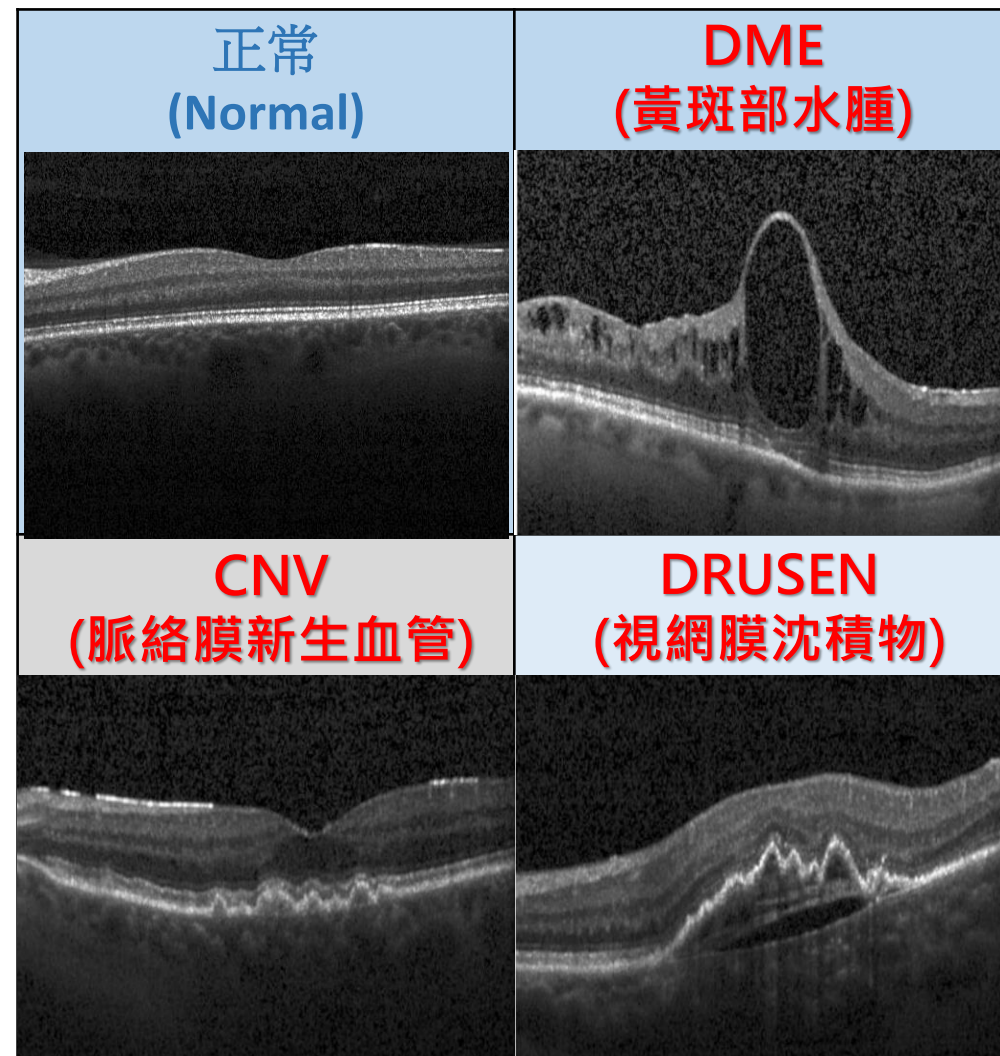
