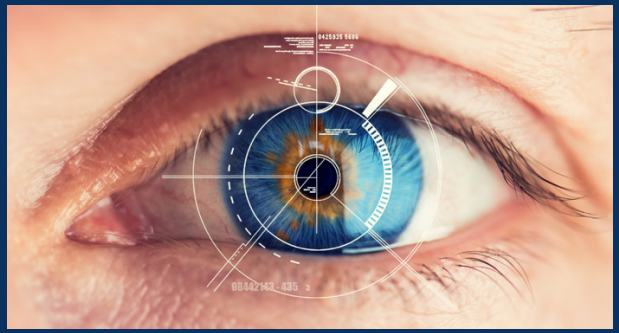
Eye AI: Present & Future

Rob Campbell 2020

Outline

- Overview of AI in ophthalmology
  - Diabetic retinopathy
  - Glaucoma

- Opportunities for Queen's and KHSC



Global Eye Disease Burden

- 2.2B people worldwide visually impaired or blind
- Rapidly growing demand for eye care services
- Great potential for AI to improve access for both diagnosis and monitoring of eye diseases

AI in Ophthalmology

- Wide range of applications:
  - Scribe natural language processing
  - Robotic surgery
  - Clinical decision making
  - Research analytics

- Image analysis at centre of many diagnoses

DIABETIC RETINOPATHY

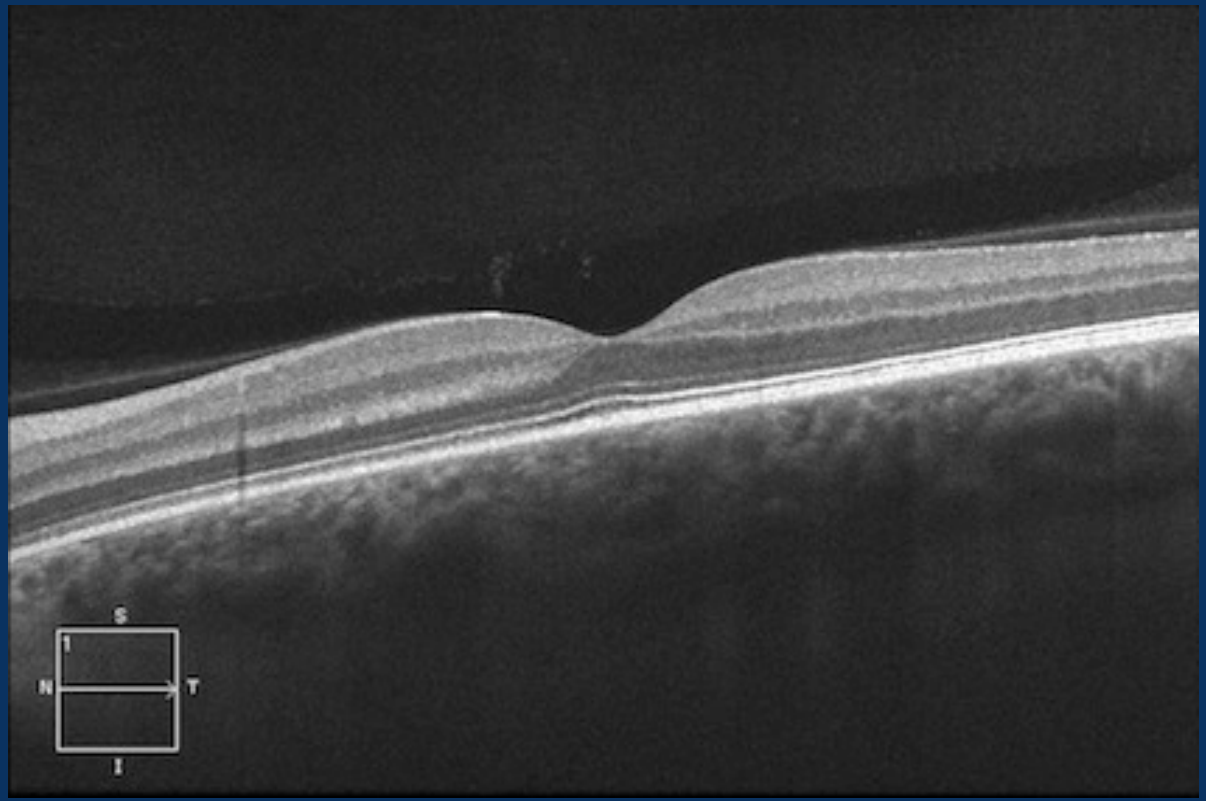
- Microvascular complication of Diabetes
- Leading cause of blindness among those <65yo
- Early detection through eye examination decreases blindness risk
- Only 50% undergoing regular screening exams

