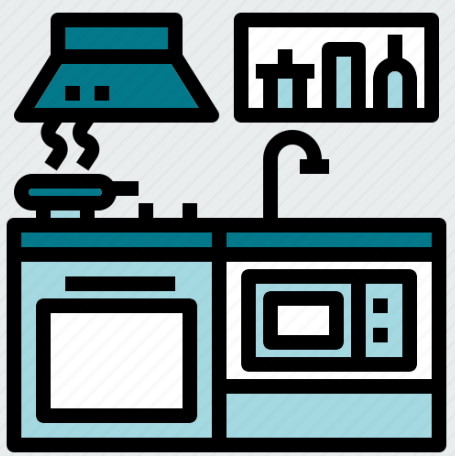
AI kitchen

組別 : 26
組員 : 洪子茵、方為寬



動機

- 宴客過後留下一大堆食材
- 手邊有些食物不想浪費
- 想嘗試新奇料理
- 怕自己煮手藝不好，煮出黑暗料理

作品名: AI Kitchen

影片連結:

- https://drive.google.com/file/d/1VSiWYXMYO4nNR8TuKNx4nHQm_z1948nx/view?usp=sharing
- https://youtu.be/8kMtALnXhuk

ingredients bag

recognization result

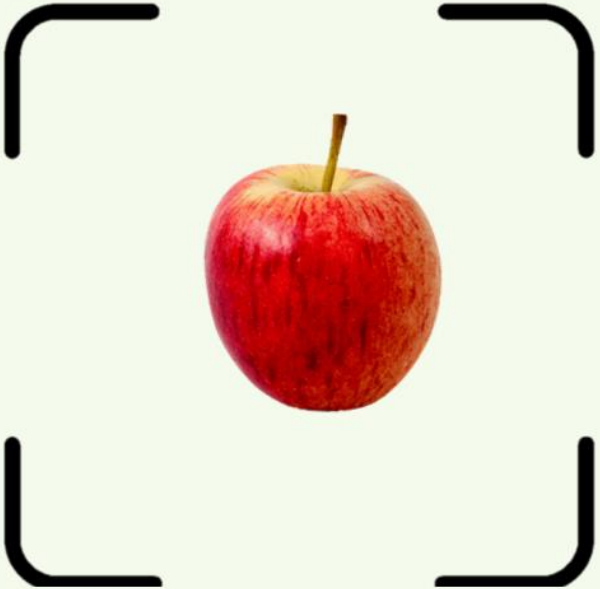
recognization area

detect

next

finish

apple



ingredients bag

recognization result

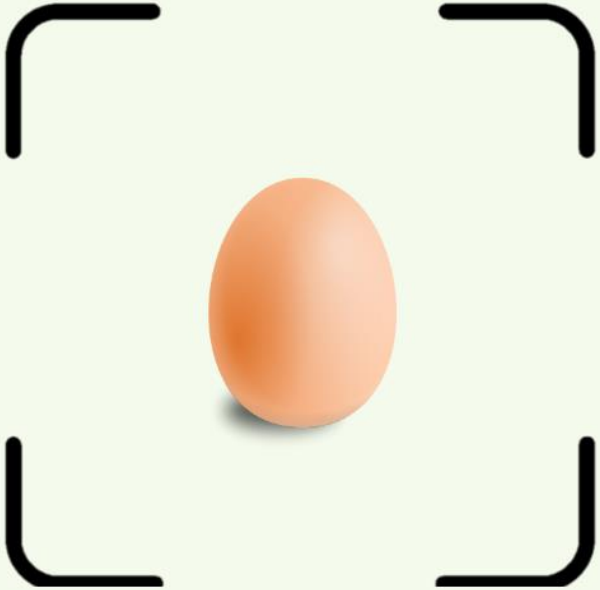
recognization area

detect

next

finish

egg



ingredients bag

recognization result

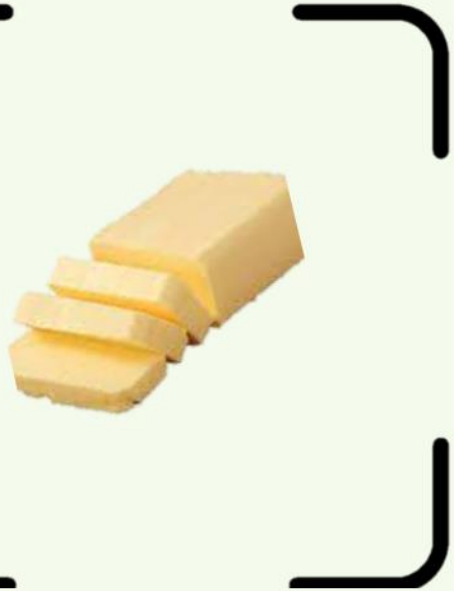
recognization area

detect

next

finish

butter



ingredients in bag

can make

Ingredients

1 recipe pastry for a 9 inch double crust pie

- ½ cup unsalted butter
- 3 tablespoons all-purpose flour
- ¼ cup water
- ½ cup white sugar
- ½ cup packed brown sugar
- 8 Granny Smith apples - peeled, cored and sliced

step

1.
前一晚先將派皮做好，將低筋麵粉、中筋麵粉、奶油、鹽放入食物調理機中攪拌均勻，再慢慢倒入適量冰水。

2.
快速打勻後倒在灑上麵粉的桌面上，麵團上也灑上麵粉，用桿麵棍桿開，再反覆摺疊桿。

3.
開中火在鍋中放入無鹽奶油，並加入蘋果。

實作方法

本次作品的實作主要分成兩個部分:

1. 食物辨識 model
2. UI interface on Jetson nano

食物辨識 model


```
images in 蛋 : 300
images in 洋蔥 : 300
images in 四季豆 : 300
images in 米 : 300
images in 薑 : 300