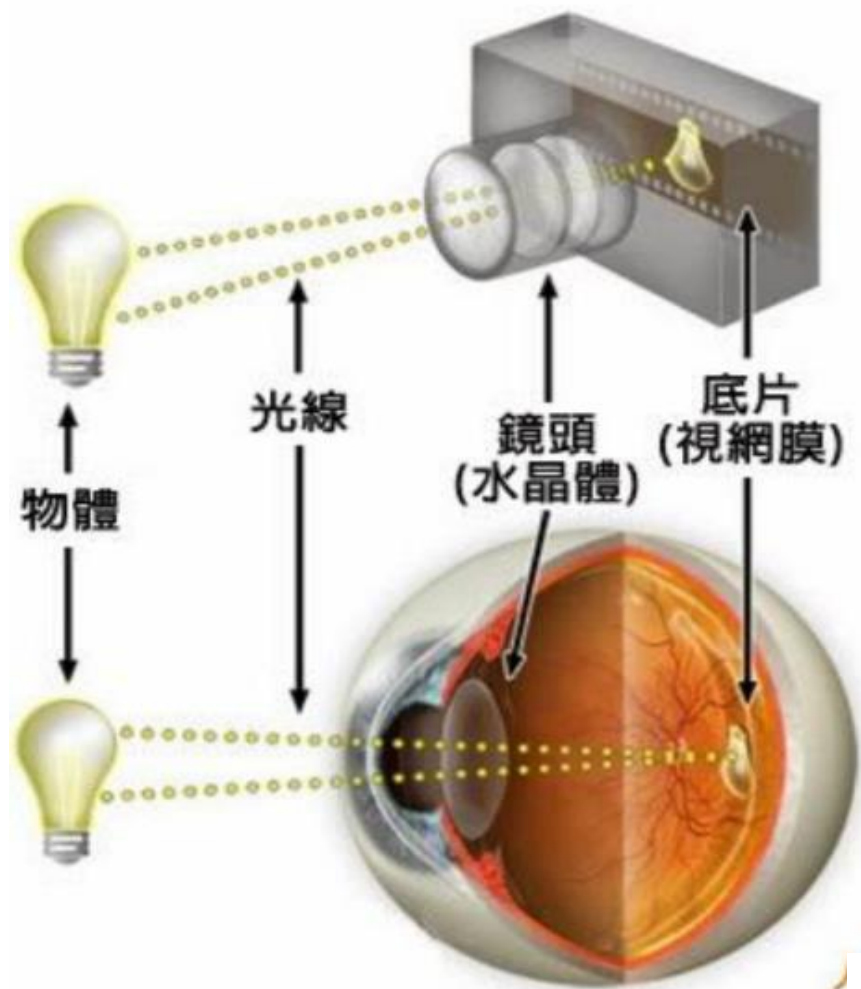




