

AI in Action: Malaysia's Experience in Strengthening Primary Care Through Digital Innovation



DATUK DR. NOR FARIZA NGAH
Senior Consultant Ophthalmologist
Deputy Director-General of Health
(Research & Technical Support)
MOH Malaysia

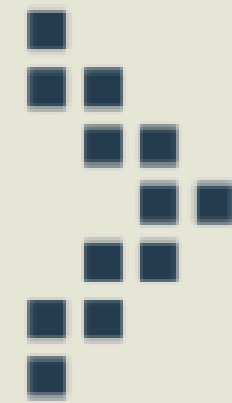


More than **One** in **three** living with diabetes will develop diabetic retinopathy

More than **130 million** people suffer some sort of **eye damage**

Diabetes in Malaysia

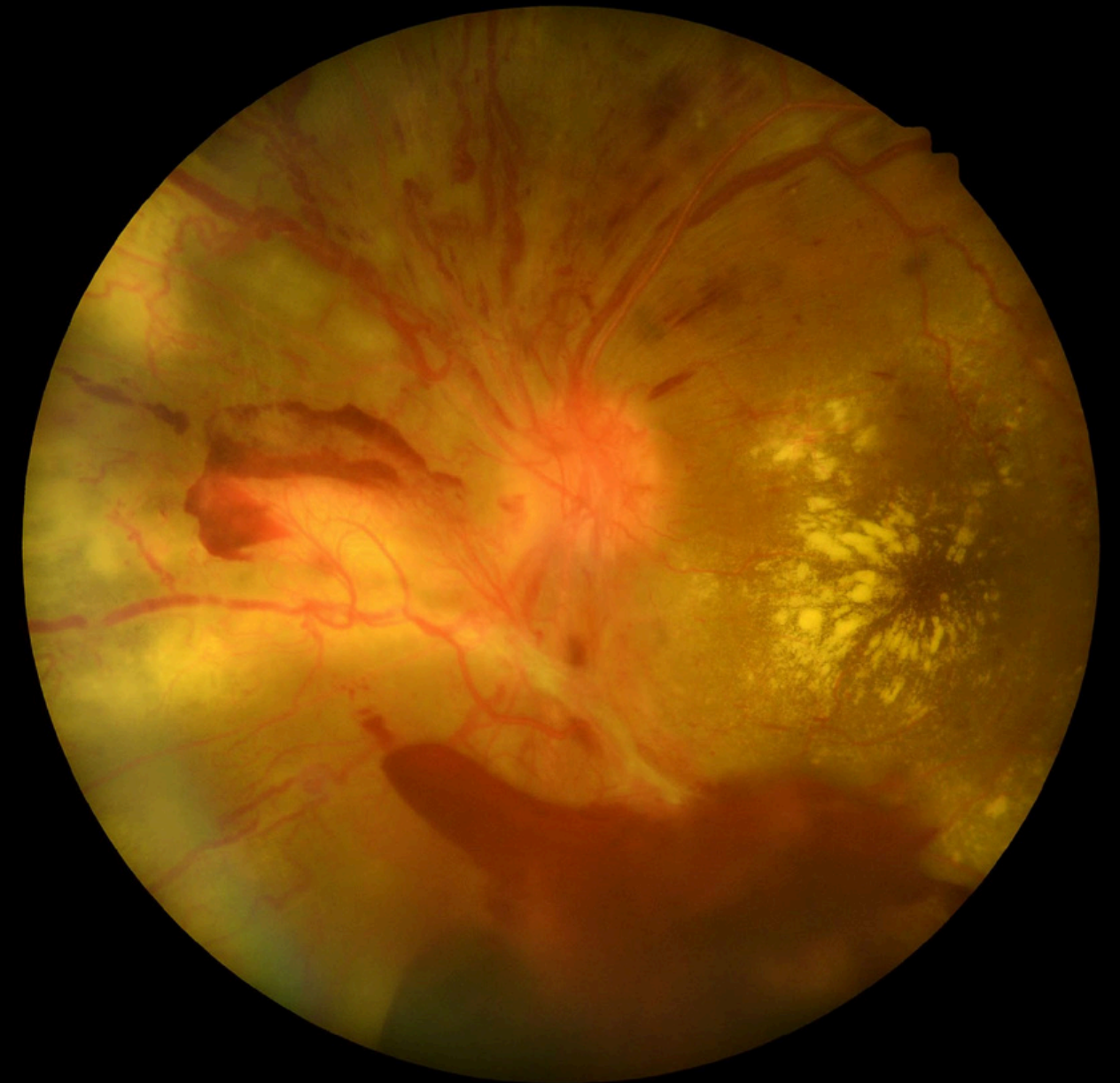
1 in 5 adults in
Malaysia
have **diabetes**