images in 紅蘿蔔 : 300
images in 肉 : 300
images in 魚 : 300
images in 豆腐 : 300
images in 菠菜 : 300
```

Train dataset : 2700 張
Valid dataset : 300 張
Test dataset : 300 張

食物辨識 model

DL model:

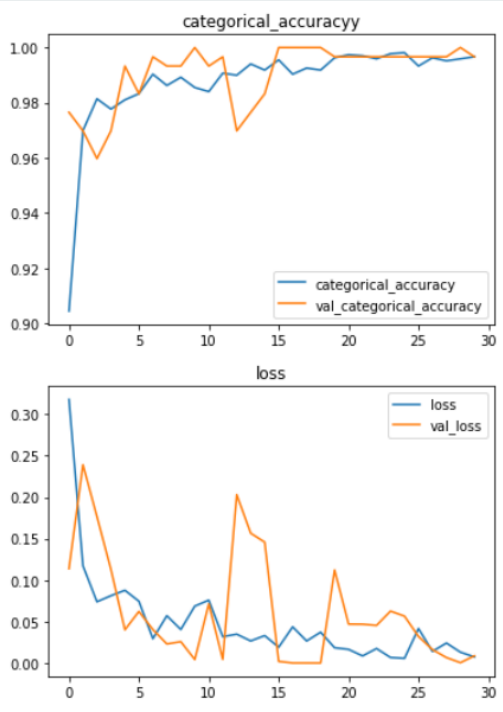
model training : Data Augmentation + transfer learning

backbone : mobilenet_v2 (pretrained on ImageNet)

input_shape: (224, 224, 3)

Model	Size (MB)	Top-1 Accuracy	Top-5 Accuracy	Parameters	Depth	Time (ms) per inference step (CPU)	Time (ms) per inference step (GPU)
MobileNetV2	14	0.713	0.901	3,538,984	88	25.90	3.83

食物辨識 model



verify on valid dataset

	precision	recall	f1-score	support
0	1.00	1.00	1.00	30
1	1.00	1.00	1.00	30
2	1.00	1.00	1.00	30
3	1.00	1.00	1.00	30
4	1.00	1.00	1.00	30
5	1.00	1.00	1.00	28
6	1.00	1.00	1.00	30
7	1.00	1.00	1.00	30
8	1.00	1.00	1.00	30
9	1.00	1.00	1.00	30
accuracy			1.00	298
macro avg	1.00	1.00	1.00	298
weighted avg	1.00	1.00	1.00	298

```
[[30  0  0  0  0  0  0  0  0  0]
 [ 0 30  0  0  0  0  0  0  0  0]
 [ 0  0 30  0  0  0  0  0  0  0]
 [ 0  0  0 30  0  0  0  0  0  0]
 [ 0  0  0  0 30  0  0  0  0  0]
 [ 0  0  0  0  0 28  0  0  0  0]
 [ 0  0  0  0  0  0 30  0  0  0]
 [ 0  0  0  0  0  0  0 30  0  0]
 [ 0  0  0  0  0  0  0  0 30  0]
 [ 0  0  0  0  0  0  0  0  0 30]]
```