Detecting Retina Damage

視網膜異常檢測

視網膜介紹與症狀



視網膜檢測時有以下問題：



誤判

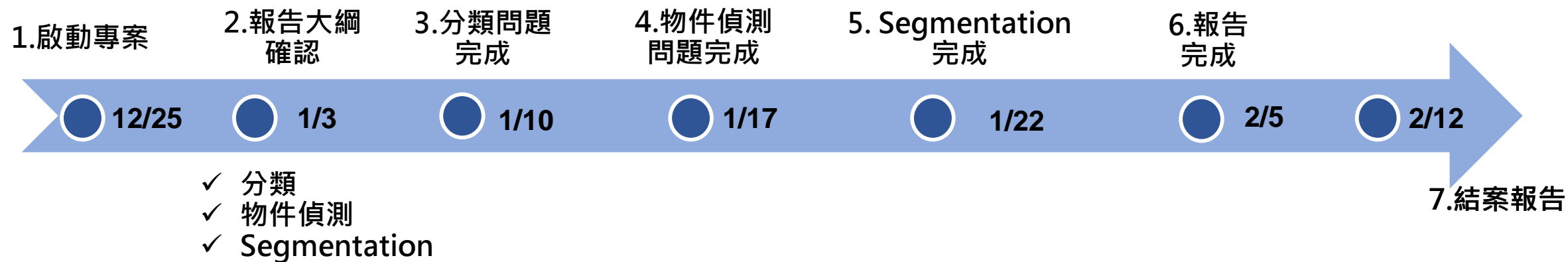


耗時

本專案期望以AI 技術輔助檢測，降低醫生診斷時負擔



解題過程



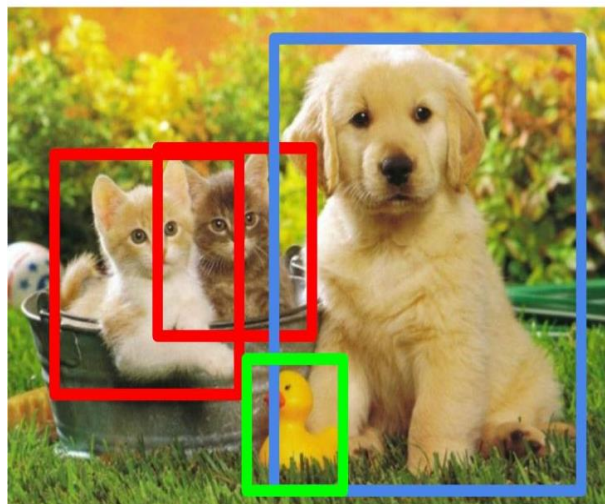
視網膜異常檢測攻堅計劃

本專案以電腦視覺三大方法做為主要攻堅計劃

物件歸類
Classification



物件偵測
Object Detection



語意分析
Instance Segmentation

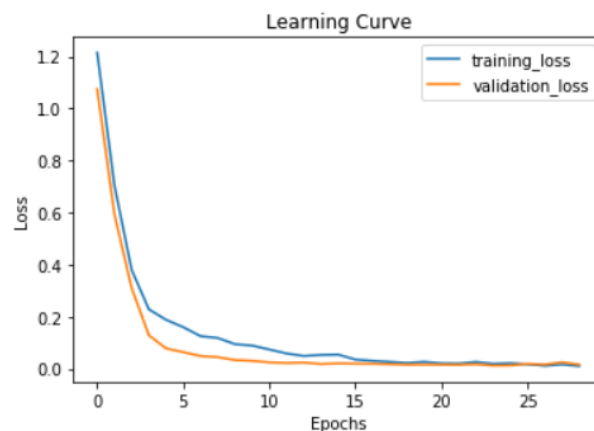
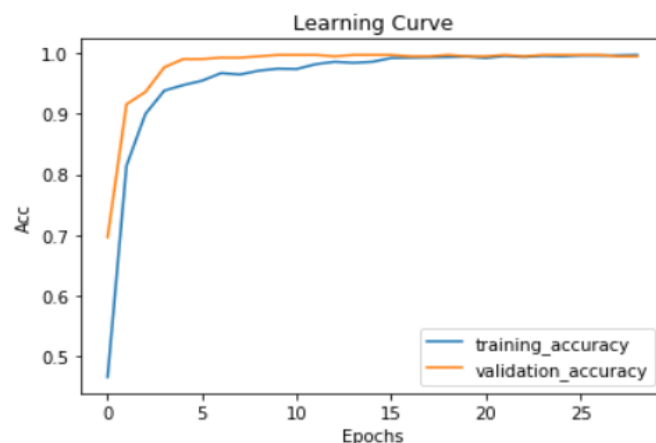


攻堅計劃一：分類

➤ Basic Information

Method		Transfer Learning
Model		Xception
Hyperparameter	optimizer	Adam(lr=10e-6)
	epochs	100
ImageDataGenerator		rotation_range=10, width_shift_range=0.1, height_shift_range=0.1, shear_range=0.1, zoom_range=0.1, horizontal_flip=True, fill_mode='nearest')
Earlystop		val_loss 連續 5 epoch 無下降
Data		CNV 605 DME 501 DRUSEN 580 Normal 517
Train_Test_Split		0.8/0.2

