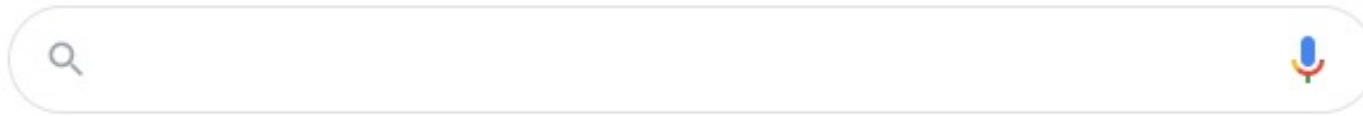


Google's AI



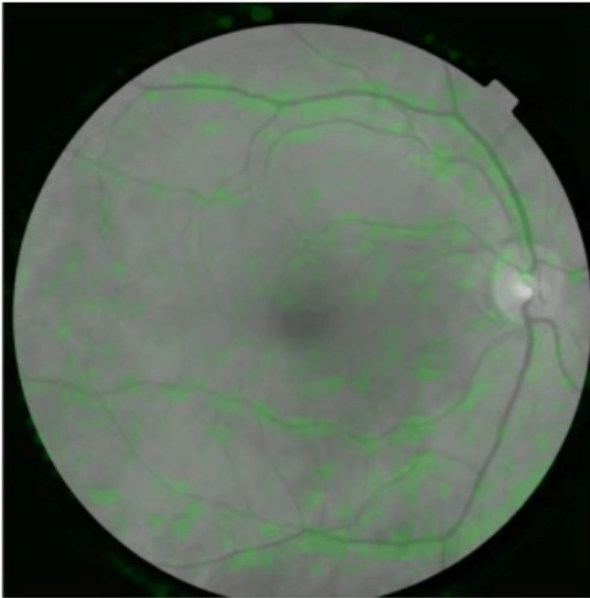
Google Search

I'm Feeling Lucky

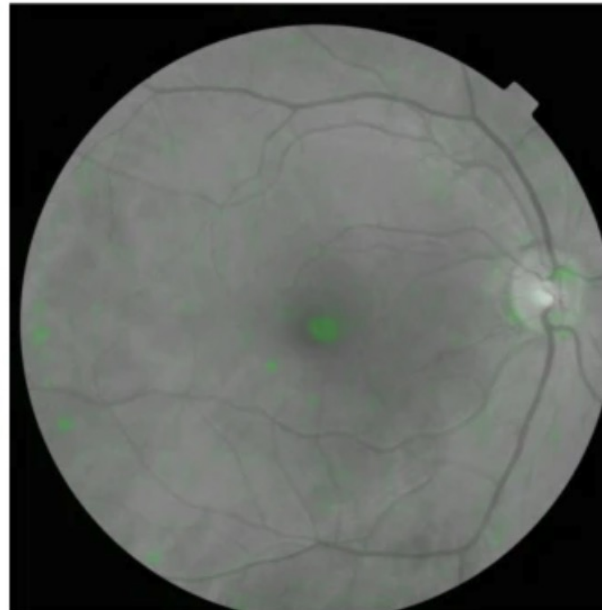
Age

AUC = 0.97

Gender



Actual: 57.6 years
Predicted: 59.1 years



Actual: female
Predicted: female

- Vessels
- macula
- optic disc
- many non-specific features

How is this to identify gender and age useful?

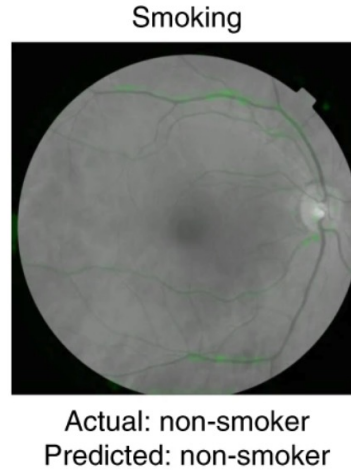
Prediction of cardiovascular risk factors from retinal fundus photographs

via deep learning

Nature Biomedical Engineering, Poplin et al. 2018

Gender/smoking
= **classification**

AUC = 0.71



Others=
regression

Model accuracy ranges from

$R^2 = 0.13$ (BMI)- 0.36 (SBP)

How Google's Deep Mind revolutionizes healthcare AI's

Traditional AI

INPUT
(Image)

BLACK BOX

OUTPUT
(Diagnosis)