That's about
3.9 million
people aged
18 years and
above

Diabetic Retinopathy

- Diabetic retinopathy (DR) is a disease of the retina caused by diabetes that involves damage to tiny blood vessels in the back of the eye.
- DR is a MAJOR CAUSE of BLINDNESS globally after cataract.
- Diagnosis and treatment of DR focus on vascular abnormalities that appear at later stages of the disease

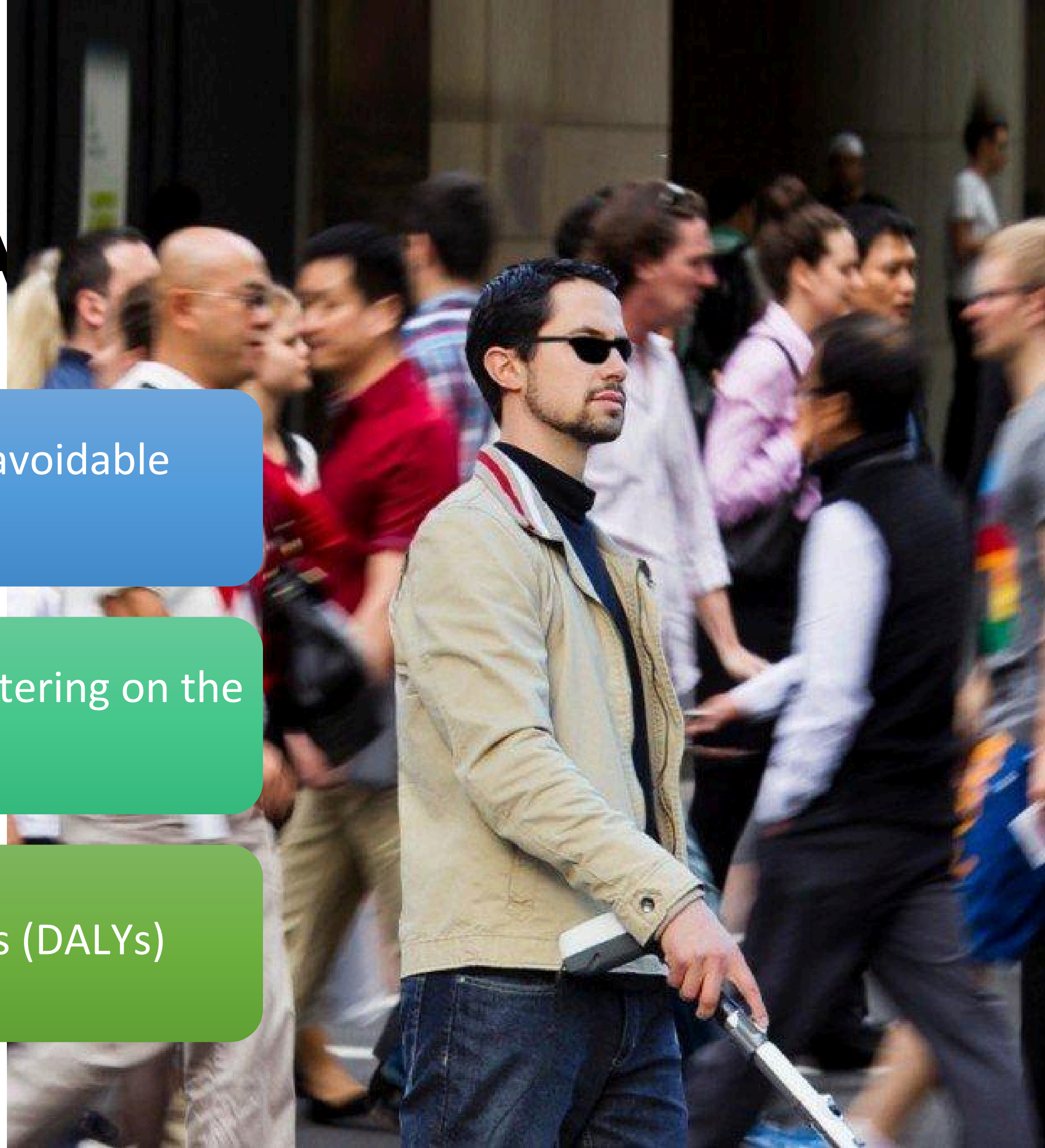


DISEASE BURDEN CONTEXT IN MALAYSIA

Diabetic Retinopathy (DR): a leading cause of avoidable blindness among the workforce age group

