

Tarea 3 Ejercicio 2 - Introducción a las Redes Neuronales y Deep Learning

Nombre: Bruno Morici

ROL USM: 202373555-8

Curso: INF395, Introducción a las Redes Neuronales y Deep Learning

Profesor: Alejandro Veloz

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Evaluar modelo preentrenado de localización de objetos en imágenes

```
In [ ]: %pip install ultralytics
```

```
In [4]: import torch
# from torchvision.models.detection import FasterRCNN_ResNet50_FPN_Weights # Mas robusto
from ultralytics import YOLO # Simple, liviano, apto para tiempo real
```

```
In [5]: # Descargamos el modelo base
model = YOLO("yolo1n.pt")

# Verificamos si se puede con GPU
print(torch.cuda.is_available())
```

False

```
In [6]: # Entrenamos haciendo un Fine-Tuning (Modelamiento mas fino)
train_results = model.train(
    data="coco8.yaml", # Dataset de entrenamiento (Una muestra en este caso)
    epochs=100,
    imgsz=640,
    device="cpu", # 0: GPU
)
```

Ultralytics 8.3.228 Python-3.11.4 torch-2.9.0+cpu CPU (Intel Core i5-9300H 2.40GHz)
engine\trainer: agnostic_nms=False, amp=True, augment=False, auto_augment=randaugment, batch=16, bgr=0.0, box=7.5, cache=False, cfg=None, classes=None, close_mosaic=10, cls=0.5, compile=False, conf=None, copy_paste=0.0, copy_paste_mode=flip, cos_lr=False, cutmix=0.0, data=coco8.yaml, degrees=0.0, deterministic=True, device=cpu, dfl=1.5, dnn=False, dropout=0.0, dynamic=False, embed=None, epochs=100, erasing=0.4, exist_ok=False, fliplr=0.5, flipud=0.0, format=torchscript, fraction=1.0, freeze=None, half=False, hsv_h=0.015, hsv_s=0.7, hsv_v=0.4, imgsz=640, int8=False, iou=0.7, keras=False, kobj=1.0, line_width=None, lr0=0.01, lrf=0.01, mask_ratio=4, max_det=300, mixup=0.0, mode=train, model=yolo11n.pt, momentum=0.937, mosaic=1.0, multi_scale=False, name=train4, nbs=64, nms=False, opset=None, optimize=False, optimizer=auto, overlap_mask=True, patience=100, perspective=0.0, plots=True, pose=12.0, pretrained=True, profile=False, project=None, rect=False, resume=False, retina_masks=False, save=True, save_conf=False, save_crop=False, save_dir=C:\Users\Bruno\Desktop\INF395 - IRN\tareas\tarea_3\runs\detect\train4, save_frames=False, save_json=False, save_period=-1, save_txt=False, scale=0.5, seed=0, shear=0.0, show=False, show_boxes=True, show_conf=True, show_labels=True, simplify=True, single_cls=False, source=None, split=val, stream_buffer=False, task=detect, time=None, tracker=botsort.yaml, translate=0.1, val=True, verbose=True, vid_stride=1, visualize=False, warmup_bias_lr=0.1, warmup_epochs=3.0, warmup_momentum=0.8, weight_decay=0.0005, workers=8, workspace=None