verify on test dataset

	precision	recall	f1-score	support
0	0.81	0.97	0.88	30
1	1.00	0.87	0.93	30
2	0.97	1.00	0.98	30
3	1.00	0.77	0.87	30
4	0.96	0.90	0.93	30
5	0.91	0.97	0.94	30
6	0.85	0.93	0.89	30
7	0.97	1.00	0.98	30
8	1.00	0.93	0.97	30
9	0.94	1.00	0.97	30
accuracy			0.93	300
macro avg	0.94	0.93	0.93	300
weighted avg	0.94	0.93	0.93	300

```
[[29  0  0  0  0  0  0  0  0  1]
 [ 1 26  1  0  0  1  0  0  0  1]
 [ 0  0 30  0  0  0  0  0  0  0]
 [ 5  0  0 23  0  0  2  0  0  0]
 [ 0  0  0  0 27  0  3  0  0  0]
 [ 1  0  0  0  0 29  0  0  0  0]
 [ 0  0  0  0  1  0 28  1  0  0]
 [ 0  0  0  0  0  0  0 30  0  0]
 [ 0  0  0  0  0  2  0  0 28  0]
 [ 0  0  0  0  0  0  0  0  0 30]]
```

食物辨識 model

Best-model	12/29/2021 5:26 PM	H5 File	16,745 KB
Best-model	12/29/2021 5:26 PM	ONNX File	8,873 KB
Best-model.trt	12/30/2021 2:46 PM	TRT File	5,029 KB

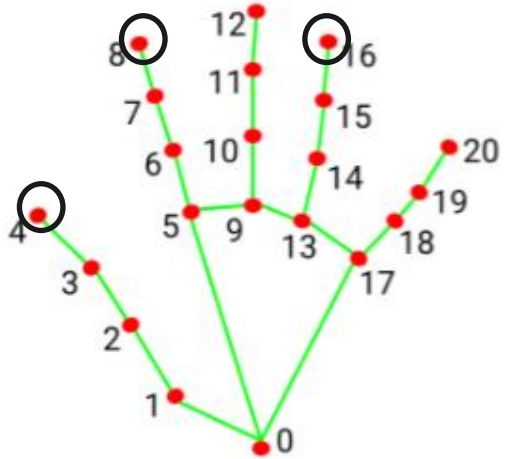
TensorRT

Precision : FP32
Inference FPS : 6 ~ 12 (no UI)

```
# TensorRT engine
engine = eng.load_engine(trt_runtime, serialized_plan)
h_input, d_input, h_output, d_output, stream = inf.allocate_buffers(engine, BATCH_SIZE, trt.float32)
out = inf.do_inference(engine, img, h_input, d_input, h_output, d_output, stream, BATCH_SIZE, IMG_SIZE, IMG_SIZE)
```

UI interface on Jetson nano

UI interface on Jetson nano



0. WRIST
1. THUMB_CMC
2. THUMB_MCP
3. THUMB_IP
4. THUMB_TIP
5. INDEX_FINGER_MCP
6. INDEX_FINGER_PIP
7. INDEX_FINGER_DIP
8. INDEX_FINGER_TIP
9. MIDDLE_FINGER_MCP
10. MIDDLE_FINGER_PIP
11. MIDDLE_FINGER_DIP
12. MIDDLE_FINGER_TIP
13. RING_FINGER_MCP
14. RING_FINGER_PIP
15. RING_FINGER_DIP
16. RING_FINGER_TIP
17. PINKY_MCP
18. PINKY_PIP
19. PINKY_DIP
20. PINKY_TIP

Fig 2. 21 hand landmarks.

未來方向

- ➔ 食物 to 食譜模型
- ➔ 資料庫(越龐大可以做出更多料理) (目前只能一種)
- ➔ Inference 速度更快

Reference

- https://www.youtube.com/watch?v=jzXZVFqEE2I 手勢辨認
- https://google.github.io/mediapipe/solutions/hands.html MediaPipe
- https://www.rs-online.com/designspark/nvidia-cudagpujetson-nano-tensorrt-cn
  NVIDIA CUDA核心GPU實做：Jetson Nano 運用TensorRT加速引擎 – 上篇
- https://www.rs-online.com/designspark/nvidia-cudagpujetson-nano-tensorrt-2-cn
  NVIDIA CUDA核心GPU實做：Jetson Nano 運用TensorRT加速引擎 – 下篇

The END

THANK YOU