Surging diabetes prevalence leave millions teetering on the brink of irreversible blindness

DR contributes to Disability Adjusted Life Years (DALYs)



DISEASE BURDEN CONTEXT IN MALAYSIA

DALYs = Years Life Lost (YLL) + Years Live Disability (YLD)

YLL is small for DR, but higher for YLD due to chronic visual impairment.

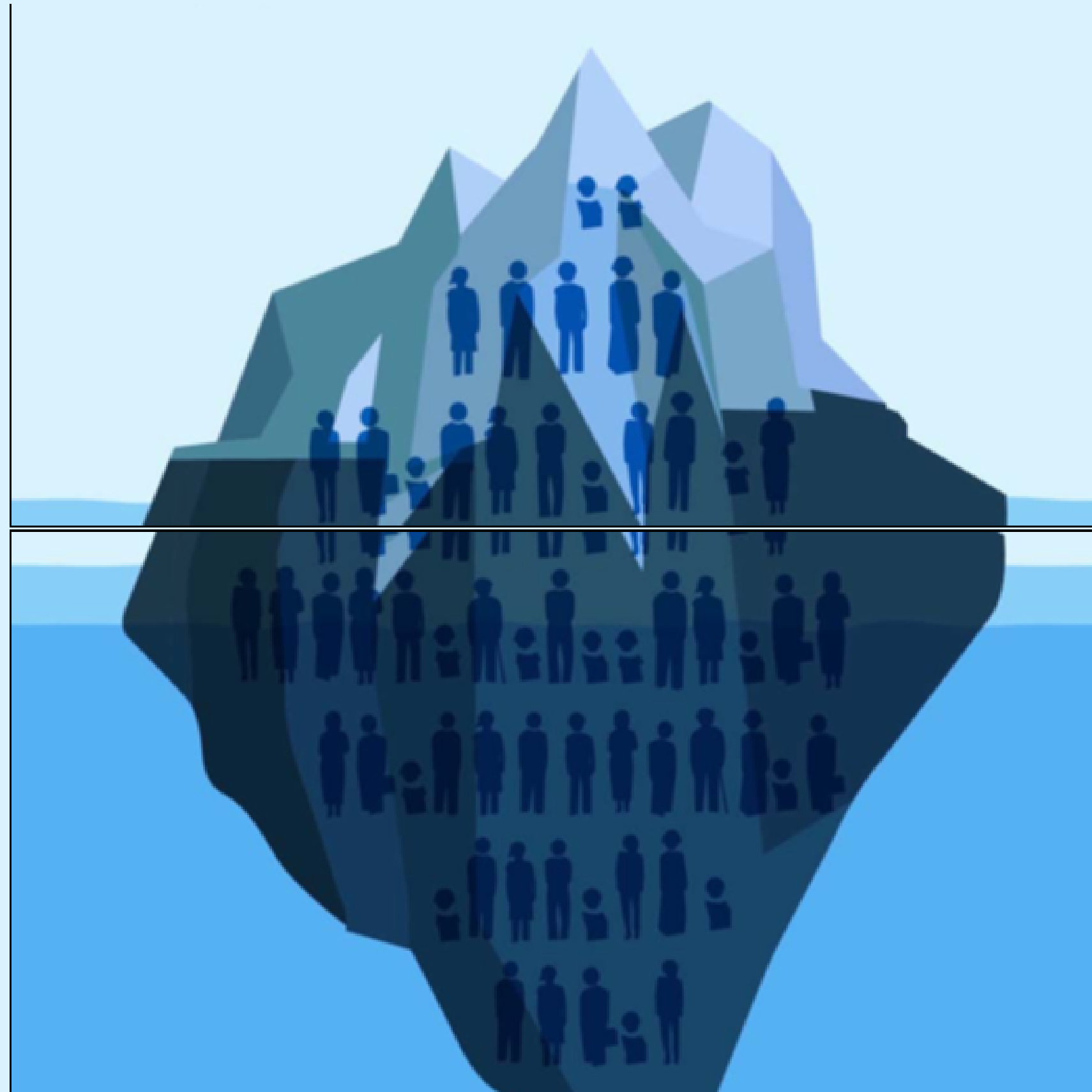
Lowering the Burden: Preventing blindness directly slashes YLD, significantly boosting population health-adjusted life expectancy.