Diabetic Retinopathy Detection and Monitoring

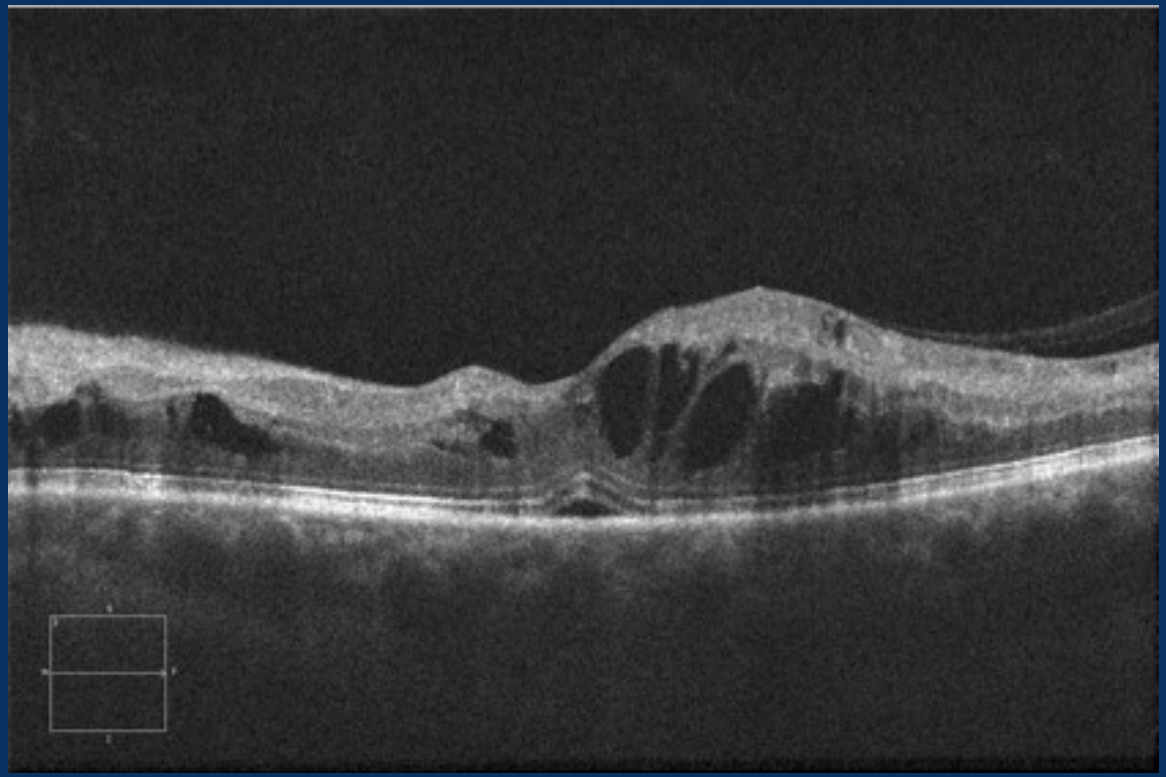
- Deep learning algorithm equipped with stand alone fundus camera
- First fully autonomous AI-enabled device for diabetic retinopathy detection
- FDA approved in 2018

