

NUS-ISS

*Problem Solving Using
Pattern Recognition*



Deep learning: Identify

by Nicholas Ho

© 2019 National University of Singapore.
All Rights Reserved.

**How deep learning is used to identify:
Use cases**

Lawyers vs AI

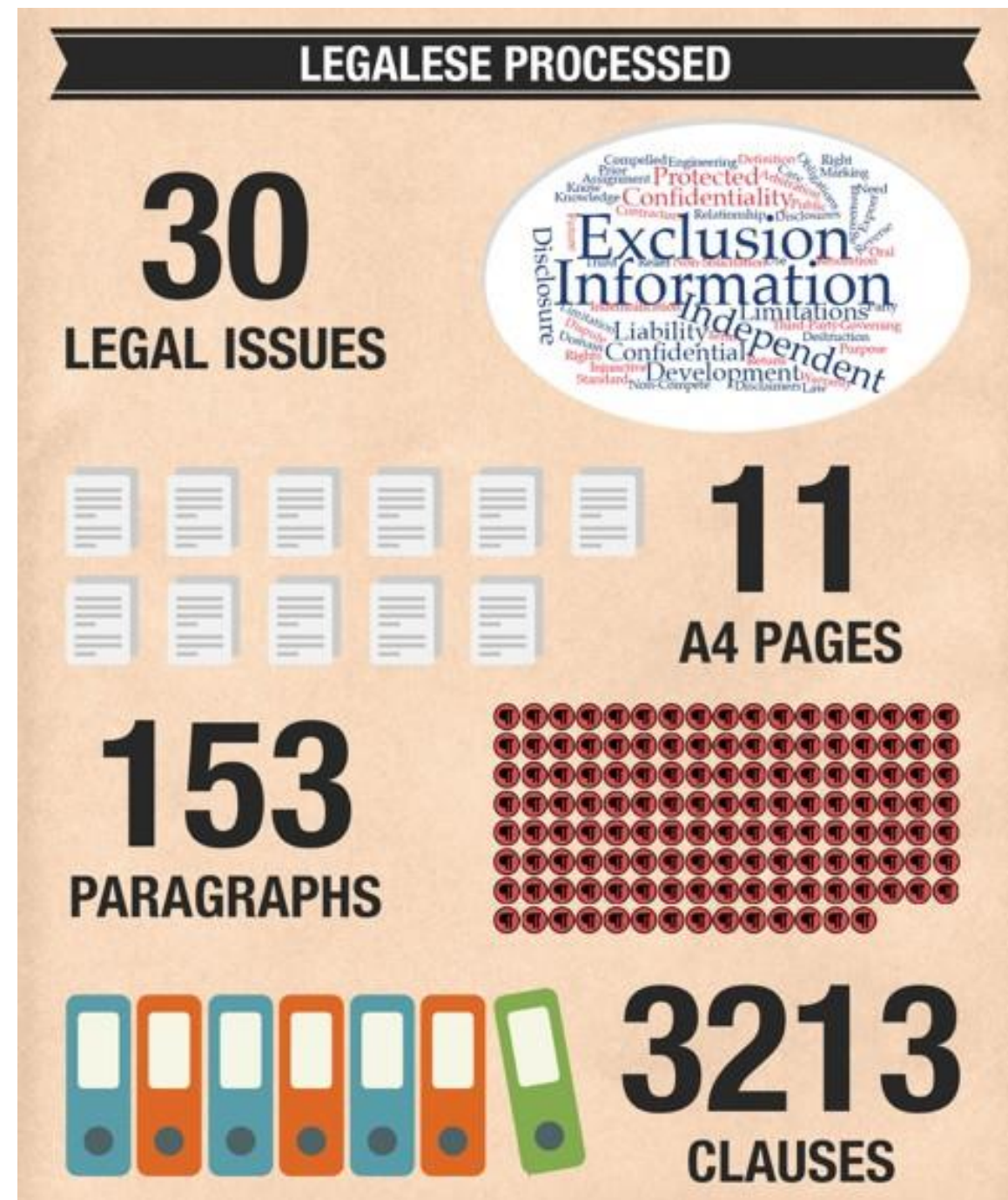
Spotting the risk in NDA

4 HOURS



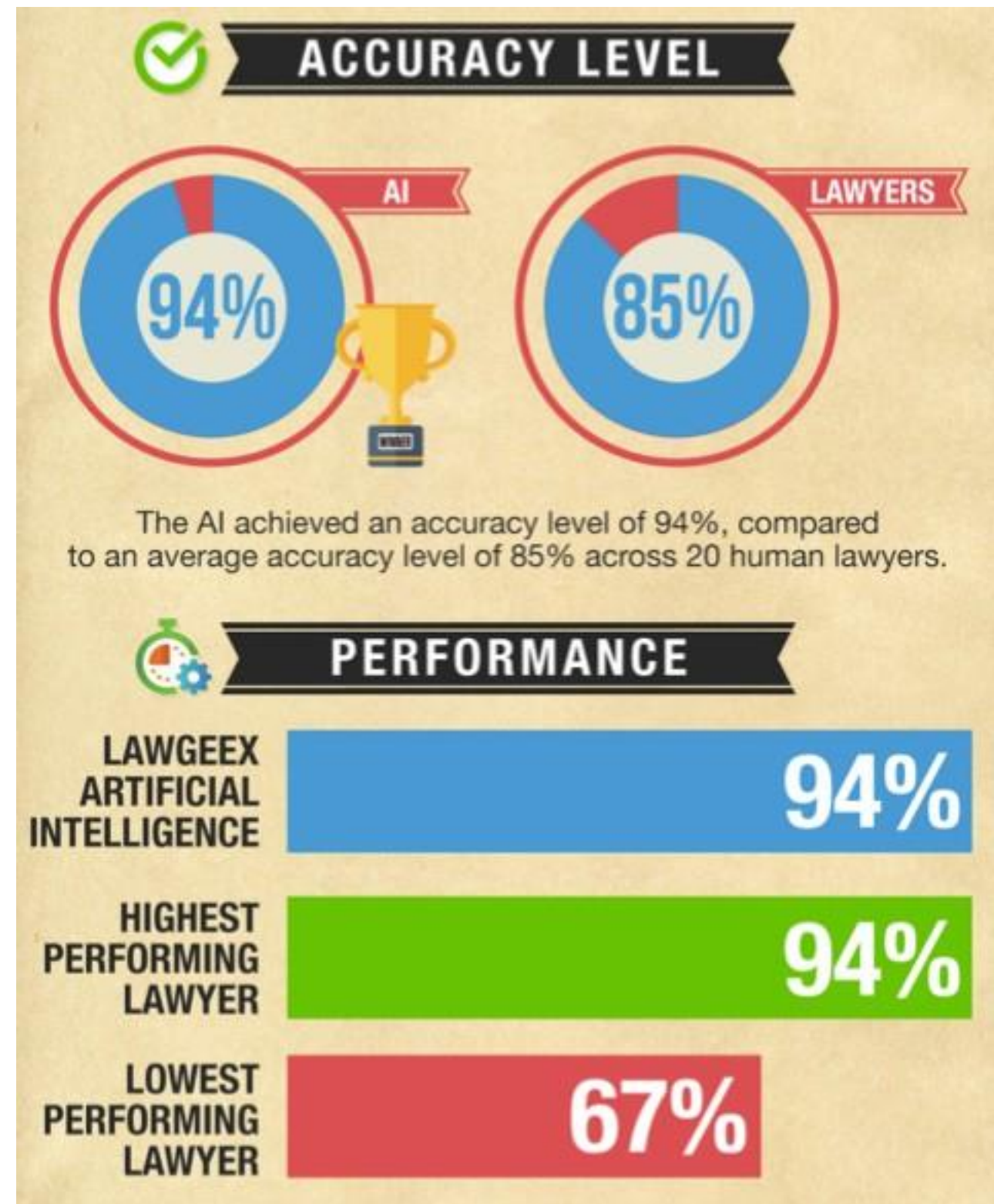
20 lawyers with experience reviewing contracts at compaines including Goldman Sachs, Cisco and etc.

Source: <https://www.lawgeex.com/resources/AlvsLawyer/>



Lawyers vs AI

Spotting the risk in NDA



It took an average of **92 minutes** for the lawyers to review all 5 NDAs. In contrast, it took the AI a total time of **26 seconds** to review all 5 NDAs

Source: <https://www.lawgeex.com/resources/AlvsLawyer/>

To spot unfair clauses?

Claudette comes to rescue

- Visit <http://claudette.eui.eu/use-our-tools/index.html>

CLAUDETTE

An Automated Detector of Potentially Unfair Clauses

Claudette found 4 potentially unfair clauses (displayed in **bold**) out of 5 sentences.
By hovering your cursor over each unfair sentence, you can see the most likely unfairness category.

[...]

Unilateral Change unfair clause

As such, the Services may change from time to time, at our discretion.

We may stop (permanently or temporarily) providing the Services or any features within the Services to you or to users generally.

We also retain the right to create limits on use and storage at our sole discretion at any time.

We may also remove or refuse to distribute any Content on the Services, suspend or terminate users, and reclaim usernames without liability to you.