MANAGING DIABETIC RETINOPATHY

BLIND

Some visual
impairment

Undetected cases



Challenges in DR Screening

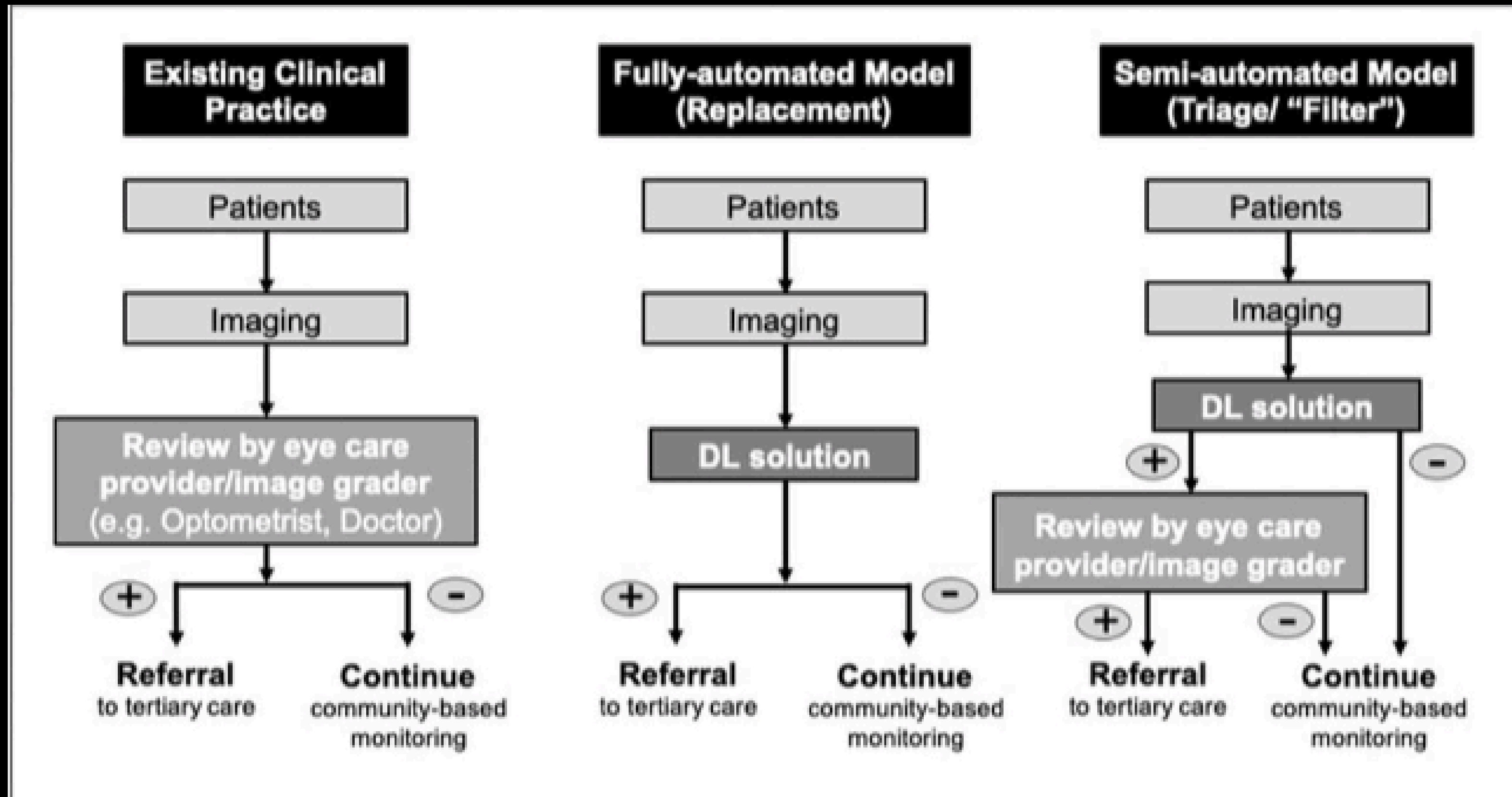
- **Most DR screening carried out in primary care**
- **Goal standard - non mydriatic fundus camera**
- **Unequal access for screening**
- **Photographer/ grader ~ same person/ two tier system**
- **High turn-over of medical staffs. Standard of graders?**
- **Report can be delayed**
- **Referral system**