➤ Training/Validation Accuracy/Loss



Comment:
由 Training/Validation 的 Accuracy/Loss
Model 無 bias · variance 問題

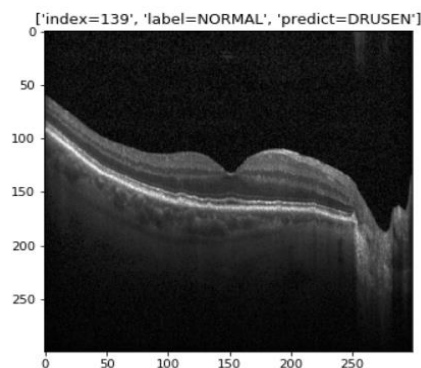
➤ 錯誤分析: 模型預測 Validation Set 結果

predict	CNV	DME	DRUSEN	NORMAL
label				
CNV	117	0	0	0
DME	0	87	0	0
DRUSEN	0	0	112	0
NORMAL	0	0	1	124

Validation loss: 0.011931998532713135

Validation accuracy: 0.9977324

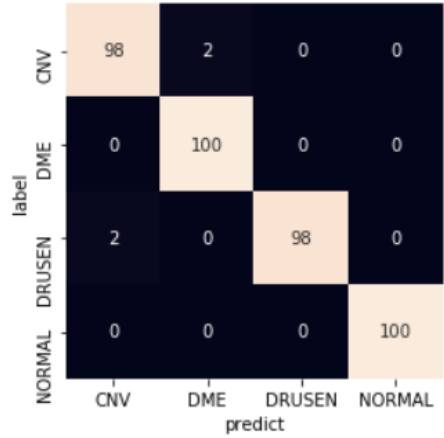
	precision	recall	f1-score	support
CNV	1.00	1.00	1.00	117
DME	1.00	1.00	1.00	87
DRUSEN	0.99	1.00	1.00	112
NORMAL	1.00	0.99	1.00	125
accuracy			1.00	441
macro avg	1.00	1.00	1.00	441
weighted avg	1.00	1.00	1.00	441