Share link

Save results

Try Again

Contact

Source: <https://arxiv.org/pdf/1805.01217.pdf>

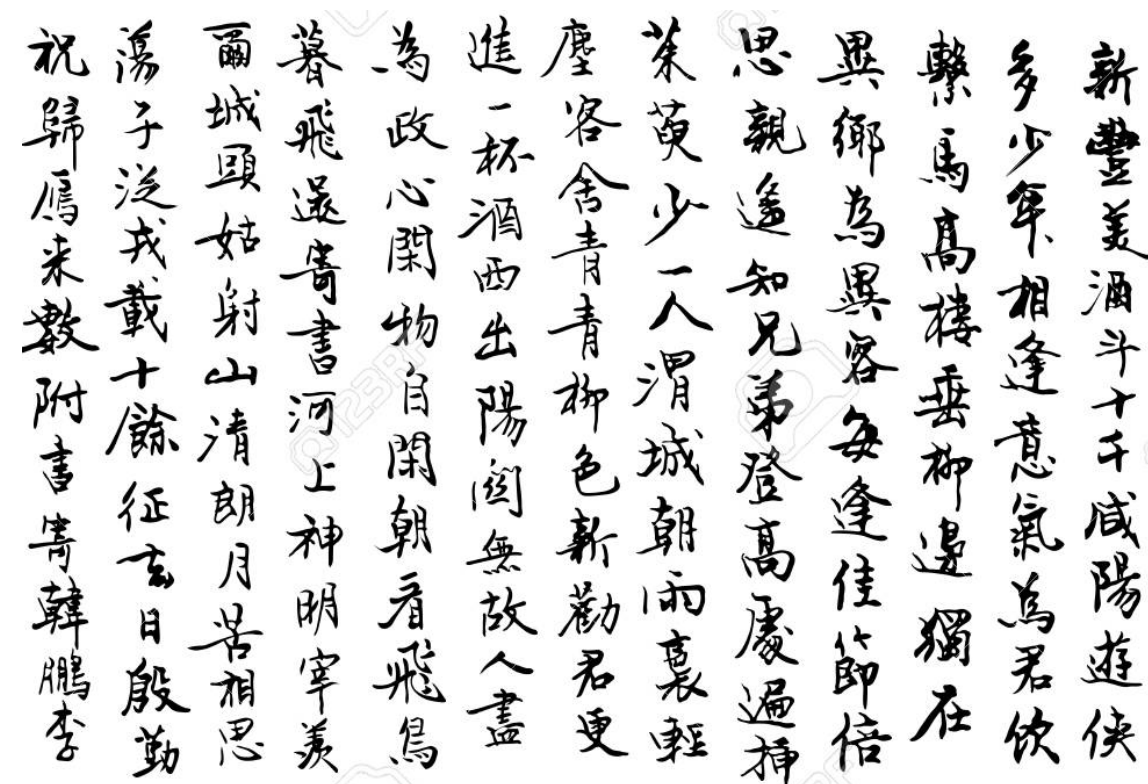
Character recognition

The challenge at Apple

- The number of symbols for alphabet-based writing: on the order of 100 symbols
- Chinese characters: at least 27,533 entries



Source: https://en.wikipedia.org/wiki/MNIST_database#/media/File:MnistExamples.png



Source: https://www.123rf.com/photo_106486597_stock-vector-vector-background-with-handwritten-chinese-characters-asian-calligraphy-illustration-traditional-bla.html

Character recognition

The challenge at Apple

- Requirements: recognize 30,000 handwritten characters in real-time
- Constraint: small memory / processing footprint
- No lag in response yet with good accuracy



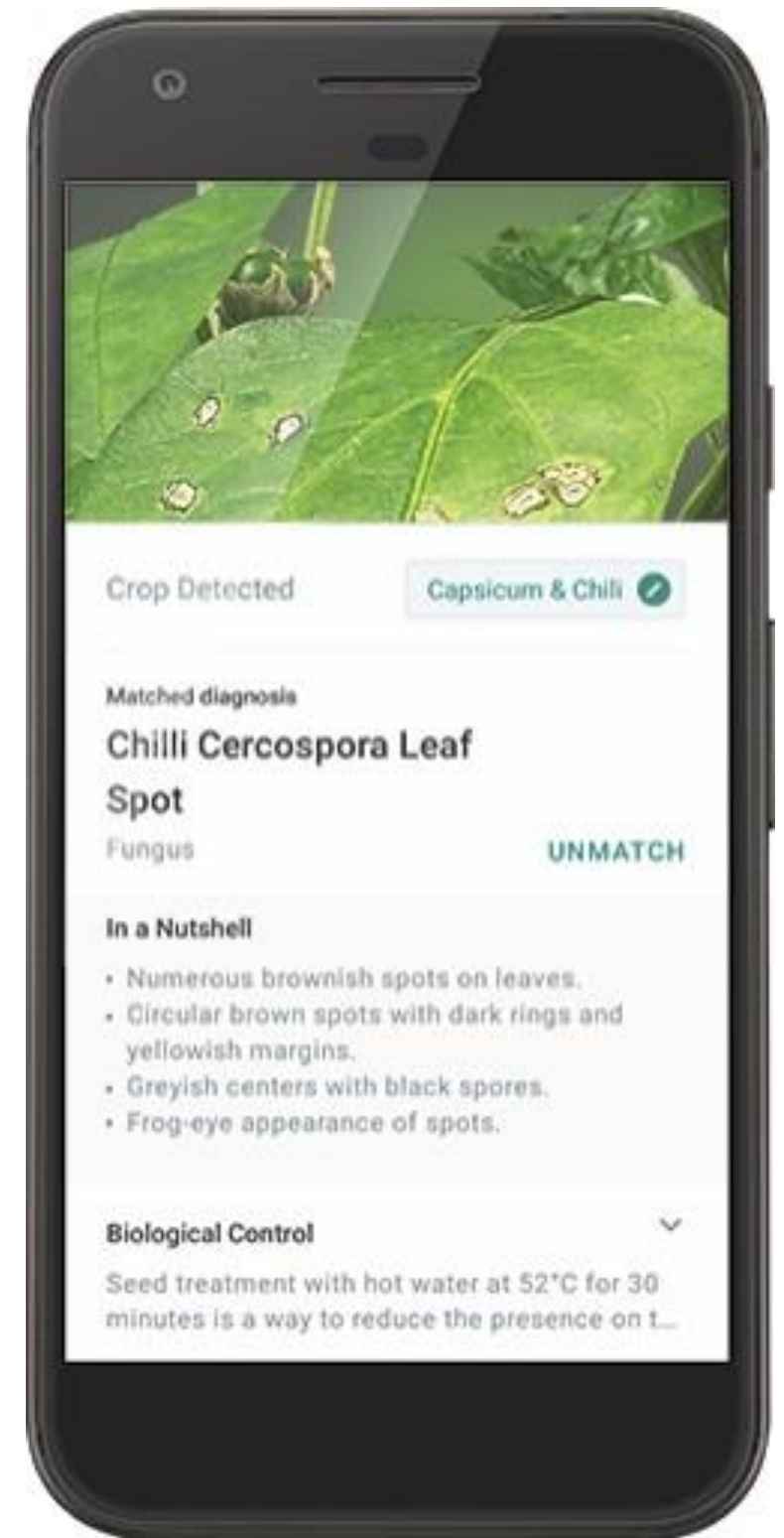
Source: <https://machinelearning.apple.com/2017/09/12/handwriting.html>

