The Problem

Lack of access to eye care globally leads to a high prevalence of preventable vision loss
• 161 million cases of visual impairment in India alone
• 80% of cases are preventable
Current outreach efforts only reach 20% of patients in need of care, leaving 130 million individuals without access to eye care

Barriers to Eye Care Access:
• Lack of trained ophthalmologists (1:91,000)
• Efforts are limited by geographical location and high costs of current screening methods
• Patients do not have consistent touch points and integration with eye care systems
• Lack of awareness in remote communities

Proposed Solution

Visilant: An integrated, end-to-end patient outreach & diagnostic system optimized to serve eye care systems in low-to-middle income countries

Collaboration with Aravind Eye Hospital in India

Visilant’s community-based model for decentralized eye screening integrates communities into healthcare facilities

Methods

Diagnostic Conformance Pilot Study

Undergoing steps to compare ability of Community Health Workers (CHW) to diagnose conditions based on our training and imaging guidelines and compare their accuracy with that of trained ophthalmologists

Machine Learning Algorithm Development

• Images captured using 1st generation hardware
• N=261 images of cataract, with varying lens opacities
• N=169 normal eye images
• Images labeled using in-person ophthalmologist exam diagnosis
• Developed Referral Criteria by selecting relevant exam information

Standardization of Image Capture

First generation hardware
• Macro lens and torchlight

Second generation hardware
• Standardized scope length to ensure image focus
• Scope designed to block out ambient light
• Focus within ideal range for anterior diseases
• Simplified design for minimally trained users

Results

Diagnostic Conformance Pilot Study

Smartphone-based examination vs. in-person ophthalmologist examination
• 95.9% visual acuity agreement between MLOP (mid-level ophthalmologic personnel) and CHW (community health worker)
• 93.33% patient level diagnostic concordance

Machine Learning Algorithm Development

Preliminary machine learning results show proof of concept for automated, smartphone-based, real-time triage of diagnostic level patient information and anterior segment images by minimally trained community health workers.

Conclusion and Acknowledgments

Visilant’s end-to-end patient outreach and diagnostic system, facilitates the collection of accurate, high-quality, diagnostic level patient information and anterior segment images by minimally trained community health workers. Preliminary machine learning results show proof of concept for automated, smartphone-based, real-time triage of anterior segment diseases.

The large-scale validation study starting in May will show that:
(1) CHWs can use smartphones to capture eye images and clinical data from rural patients and submit findings for remote, asynchronous review;
(2) Remote ophthalmologists can review smartphone screening data to diagnose cataract with good concordance with in-person eye camp exams;
(3) A machine learning (ML) algorithm can diagnose cataract with high concordance with remote ophthalmologist graders.

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Next Steps

Large Scale Validation Study

Diagnostic validation study using 2nd generation device
• N=2000 eyes of 1000 patients
• Evaluate acceptability in key stakeholders

Machine learning algorithm using 2nd generation device
• N=2000 eyes of 1000 patients
• Combine images, visual acuity, and eye history data
• Diagnostic cataract, refractive error, normal eye exam

Use “back end” platform to improve health system performance
• Track CHW performance
• Integrate data into electronic health record
• Pragmatic trials to optimize patient follow-up

Conclusion

Visilant has developed a community-based model for decentralized eye screening that integrates communities into healthcare facilities. The system utilizes a smartphone-based examination and a machine learning algorithm to improve diagnostic accuracy and expand access to eye care. The large-scale validation study will further validate the system’s effectiveness and potential for scalability.