able to provide estimated measurements of the pupil diameter with a theoretical error range of less than ±0.5 mm per 10 mm.

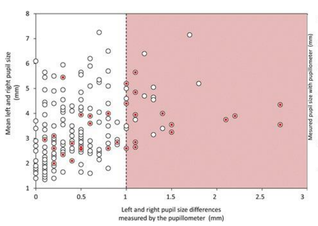
Additionally our app is capable of automatically segmenting the eyelid margins, allowing for automatic measurement of mrd1, mrd2, palpebral fissure width/height and IPD. Future directions will include field testing the application in various clinical settings (e.g. ICU, primary care, emerg) and development of additional modes to help users walk through the anisocoria diagnostic flowchart, EOM measurement, and strabismus detection. In conclusion, we present our work developing OphthoRuler, a novel AI-based smartphone application for quick and accurate pupillometry and ocular morphometry.

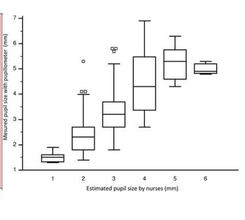
PURPOSE

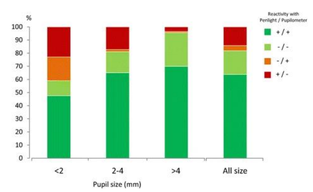
$$$$ / ±0.01-0.1mm

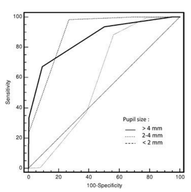
VS

$ / ±0.5-2mm









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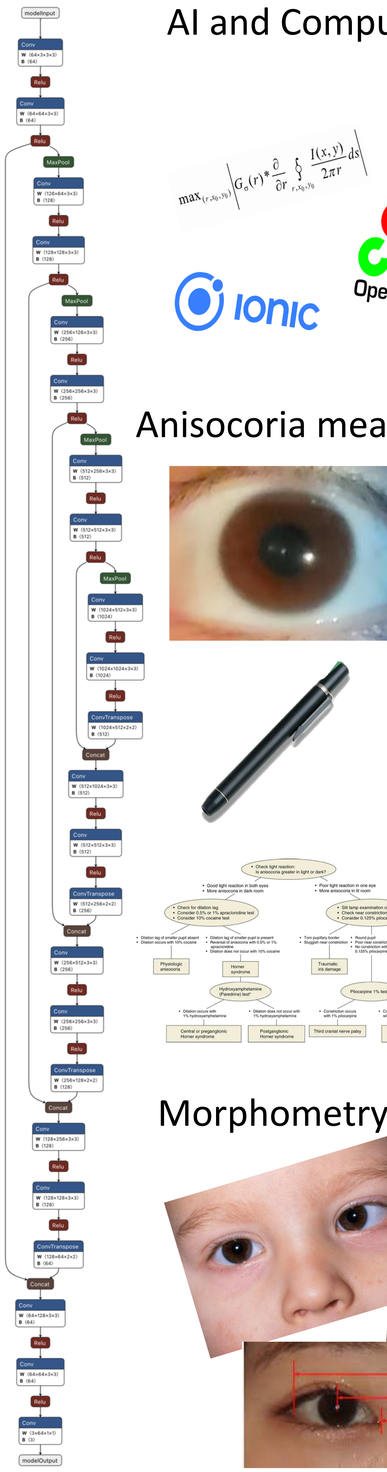
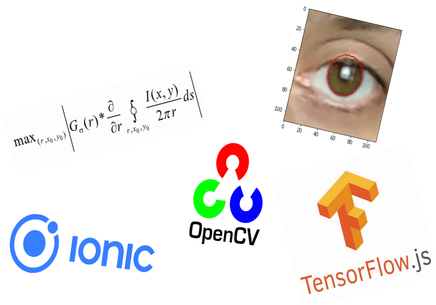
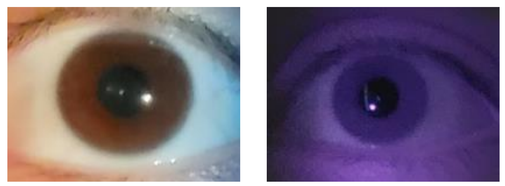
MATERIALS AND METHODS