Plants' disease

Better detection



Source: <https://plantix.net/en>



Product search

For shopping



Source: <https://twitter.com/mbrennanchina/status/1183717500803932160?s=20>

Custom sorter

Sort your own items

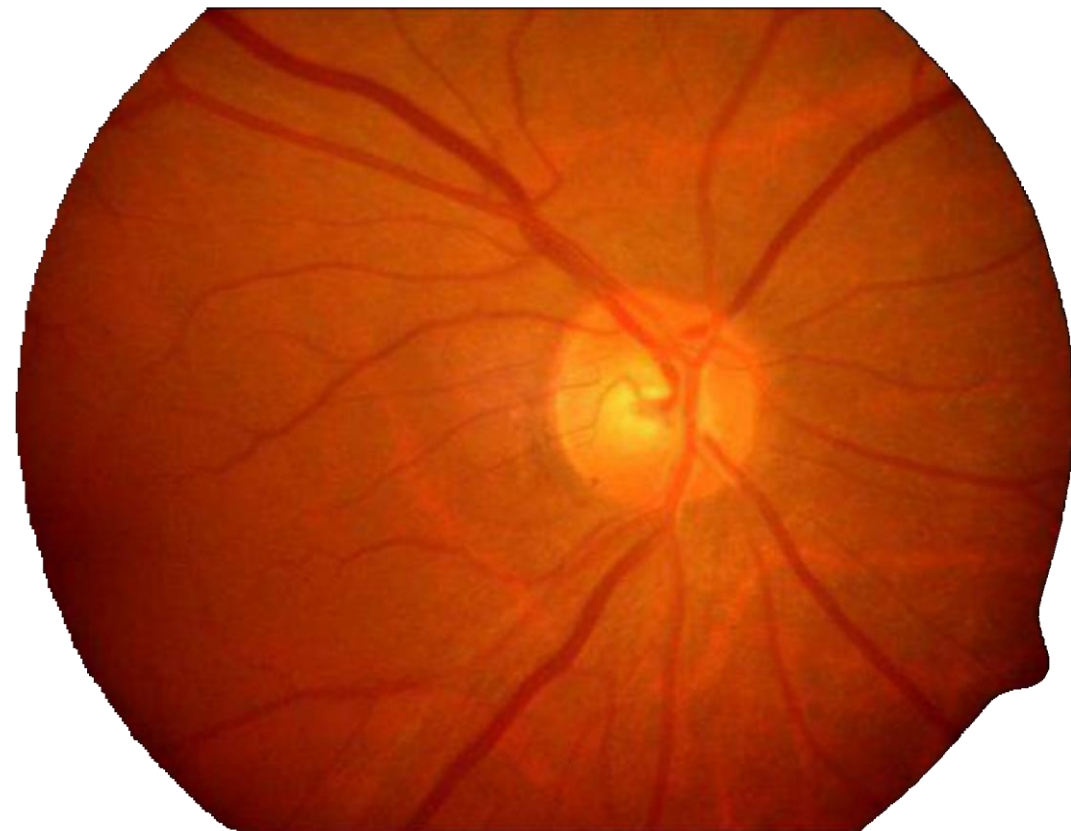
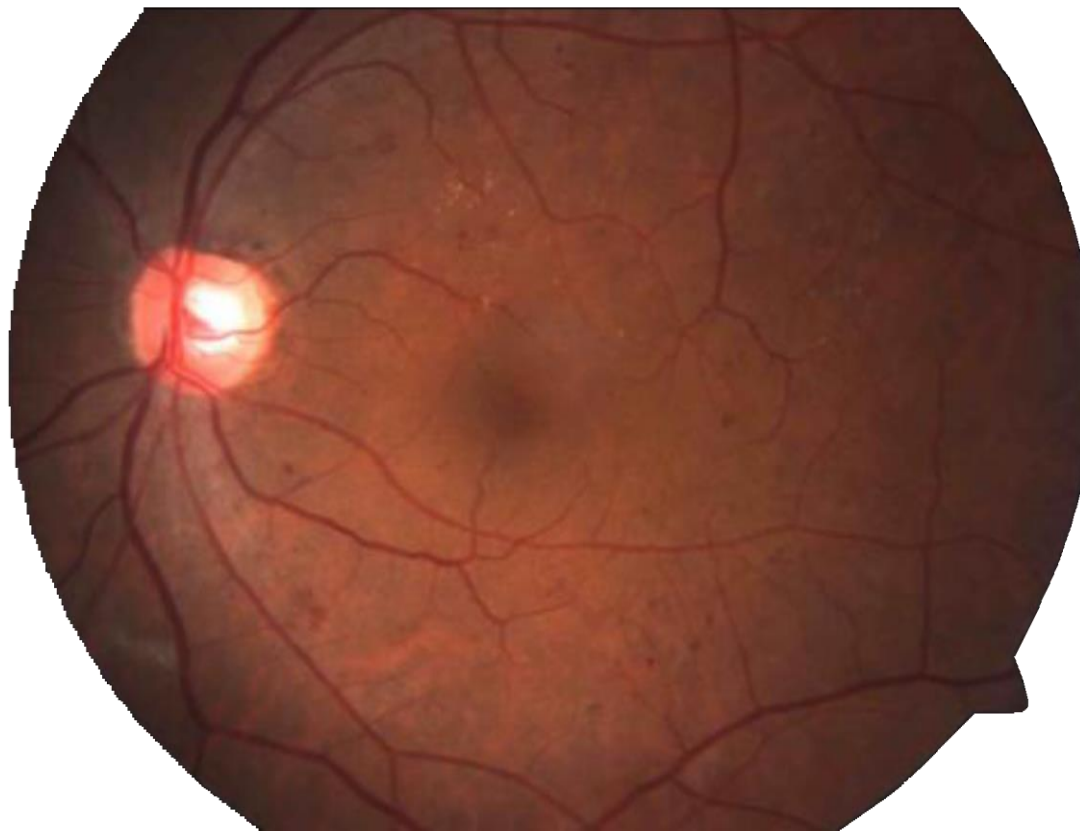
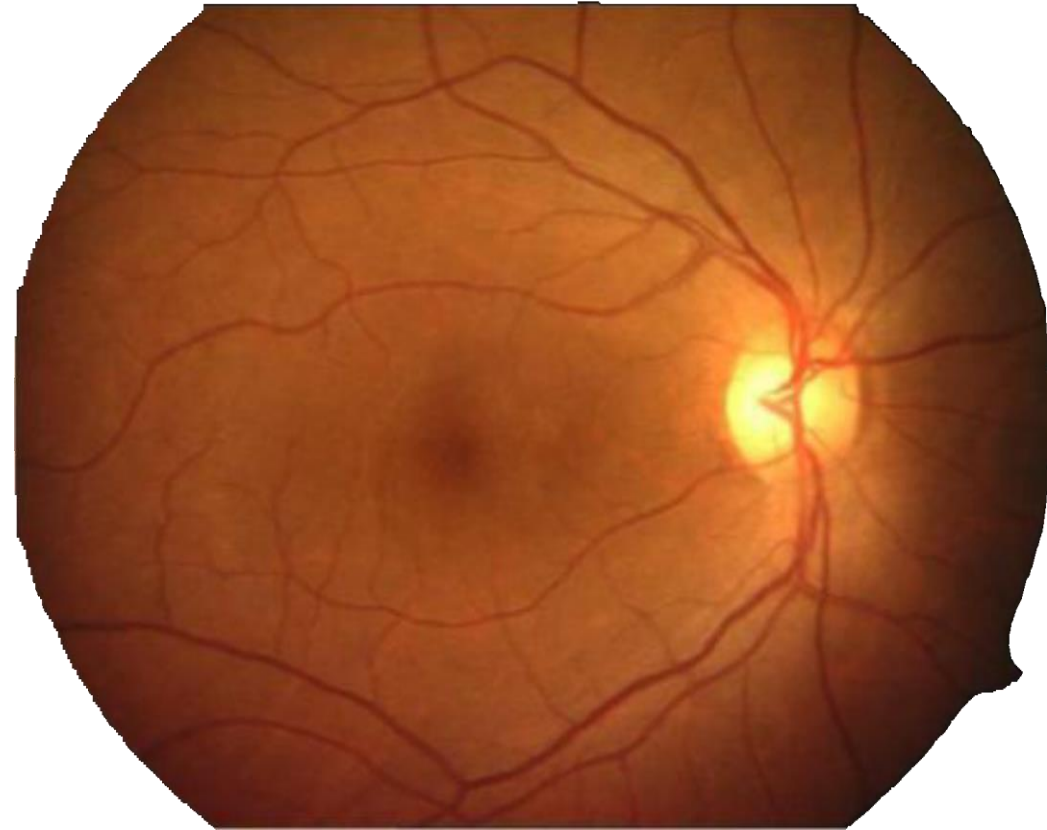
- Allow custom sorting using your own labelled images



