AI-ENABLED GLAUCOMA DETECTION

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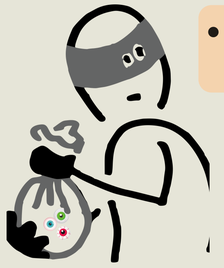
ARAVIND EYE CARE SYSTEM

GLAUCOMA = THE SILENT THIEF OF SIGHT



- Progressive & asymptomatic disease of optic nerve head (ONH)
- Results in loss of peripheral vision
- Mainly caused by increased intraocular pressure

EFFECTS ON THE INDIVIDUAL

- Decrease in quality of life & independence
- Increase in falls & road traffic accidents

WORLDWIDE BURDEN

- Leading cause of irreversible blindness worldwide
- Cases of glaucoma are predicted to rise by 45% in 20 years
- IF caught early, treatment can stop/slow glaucoma progression

EARLY CASE DETECTION IS KEY!

CURRENT PRACTICE OF DETECTING GLAUCOMA

- Fundus images capture the ONH, they are assessed by experts to detect the presence of glaucoma
- Fundus images are cheap & non-invasive
- Manual image assessment can be costly, subjective, AND requires advanced clinical expertise

⚠ Developing nations lack resources, clinicians, and infrastructure, resulting in many cases of preventable blindness

CAN ARTIFICIAL INTELLIGENCE HELP?

Can we develop AI to mimic clinicians' diagnosis of glaucoma from fundus images?

Can the AI be interpretable & explainable?

AIM

Develop an AI-enabled framework for glaucoma detection using low-cost fundus imaging

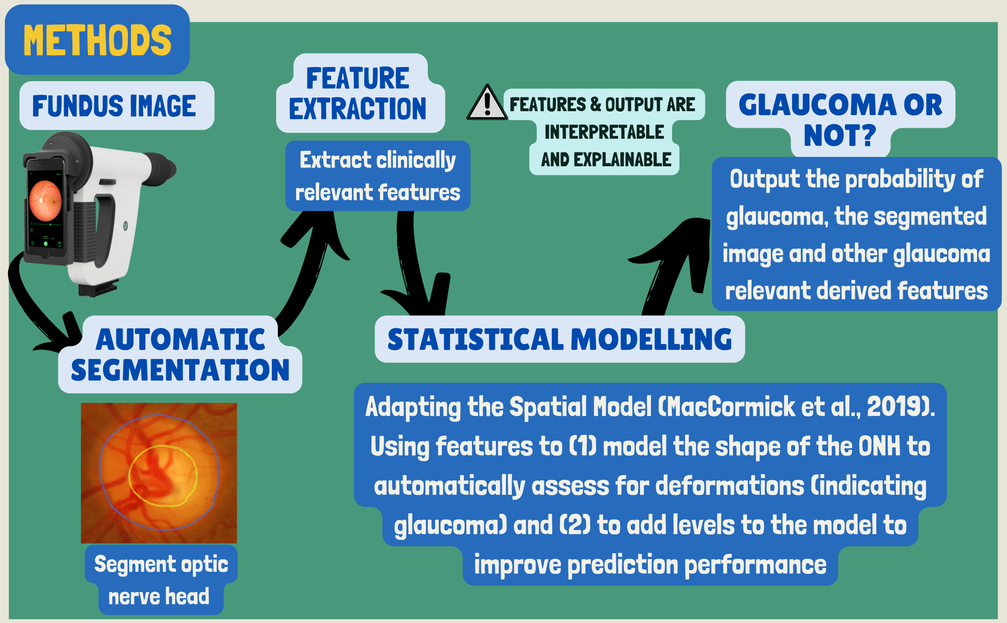
OBJECTIVE 1 ✓

Literature review of existing AI-enabled glaucoma detection methods

Main findings (Coan et al., 2022)

- Fundus imaging provides high-quality, yet low-cost images
- One-step & two-step AI algorithms have been developed showing promising results
- Two-step algorithms have inherent interpretability & explainability
- Higher quality reporting and further external testing is required before methods can be translated into clinical practice

METHODS



OBJECTIVES 2 – 5

Development of a statistical model to underpin the AI

- Including personalised clinical data
- Increase interpretability & explainability
- Uncertainty quantification
- Incorporate further imaging data

RETROSPECTIVE & PROSPECTIVE DATASETS COLLECTED FROM ARAVIND EYE CARE SYSTEM, INDIA

INITIAL RESULTS

TESTING	AUC	SENSITIVITY	SPECIFICITY
INTERNAL	0.98	0.98	0.97
EXTERNAL	0.96	0.93	0.92

High performance metrics by using clinical features extracted from the fundus images

AI can correctly predict unseen test images with high accuracy

POTENTIAL IMPACT

- Prevention of irreversible blindness in many more individuals than current services allow, particularly in developing nations
- Reduction of workload for clinicians, allowing more time to focus on patients
- Reduction of associated costs with manual image assessments
- Advancement in AI for disease detection

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References:
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Coan et al. (2022) Automatic detection of glaucoma via fundus imaging and artificial intelligence: A review. arXiv preprint arXiv:2204.05591. 2022 Apr 12.