DeepMind's Framework

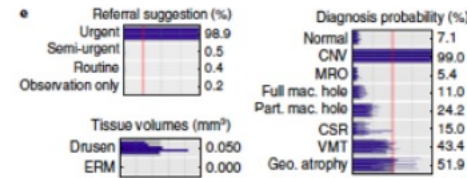
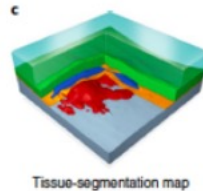
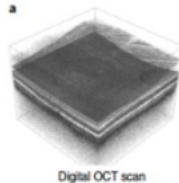
INPUT
(Image)

①
Segmentation network

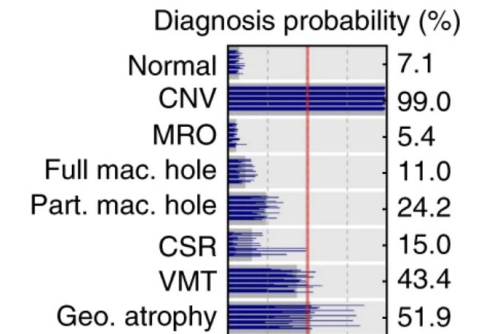
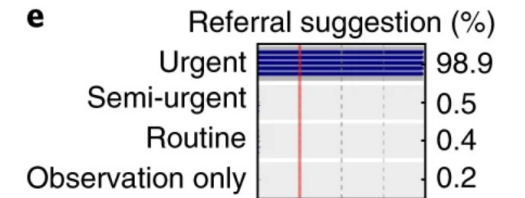
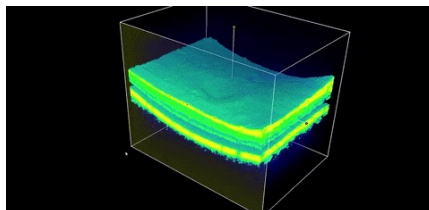
TISSUE MAP
(with labels for anatomy,
pathology, artefacts)

②
Classification network

OUTPUT
(Referral suggestion +
Diagnosis)



DeepMind's framework tackles the "Black Box" Problem by having 2 neural networks with a readily viewable intermediate representation (tissue map) in between



Diabetic Retinopathy

What we would need:

- Growing amount of specialised ophthalmologists
- Also in developing countries

Instead, we can use:

- a reliable Convolutional neural network



For humans difficult to evaluate a wide variety of features, patterns, colours, values and shapes

97% Sensitivity (True Positive rate)

93% Specificity (True Negative Rate)



Model performance - classification

Gender

AUC= 0.97

area under the ROC

ROC: receiver operating characteristic curve

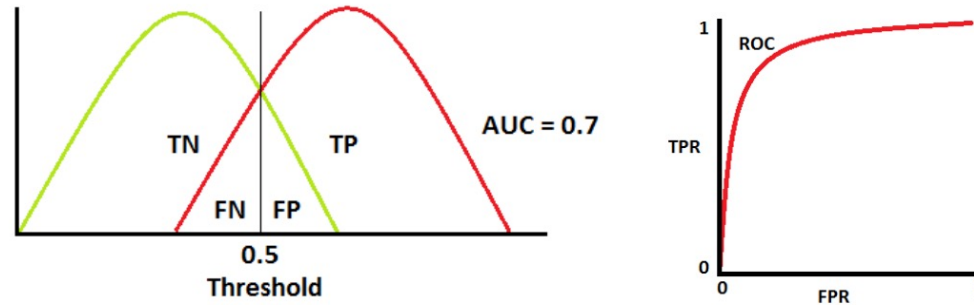
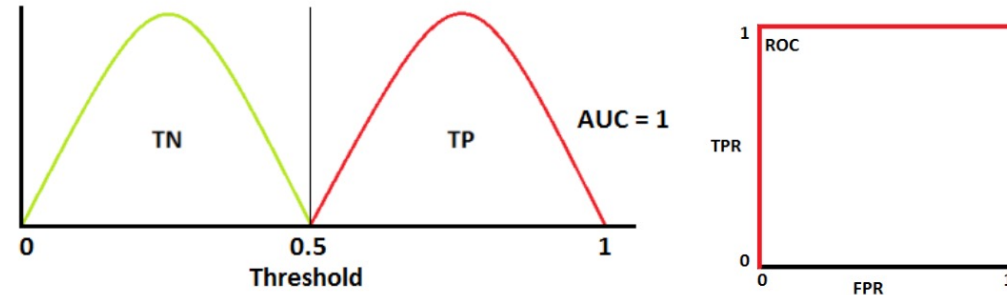
This curves plots two parameters:

Sensitivity (true positive rate)=

$$\frac{TP}{TP + FN}$$

false positive rate=

$$\frac{FP}{FP + TN}$$



AUC predictions quality evaluation is irrespective of what classification threshold is chosen.