Comment:
正常照片 recall 為 0.99
異常照片 recall 為 1
=> Model 無漏篩問題

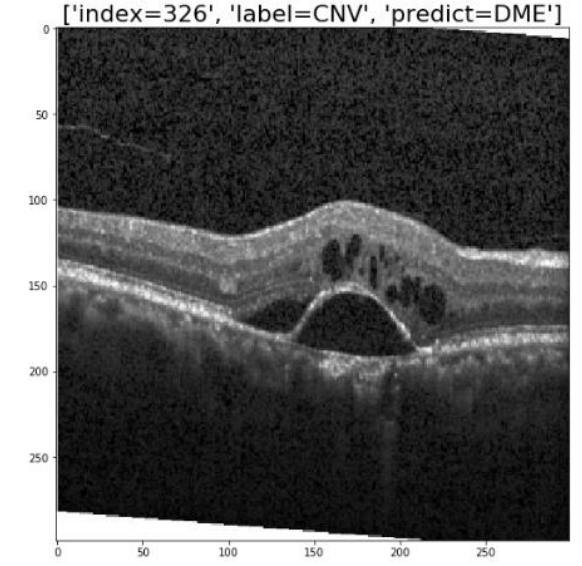
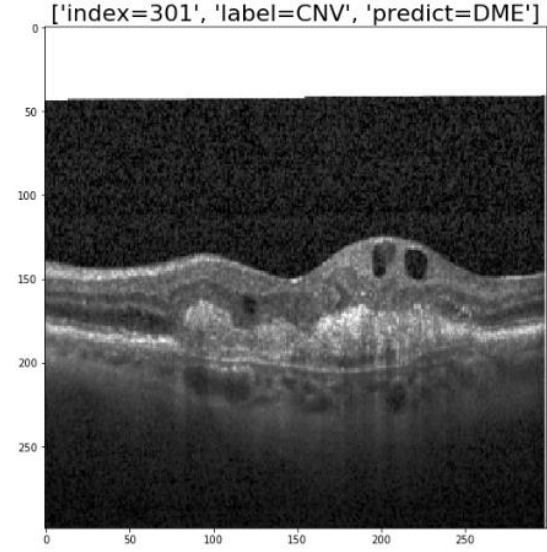
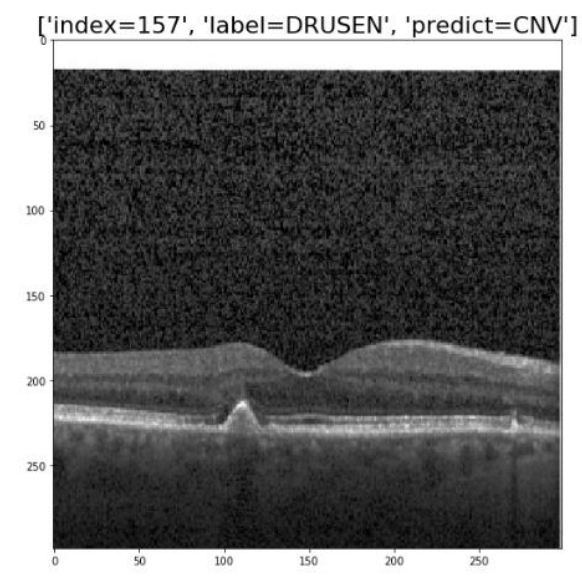
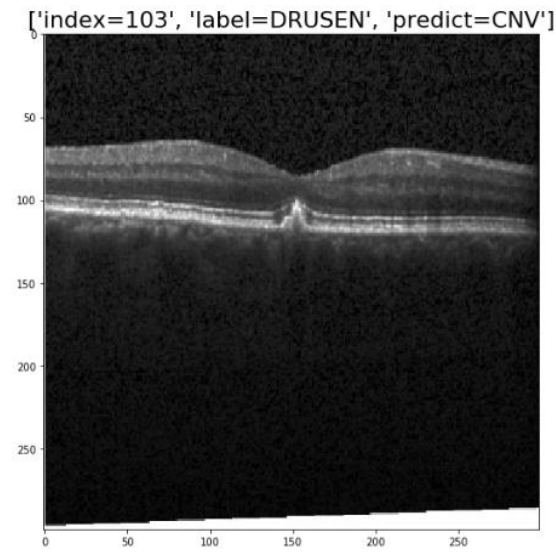
➤ 針對新資料預測 (每類各 100 張)

predict \ label	CNV	DME	DRUSEN	NORMAL
CNV	98	2	0	0
DME	0	100	0	0
DRUSEN	2	0	98	0
NORMAL	0	0	0	100



	precision	recall	f1-score	support
CNV	0.98	0.98	0.98	100
DME	0.98	1.00	0.99	100
DRUSEN	1.00	0.98	0.99	100
NORMAL	1.00	1.00	1.00	100
accuracy			0.99	400
macro avg	0.99	0.99	0.99	400
weighted avg	0.99	0.99	0.99	400