Smartphone-based Imaging Systems

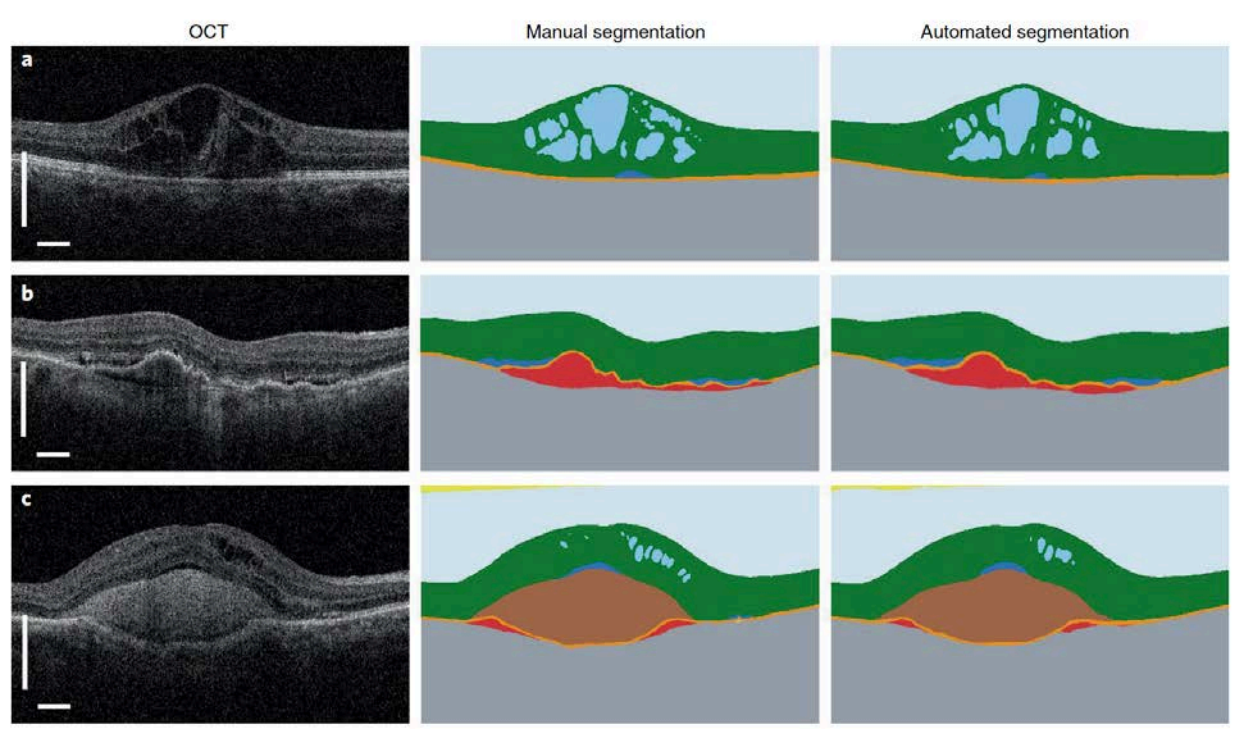
Optical Coherence Tomography (OCT)



