

YoloV5 on SBC Report

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INTRODUCTION

In our vision, the AI vehicle detection system needs to run on a single-board computer that can be integrated with the camera system. Until now, we've had success running it on desktops with 9th-generation Intel i9 processors and laptops with 4th-generation Intel i7 processors.

HYPOTHESIS

Since YoloV5 has worked successfully on our local computers, we believe it will work on single-board computers as well. There may be differences in fluency due to performance differences, but what we want to test is whether it can run successfully on the single-board computer.

CONFIGURATION LIST

- Broadcom BCM2711, Quad core Cortex-A72 (ARM v8) 64-bit SoC @ 1.5GHz
- 2GB LPDDR4-3200 SDRAM (depending on model)
- 2.4 GHz and 5.0 GHz IEEE 802.11ac wireless, Bluetooth 5.0, BLE Gigabit Ethernet
- 2 USB 3.0 ports; 2 USB 2.0 ports.
- Raspberry Pi standard 40 pin GPIO header (fully backwards compatible with previous boards)
- 2 × micro-HDMI ports (up to 4kp60 supported)
- 2-lane MIPI DSI display port
- 2-lane MIPI CSI camera port
- 4-pole stereo audio and composite video port
- H.265 (4kp60 decode), H264 (1080p60 decode, 1080p30 encode)
- OpenGL ES 3.1, Vulkan 1.0
- Micro-SD card slot for loading operating system and data storage
- 5V DC via USB-C connector (minimum 3A)
- 5V DC via GPIO header (minimum 3A)
- Power over Ethernet (PoE) enabled (requires separate PoE HAT)
- Operating temperature: 0 – 50 degrees C Ambient

RESULTS



```
top - 00:15:56 up 1:28, 3 users, load average: 3.60, 1.88, 1.86
Tasks: 150 total, 2 running, 148 sleeping, 0 stopped, 0 zombie
%Cpu(s): 93.4 us, 2.5 sy, 0.0 ni, 4.1 id, 0.0 wa, 0.0 hi, 0.0 si, 0.0 st
MiB Mem : 1849.2 total, 501.0 free, 675.2 used, 673.0 buff/cache
MiB Swap: 100.0 total, 97.7 free, 2.2 used, 1067.1 avail Mem
```

PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	SMEM	TIME+	COMMAND
4233	pi	20	0	1869640	718940	118808	R	381.5	38.0	0:08.45	python
4152	root	20	0	0	0	0	I	0.3	0.0	0:00.05	kworke/3:0+
4207	pi	20	0	9996	3212	2704	R	0.3	0.2	0:01.72	top

```
(venv) pi@raspberrypi:~/Apollo-Capstone-Project/ezparking_ai_detector $ python main
.py
/home/pi/Apollo-Capstone-Project/ezparking_ai_detector/venv/lib/python3.9/site-pack
ages/torchvision/io/image.py:13: UserWarning: Failed to load image Python extension
:
warn(f"Failed to load image Python extension: {e}")
/home/pi/Apollo-Capstone-Project/ezparking_ai_detector/deep_sort/utils/parser.py:23
: YAMLLoadWarning: calling yaml.load() without Loader=... is deprecated, as the def
ault Loader is unsafe. Please read https://msg.pyyaml.org/load for full details.
self.update(yaml.load(fo.read()))
Fusing layers...
/home/pi/Apollo-Capstone-Project/ezparking_ai_detector/venv/lib/python3.9/site-pack
ages/torch/functional.py:504: UserWarning: torch.meshgrid: in an upcoming release,
it will be required to pass the indexing argument. (Triggered internally at /root/p
ytorch/aten/src/ATen/native/TensorShape.cpp:3190.)
return _VF.meshgrid(tensors, **kwargs) # type: ignore[attr-defined]
/home/pi/Apollo-Capstone-Project/ezparking_ai_detector/deep_sort/deep_sort/pre
processing.py:40: ComplexWarning: Casting complex values to real discards the imagi
nary part
boxes = boxes.astype(np.float32)
/home/pi/Apollo-Capstone-Project/ezparking_ai_detector/deep_sort/deep_sort/iou
_matching.py:80: ComplexWarning: Casting complex values to real discards the imagin
ary part
cost_matrix[row, :] = 1. - iou(bbox, candidates)
/home/pi/Apollo-Capstone-Project/ezparking_ai_detector/deep_sort/deep_sort/deep_sor
t.py:88: ComplexWarning: Casting complex values to real discards the imaginary part
x1 = max(int(x),0)
/home/pi/Apollo-Capstone-Project/ezparking_ai_detector/deep_sort/deep_sort/deep_sor
t.py:89: ComplexWarning: Casting complex values to real discards the imaginary part
x2 = min(int(x+w),self.width-1)
/home/pi/Apollo-Capstone-Project/ezparking_ai_detector/deep_sort/deep_sort/deep_sor
t.py:90: ComplexWarning: Casting complex values to real discards the imaginary part
y1 = max(int(y),0)
/home/pi/Apollo-Capstone-Project/ezparking_ai_detector/deep_sort/deep_sort/deep_sor
t.py:91: ComplexWarning: Casting complex values to real discards the imaginary part
y2 = min(int(y+h),self.height-1)
Type: Car | id: 7 | Vehicle_Exit_Detected | Count: 1 | id: [7, 12]
Database updated
Type: Car | id: 12 | Vehicle_Exit_Detected | Count: 2 | id: [12]
Database updated
```

CONCLUSION

Through our testing and debugging, we finally made YOLOv5 run successfully on the SBC without any errors. This was a major breakthrough in our project and it was very helpful for future developments.