Comment:
正常照片 recall 為 1 (100/100)
異常照片 recall 為 0.987 (4/300)
=> Model 無漏篩問題



Comment:
複合型異常，導致分類錯誤。解法: Object Detection

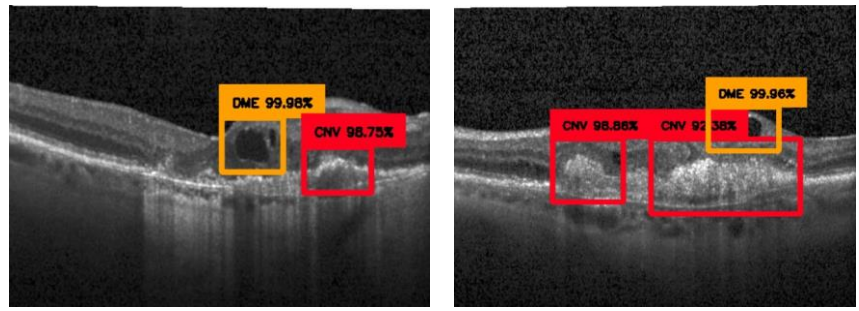
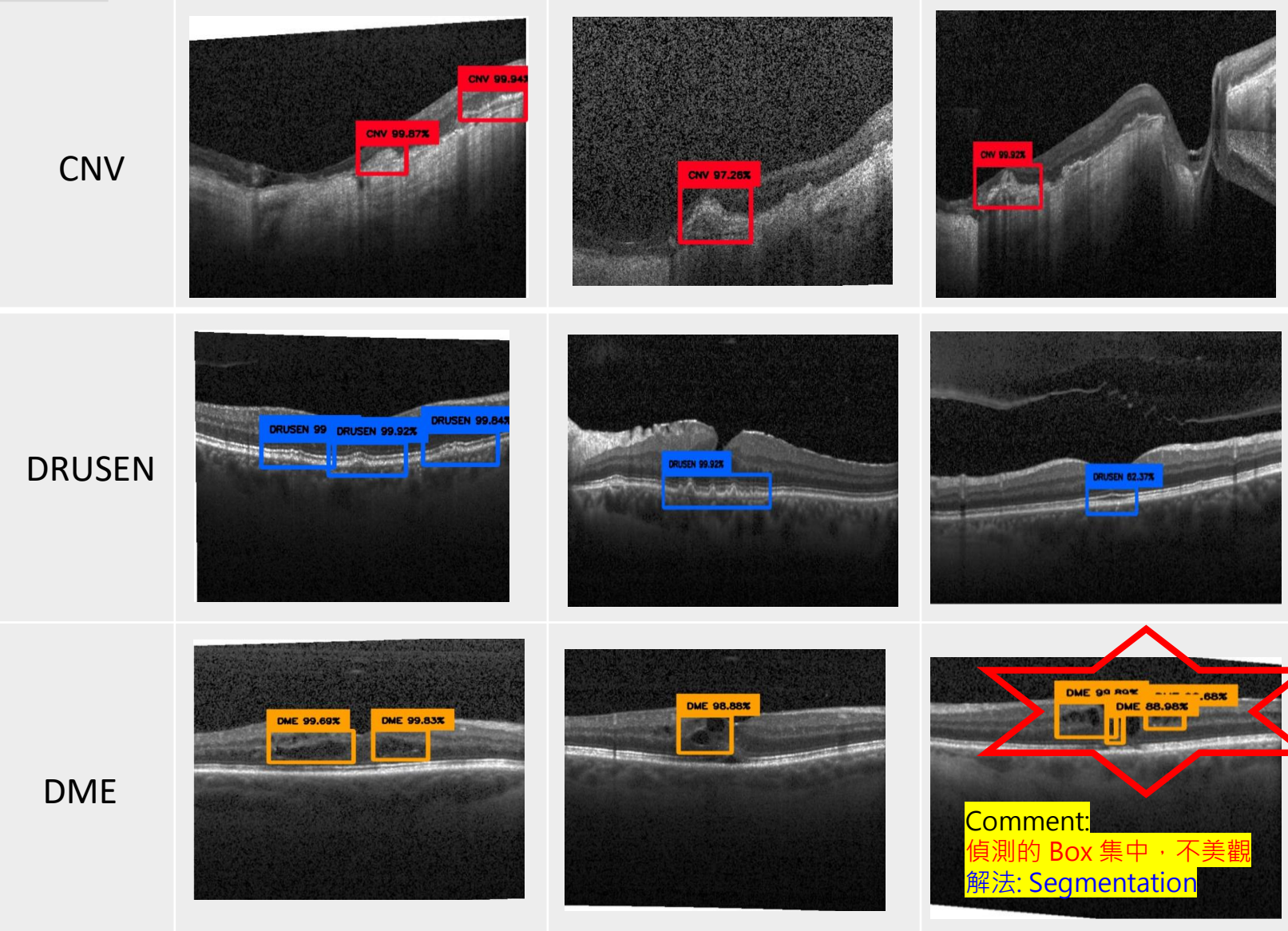
攻堅計劃二：物件偵測