Technology will optimize workflows and elevate the standard of eye care

Therefore thoughtful applications are needed to maximise the potential of technology to improve the existing challenges



HOW CAN AI MAKE AN IMPACT IN OPHTHALMOLOGY DIAGNOSIS AND SCREENING?





Artificial Intelligence for DR Screening



There are many available systems in the current market looking at AI for diabetic retinopathy images



Majority of the systems are only focusing on the presence or absence of disease and not able to give the grading in detail



Different grading severity will require different referral urgency



The earlier the patients been referred; the earlier treatment can be commenced and the better the vision can be preserved



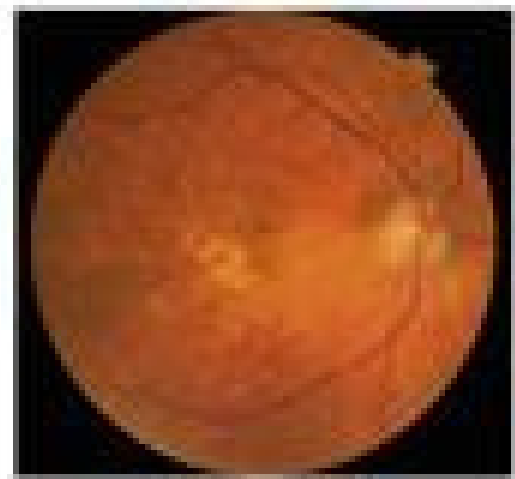
DR-MATA

Diabetic **R**etinopathy Inference with **M**ulti **A**rtificial Neural Network **T**echnology **A**utomation

- Development of algorithms that can detect variable degrees of diabetic retinopathy
- 14, 344 images were used in algorithm development and training of the system
- Sensitive, specific and accurate