Source: <https://www.refind.se/refind-sorter>

Automated diagnosis

On our eyes



Automated diagnosis

On our eyes

- Key objective: not to replace doctors, but to improve early discovery
- Intended to place such system in family clinic or polyclinic
- Such system does first-line check-up, makes referral, reduce hospital / specialist load
- In third world countries, improve medical care in rural areas (lack of doctors)



Source: <https://www.eyefficient.com/product/hand-held-fundus-camera/>


Automated diagnosis

On our eyes

Retinal image analysis

Select file

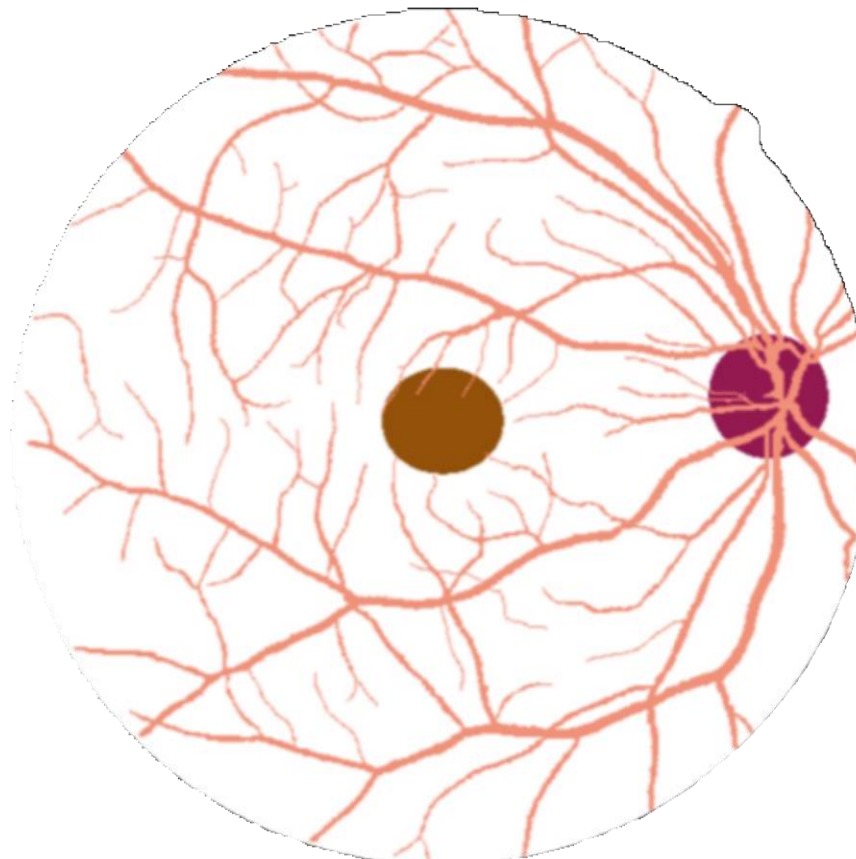
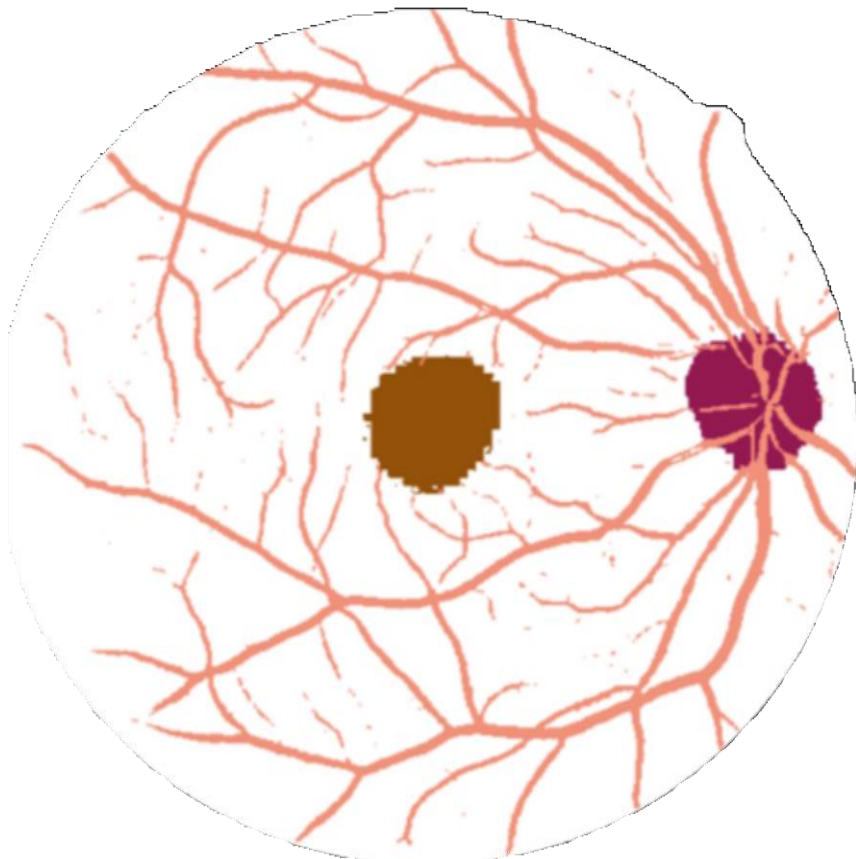
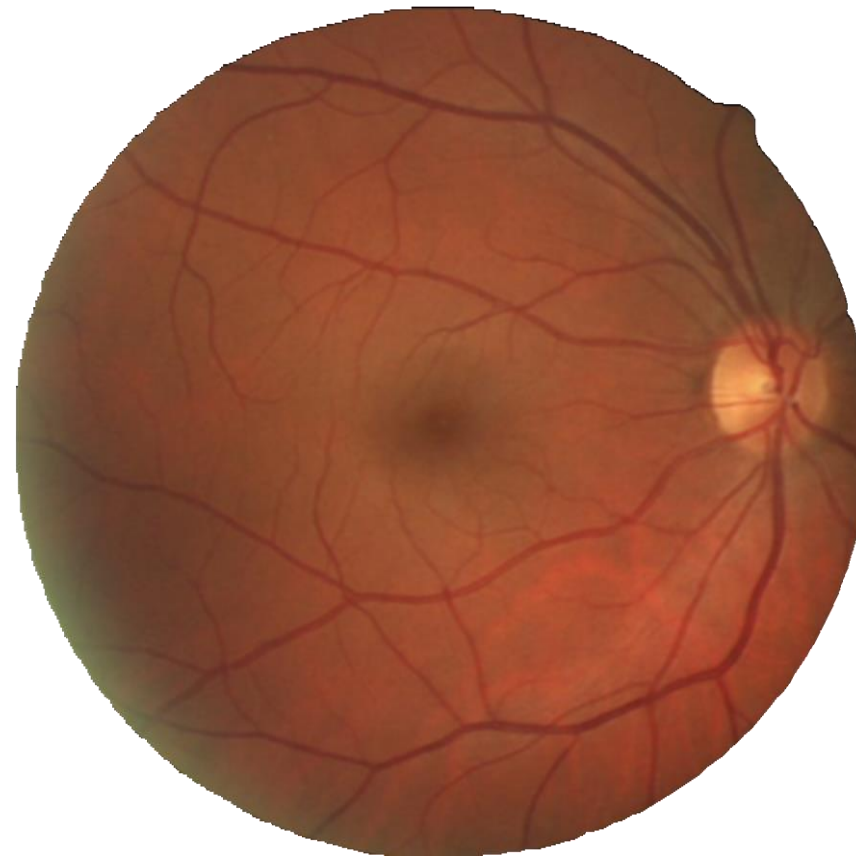
kmc_002_0027_o.jpg
137.132.214.213
14/Mar/2019:05:11:59 +0000
2.62s



Diabetic Retinopathy retinal image

Automated segmentation

On our eyes



When it comes to vision ...