CNV: 0.9020
DME: 0.9540
DRUSEN: 0.9279
mAP: 0.9280

結果: mAP: 0.928

Basic Information

Method		YOLOv3
Hyperparameter	epochs	30
Number of label		CNV 252
		DME 146
		DRUSEN 183



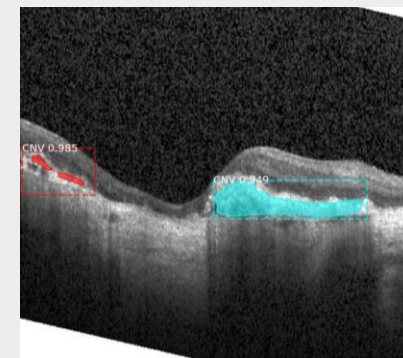
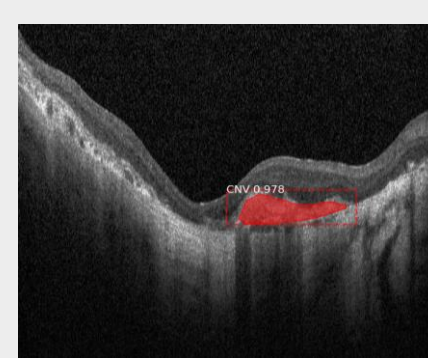
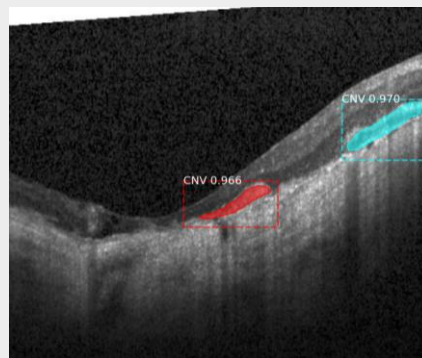
解決分類無法做到的複合型異常

攻堅計劃三：語意分析

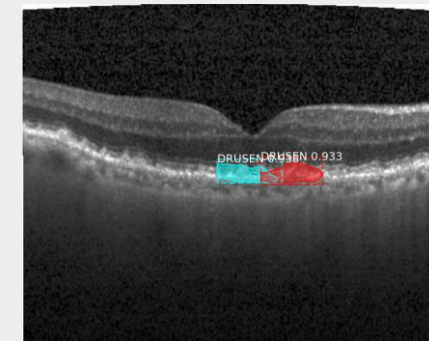
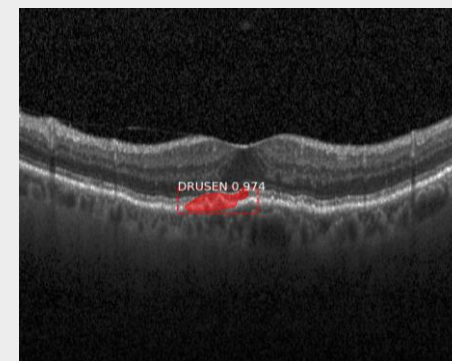
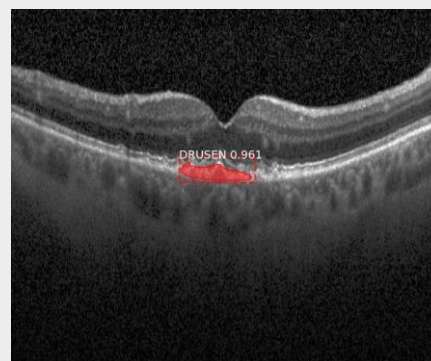
➤ Basic Information

Method		Mask R-CNN
Hyperparameter	epochs	10
STEPS_PER_EPOCH		100
Detection min confidence		0.9
Number of label		CNV 30
		DME 30
		DRUSEN 30