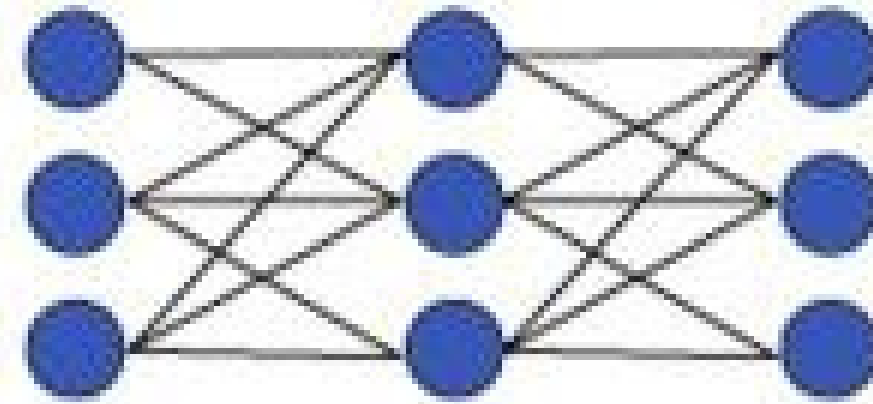
Classic Machine Learning



Input



Feature extraction

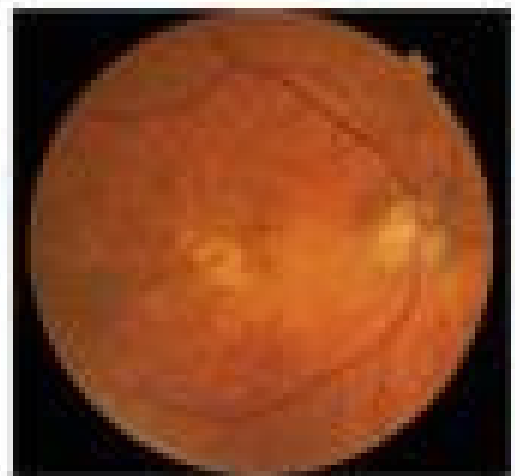


Classification

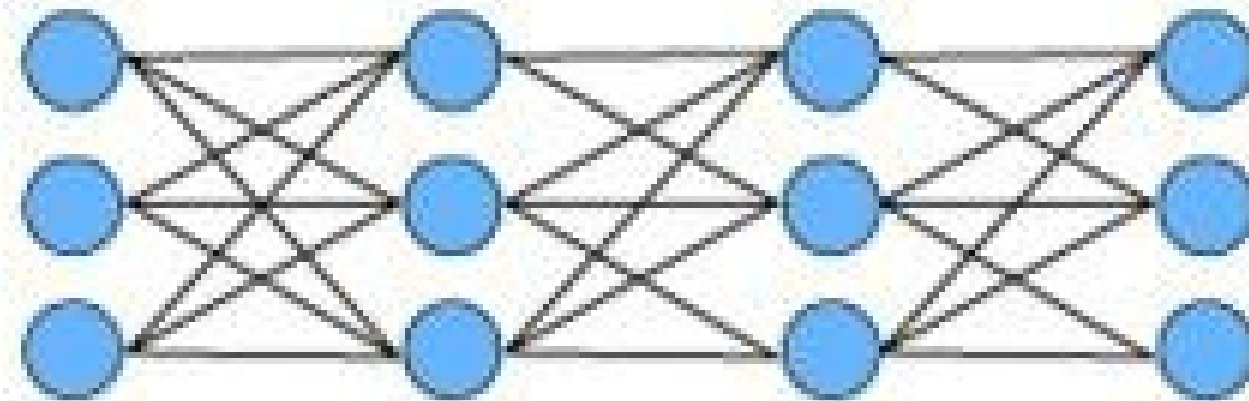


Output

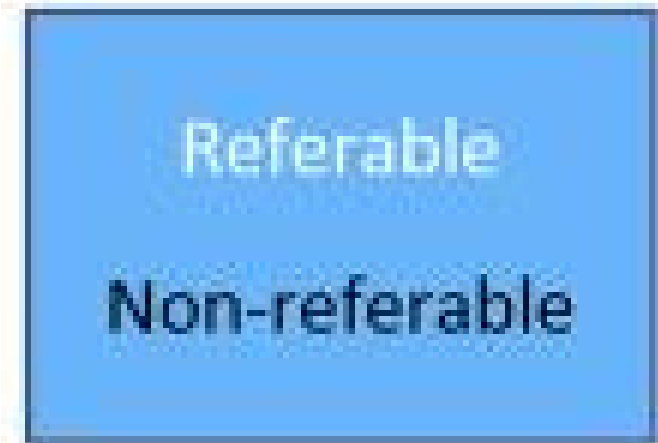
Deep Learning



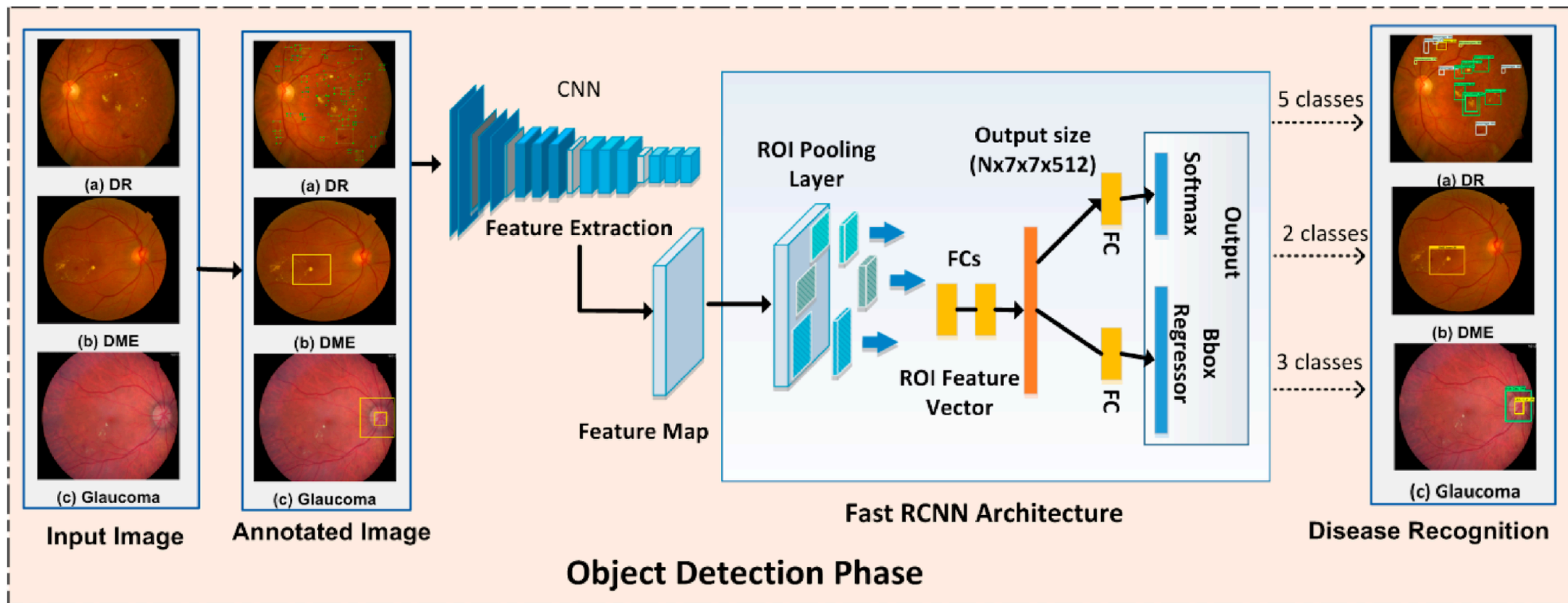
Input



Feature extraction + Classification



Output

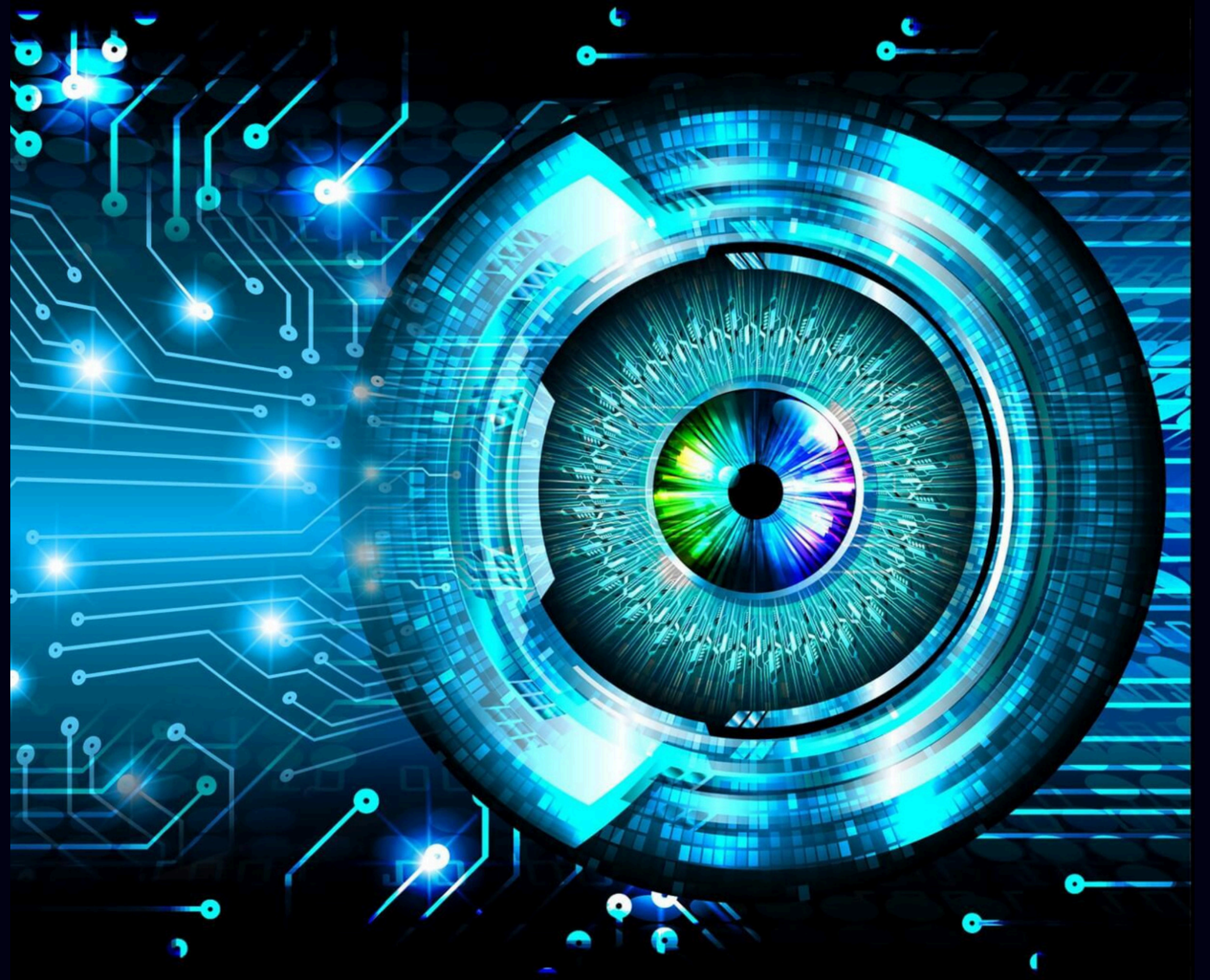


FINAL OUTCOME

SENSITIVITY : 70-93%

SPECIFICITY : 88-92%

ACCURACY : 84%



Clinical Validation from Pilot Study

Image quality directly influences both human and AI performance

AI agreement improves markedly when images are clear and gradable

Diagnostic performance is strongly dependent on image clarity

Poor or artefact-heavy images should not proceed to AI and must be re-captured

Strengthen training and QA for image capture (manual cameras)

Automated cameras can reduce operator variability

Sensitivity: 92.1%

Specificity: 91.8%

Multi-class Accuracy: 82.5%

AI Innovations in Primary Eye Care

THE CHALLENGES