OCT of Diabetic Retinopathy



Google Deepmind



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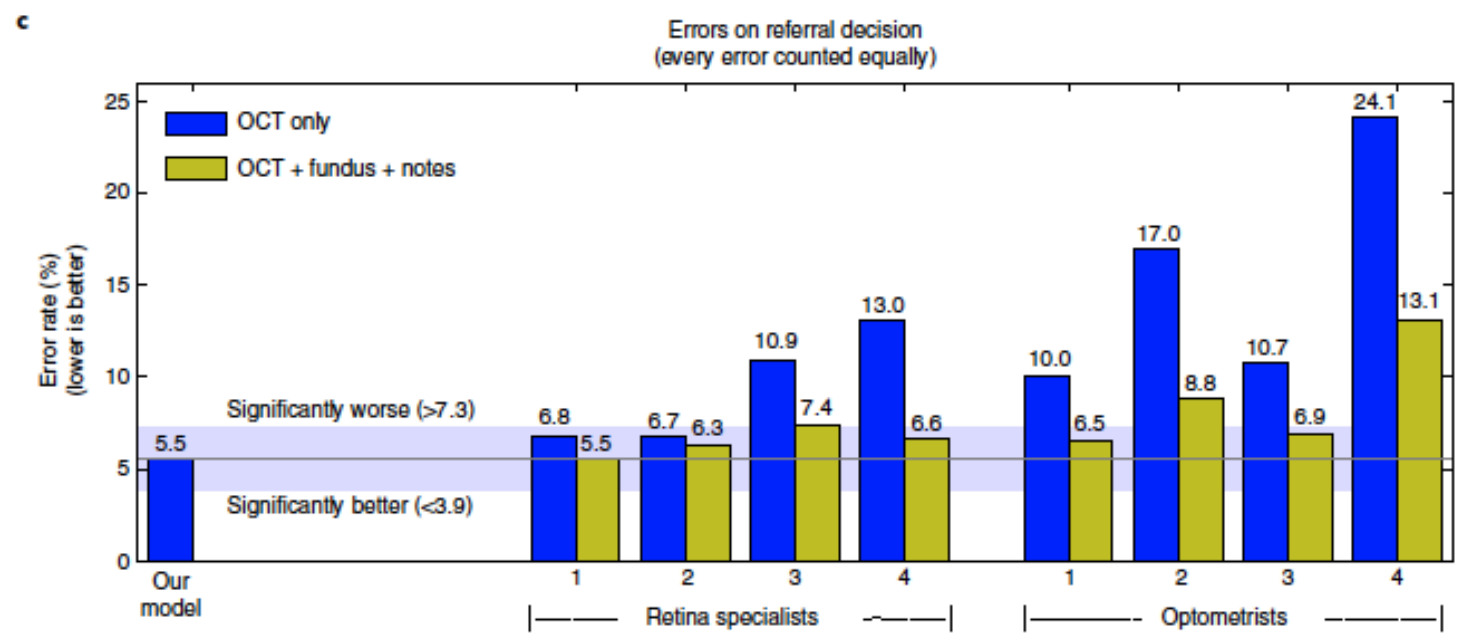