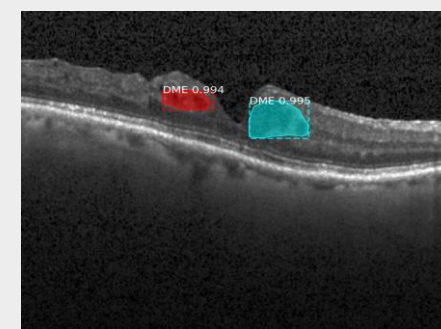
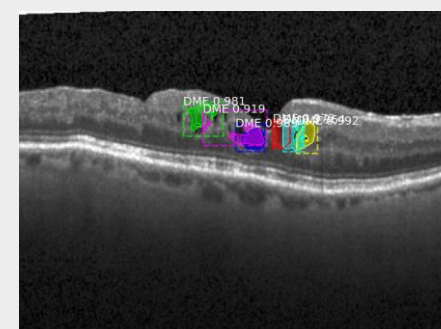
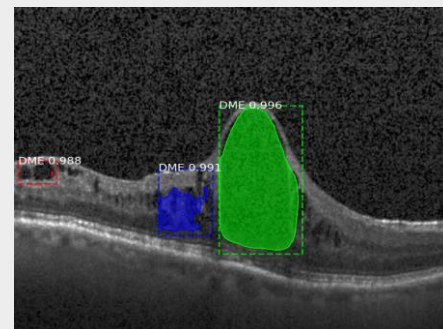
CNV



DRUSEN



DME



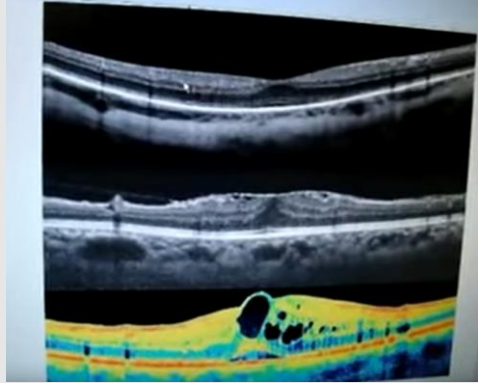
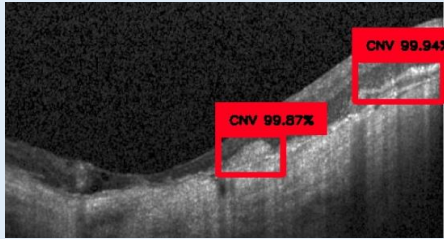
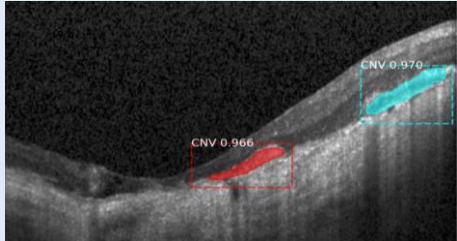
解決:

- 分類無法做到的複合型異常
- 物件偵測 Box 集中，不美觀

AI 導入前後比較



資料來源:
高雄榮總台南分院眼科李尹暘醫師

	螢幕
As Was	
To Be	<p>分類: 判定 CNV 物件偵測:</p>  <p>語意分析:</p>  <p>分類與偵測的結果顯示在螢幕上，幫助醫生做正確判斷</p>

對企業/產業的IMPACT

➤ 產業共通挑戰:



結論: 運用 AI 在異常檢測問題上，會使用到的 AI 技術不外乎是:
Classification , Object Detection, Instance Segmentation
本報告 Demo 出一個異常檢測的 AI 專案應有的流程與技術，供各企業做參考

參考資料

- Coursera , Deep Learning, Structuring Machine Learning Projects, Andrew Ng
- AI 學校技術班 YOLOv3 教材
- ORAI Mask R-CNN
- 高雄榮總台南分院眼科李尹暘醫師:視網膜眼斷層掃描 Retina OCT
<https://www.youtube.com/watch?v=T2kuA5ZfKL4>