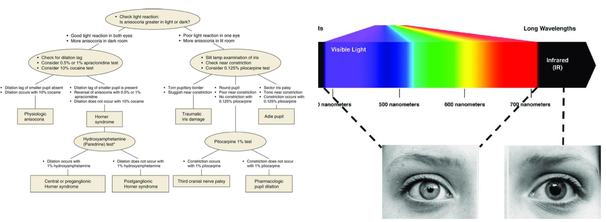
AI and Computer Vision



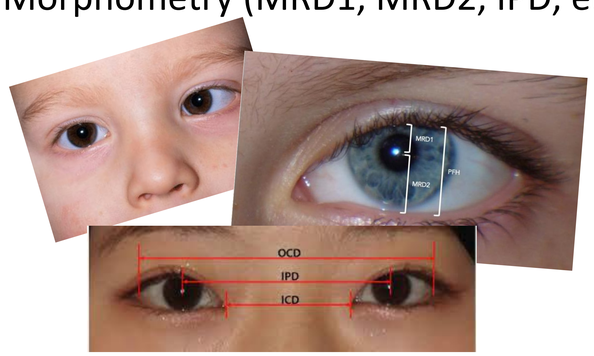


Anisocoria measurement



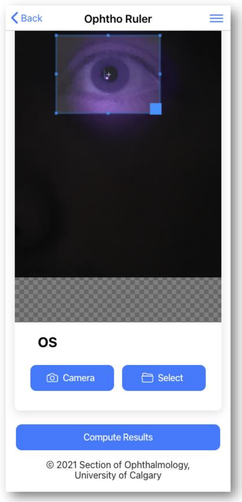


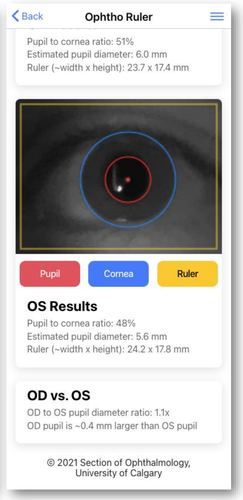
Morphometry (MRD1, MRD2, IPD, etc.)

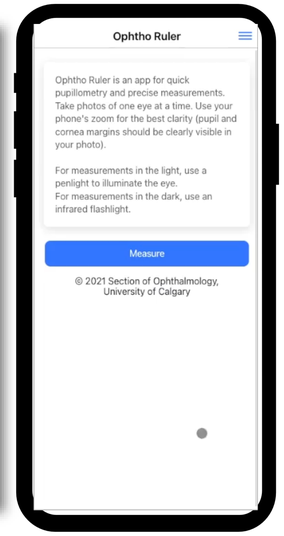


RESULTS

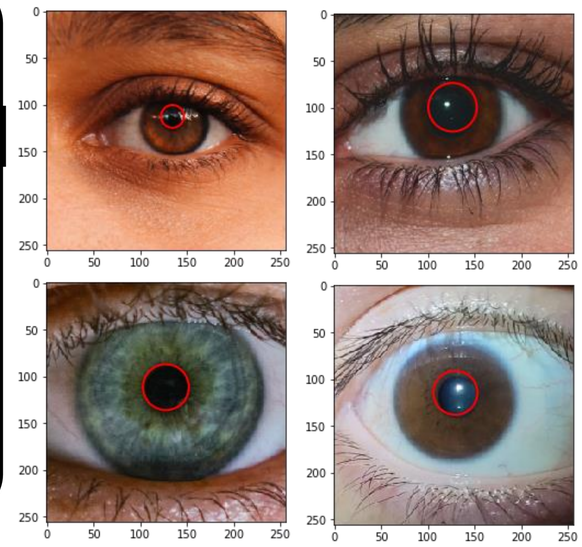
OphthoRuler App







Pupillometry



Morphometry

AI model detects:

- Upper and Lower eyelid margins
- Corneal limbus
- Pupil centre

Calculated values:

- MRD1/MRD2/PFH
- PFW
- IPD
- Inner/Outer intercanthal distance

CONCLUSIONS AND NEXT STEPS

Pupillometry	Morphometry	EOM	Strabismus
ophthalmology	oculoplastics	ophthalmology	ophthalmology
neurology	plastics	neurology	pediatrics
IM/crit care	pediatrics/FM	Emerg	neurology
Emerg/FM			

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