Home OCT

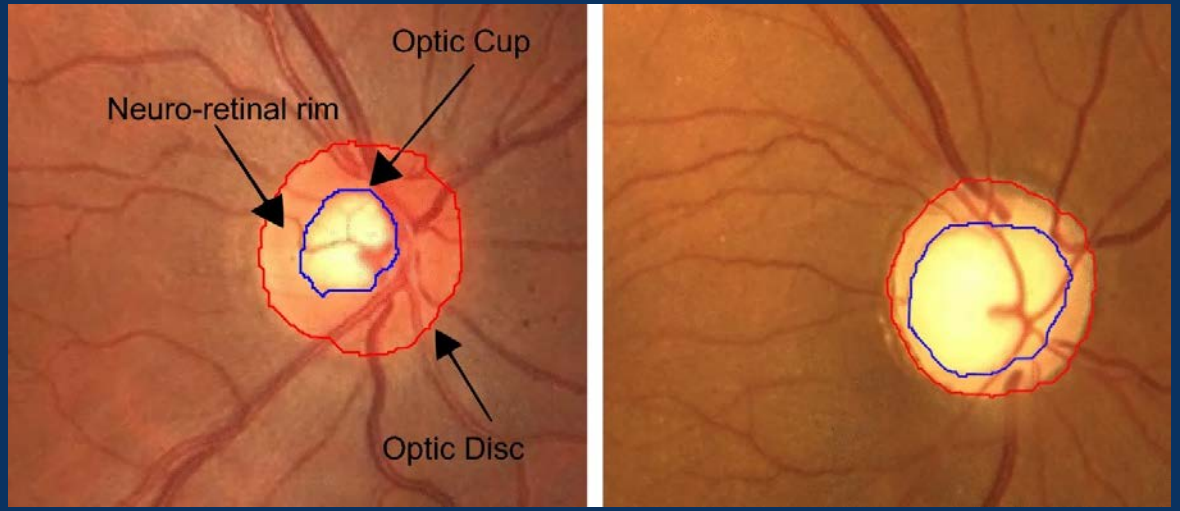
NOTAL VISION

Queen's University

- Deep learning algorithm and stand alone OCT
- FDA approved in 2018
- Commercially available in 2020

GLAUCOMA

- Multifactorial optic nerve degenerative process
- The leading cause of irreversible blindness



GLAUCOMA

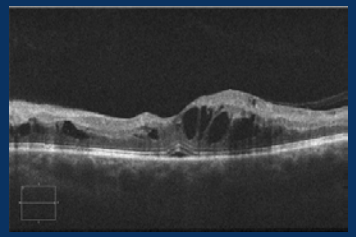
- Silent vision loss initially
- 50% of patients remain undiagnosed until severe, irreversible vision loss has occurred
- Monitoring for progression is time consuming and clinician dependent

Glaucoma Detection

- Pegasus: Deep learning algorithm to identify glaucoma
- High sensitivity = valuable screening tool
- Small training set

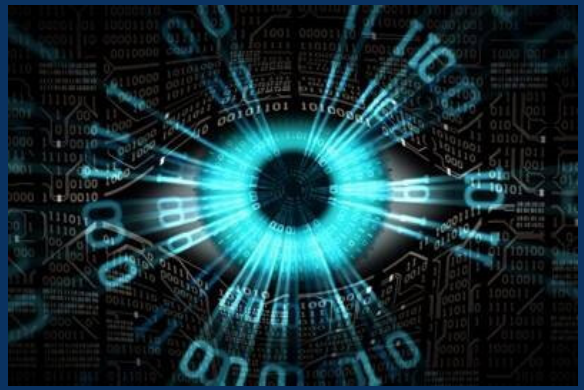
Near Future Evolution

- Type of input tech (e.g. photos vs. OCT)
- Stand alone vs. cloud AI
- Stand alone imaging vs. smartphone based imaging
- Home vs. clinic-based
- Validation & generalizability issues



AI in Digital Eye Care at Queen's & KHSC

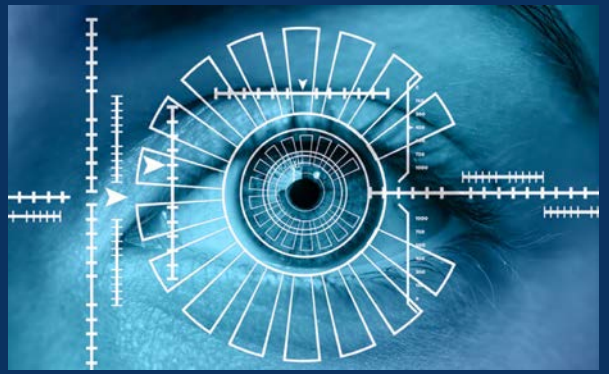
- Opportunities to innovate and lead
- AI as part of an integrated digital health system
- Development of networking infrastructure for communication, data exchange & analysis
- FORUM: Image analysis and archival system
  - City-wide then regional integration plans



AI in Digital Eye Care at Queen's & KHSC

- eConsult at Queen's & KHSC
- Kingston has established the first ophthalmology/optometry eConsult collaboration in Ontario

eConsult
Ontario eConsult Program



Thank you