A few things to note

- **Classification by itself will get confused if there are other objects inside the image**
- **Hence, we require localization to draw a bounding box (or bbox) to separate the target object and other objects**

Classification



CAT

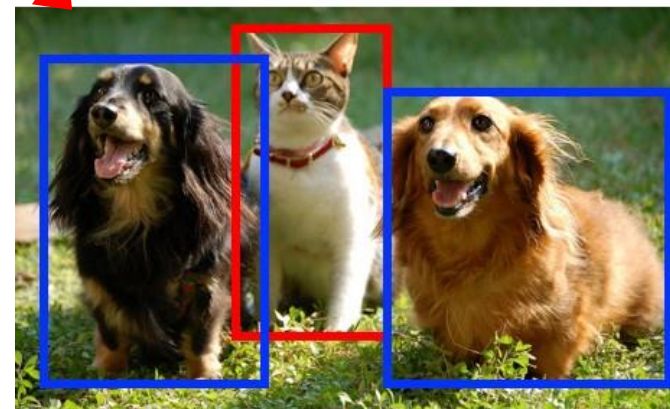
Classification + Localization



CAT

Single object

Object Detection



CAT, DOG

Instance Segmentation



CAT, DOG

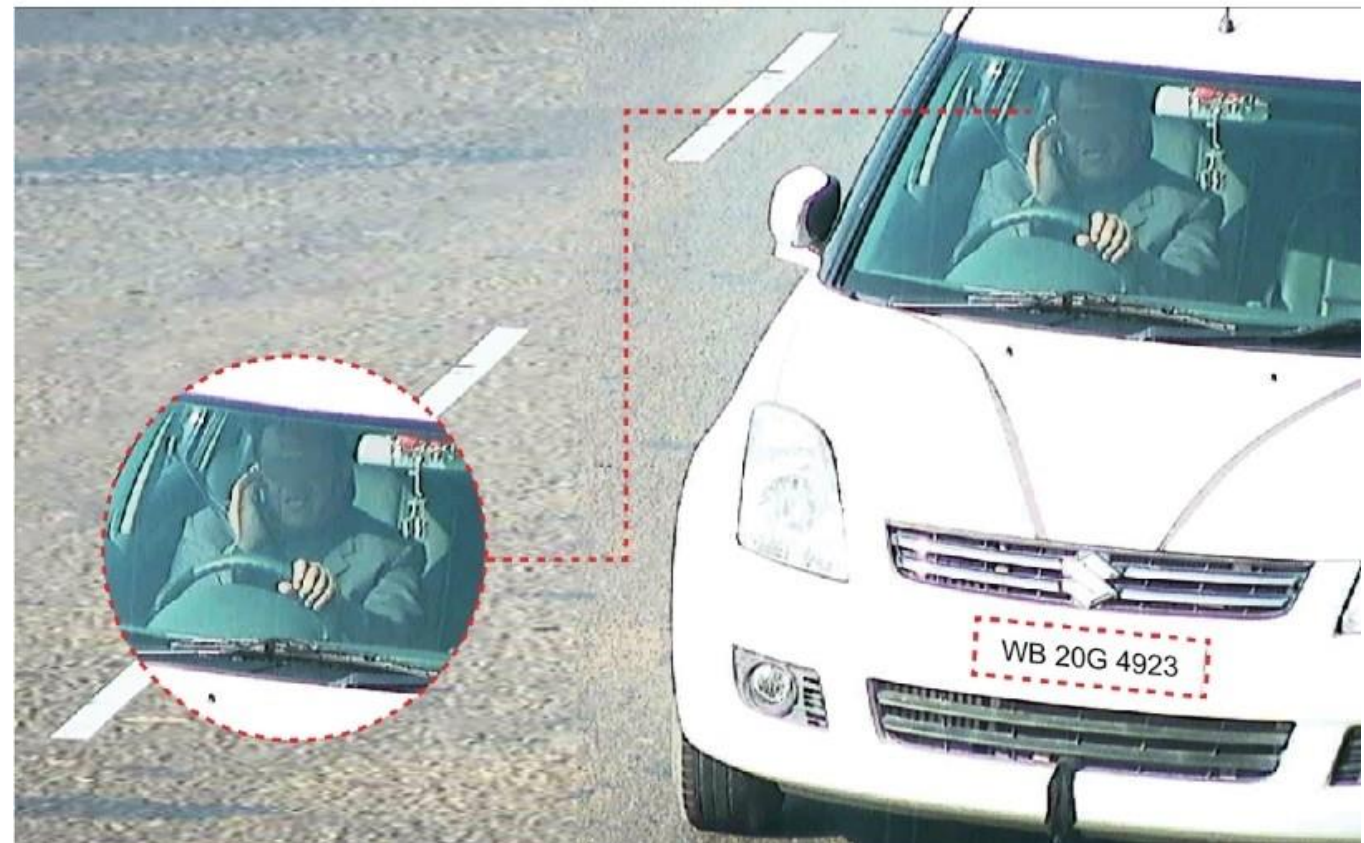
Multiple objects

Source: Deep Learning for Computer Vision by
Rajalingappaa Shanmugamani

Object detection

Identify traffic offences

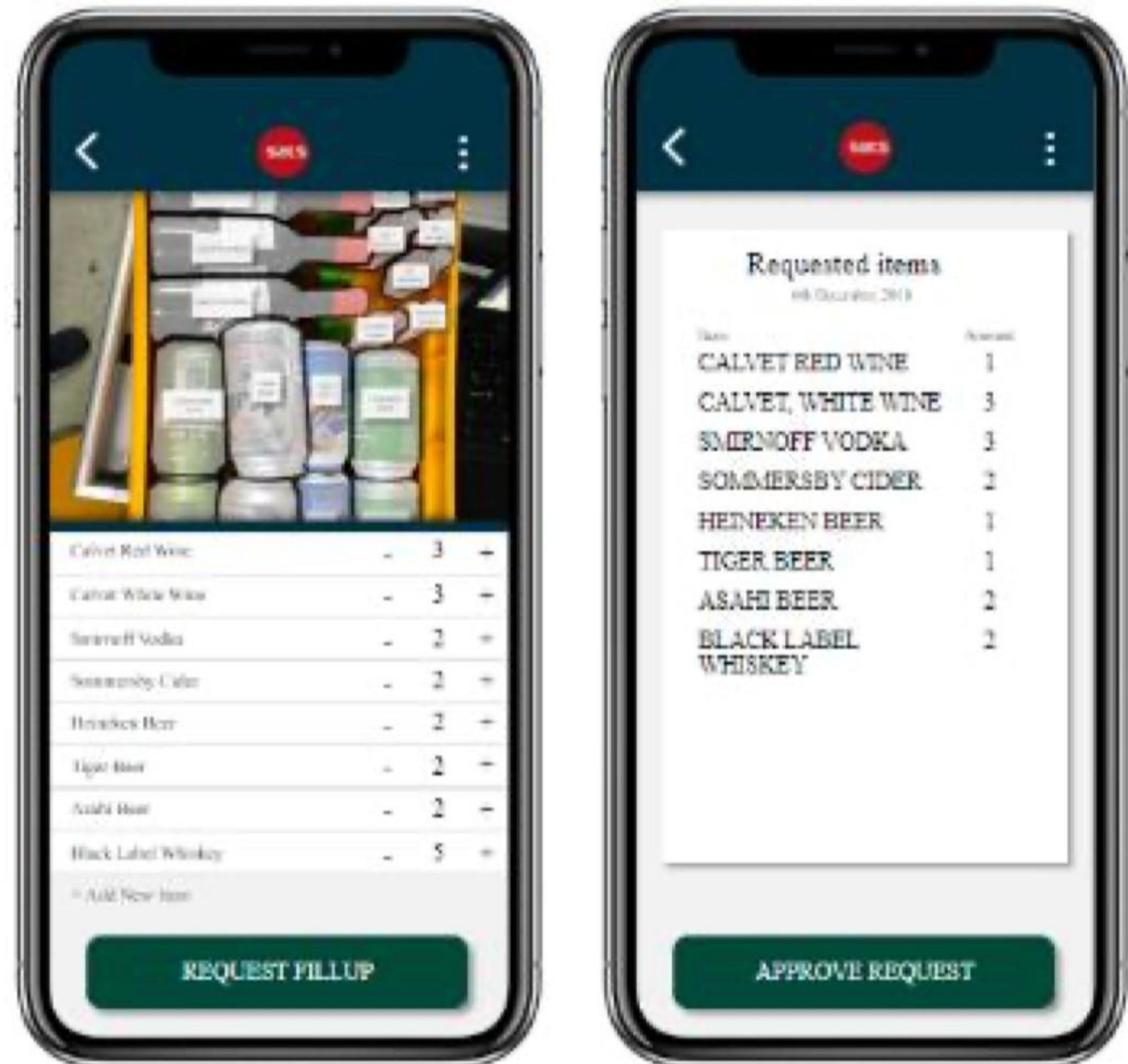
- NO seat belt detection
- Using-phone-while-driving detection



Source: <https://www.sourcesecurity.com/news/videonetics-artificial-intelligence-deep-learning-no-seat-belt-detection-co-4403-ga-npr.1551018780.html>

Airline catering

Check the correct items



Source: SATS

Object detection

For autonomous vehicle



Source: <https://www.pond5.com/stock-footage/83053263/autonomous-or-driverless-car-computer-vision-object-detectio.html>

Volvo in-car cameras

Combat distraction and drunk driving

- 'Pro-active' driver monitoring system



Source: <https://www.caranddriver.com/news/a26893035/volvo-interior-cameras-distraction-drunk-driving/>

Aircraft

Monitoring check-in

[Learn more](#)



Source: <https://assaia.com/tmc/>

Tracking hands

in real time



▶ Play Video

Source: <https://victordibia.github.io/handtrack.js/#/>

Behaviour identification

by Aipoly



Source: <https://www.aipoly.com>;
<https://www.youtube.com/watch?v=t33G77R7FJQ>

Object detection

Auto referee?

- Track ball and players
- Report score based on the events in scene



Source: <https://arxiv.org/abs/2004.09927>;
<https://www.youtube.com/watch?v=5P3k5ZCDcq8>