- Practicality-Is the new technology practical
- Technical support- A technology may be useless without technical support on its implementation
- Lack of infrastructure in some regions
- Financial cost
- Maintenance expertise-expertise for maintenance and upgrading
- Data security- Ethical and legal challenges in data security

ECONOMIC IMPLICATIONS FOR MALAYSIA

Out of 10,000 people with DM, 600 referable DR (prevalence of sight-threatening/referable DR = 6%)

Assume 120 (20%) expected blindness cases over 10 years without screening.

Screening with early treatment reduces blindness risk by 56% (midpoint from programmatic estimates).

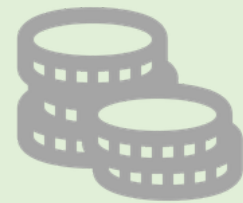
Screening will prevent cases of blindness to $120 \times 0.56 = 67.2$

67 blindness cases prevented with systematic screening.

Conservative lifetime societal cost per blindness case:



Direct + indirect cost \approx RM 150,000–300,000 per case (productivity + care + treatment)



If 67 cases are prevented,

Economic savings range from:

- $67 \times \text{RM}150,000 = \text{RM}10.05$ million
- to $67 \times \text{RM}300,000 = \text{RM}20.1$ million



Screening costs (camera, AI software, staff time)

MACROECONOMIC & PUBLIC HEALTH IMPLICATIONS FOR MALAYSIA

AI-assisted DR screening is not merely a clinical tool but a cost-containment strategy for chronic disease complications.

AI screening reduces future disability-adjusted life years and downstream tertiary expenditure while preserving workforce productivity.

Reduces expensive tertiary interventions.

Improves allocative efficiency within Malaysia's constrained public health budget.

CONCLUSIONS

01

AI has shown tremendous promise in expanding health systems' capacity of eye screening

02

DR.MATA System may be the solution for DR screening in Malaysia, provided it gets the technical support for its implementation

03

Digital Health should be given a priority for the betterment of our healthcare system

04

Low-cost, simpler digital solutions, such as smart phone-based systems in resource-limited settings, may add to the ease of AI implementation.

THANK YOU