	from	n	params	module	a
rguments					
0		-1 1	464	ultralytics.nn.modules.conv.Conv	
[3, 16, 3, 2]					
1		-1 1	4672	ultralytics.nn.modules.conv.Conv	
[16, 32, 3, 2]					
2		-1 1	6640	ultralytics.nn.modules.block.C3k2	
[32, 64, 1, False, 0.25]					
3		-1 1	36992	ultralytics.nn.modules.conv.Conv	
[64, 64, 3, 2]					
4		-1 1	26080	ultralytics.nn.modules.block.C3k2	
[64, 128, 1, False, 0.25]					
5		-1 1	147712	ultralytics.nn.modules.conv.Conv	
[128, 128, 3, 2]					
6		-1 1	87040	ultralytics.nn.modules.block.C3k2	
[128, 128, 1, True]					
7		-1 1	295424	ultralytics.nn.modules.conv.Conv	
[128, 256, 3, 2]					
8		-1 1	346112	ultralytics.nn.modules.block.C3k2	
[256, 256, 1, True]					
9		-1 1	164608	ultralytics.nn.modules.block.SPPF	
[256, 256, 5]					
10		-1 1	249728	ultralytics.nn.modules.block.C2PSA	
[256, 256, 1]					
11		-1 1	0	torch.nn.modules.upsampling.Upsample	
[None, 2, 'nearest']					
12		[-1, 6] 1	0	ultralytics.nn.modules.conv.Concat	
[1]					
13		-1 1	111296	ultralytics.nn.modules.block.C3k2	
[384, 128, 1, False]					
14		-1 1	0	torch.nn.modules.upsampling.Upsample	
[None, 2, 'nearest']					
15		[-1, 4] 1	0	ultralytics.nn.modules.conv.Concat	
[1]					
16		-1 1	32096	ultralytics.nn.modules.block.C3k2	

```

[256, 64, 1, False]
17 -1 1 36992 ultralytics.nn.modules.conv.Conv
[64, 64, 3, 2]
18 [-1, 13] 1 0 ultralytics.nn.modules.conv.Concat
[1]
19 -1 1 86720 ultralytics.nn.modules.block.C3k2
[192, 128, 1, False]
20 -1 1 147712 ultralytics.nn.modules.conv.Conv
[128, 128, 3, 2]
21 [-1, 10] 1 0 ultralytics.nn.modules.conv.Concat
[1]
22 -1 1 378880 ultralytics.nn.modules.block.C3k2
[384, 256, 1, True]
23 [16, 19, 22] 1 464912 ultralytics.nn.modules.head.Detect
[80, [64, 128, 256]]
YOLO11n summary: 181 layers, 2,624,080 parameters, 2,624,064 gradients, 6.6 GFLOPs

```

Transferred 499/499 items from pretrained weights
Freezing layer 'model.23.dfl.conv.weight'
train: Fast image access (ping: 0.20.0 ms, read: 57.435.3 MB/s, size: 50.0 KB)
train: Scanning C:\Users\Bruno\Desktop\INF395 - IRN\tareas\datasets\coco8\labels\train.cache... 4 images, 0 backgrounds, 0 corrupt: 100% ————— 4/4 2.0Kit/s 0.0s
val: Fast image access (ping: 0.20.0 ms, read: 75.927.9 MB/s, size: 54.0 KB)
val: Scanning C:\Users\Bruno\Desktop\INF395 - IRN\tareas\datasets\coco8\labels\val.cache... 4 images, 0 backgrounds, 0 corrupt: 100% ————— 4/4 4.0Kit/s 0.0s
Plotting labels to C:\Users\Bruno\Desktop\INF395 - IRN\tareas\tarea_3\runs\detect\train4\labels.jpg...
optimizer: 'optimizer=auto' found, ignoring 'lr0=0.01' and 'momentum=0.937' and determining best 'optimizer', 'lr0' and 'momentum' automatically...
optimizer: AdamW(lr=0.000119, momentum=0.9) with parameter groups 81 weight(decay=0.0), 88 weight(decay=0.0005), 87 bias(decay=0.0)
Image sizes 640 train, 640 val
Using 0 dataloader workers
Logging results to C:\Users\Bruno\Desktop\INF395 - IRN\tareas\tarea_3\runs\detect\train4
Starting training for 100 epochs...

Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
1/100	0G	0.9853	2.649	1.312	30	640: 100%
	1/1 2.3s/it 2.3s					
	Class	Images	Instances	Box(P)	R	mAP50 mAP50
-95): 100%	—————	1/1 1.3it/s 0.7s				
	all	4	17	0.559	0.85	0.878
0.635						
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
2/100	0G	1.036	3.263	1.381	30	640: 100%
	1/1 2.0s/it 2.0s					
	Class	Images	Instances	Box(P)	R	mAP50 mAP50
-95): 100%	—————	1/1 1.2it/s 0.8s				
	all	4	17	0.556	0.85	0.886
0.635						
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size
3/100	0G	1.375	2.782	1.774	16	640: 100%
	1/1 2.0s/it 2.0s					

	Class	Images	Instances	Box(P)	R	mAP50	mAP50
-95): 100%	all	1/1 1.4it/s 0.7s	4	0.551	0.85	0.85	
0.617							
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
4/100	0G	1.497	3	2.072	16	640:	100%
	1/1 2.1s/it 2.1s						
-95): 100%	all	1/1 1.3it/s 0.8s	4	0.548	0.85	0.854	
0.638							
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
5/100	0G	1.49	3.27	1.938	31	640:	100%
	1/1 1.9s/it 1.9s						
-95): 100%	all	1/1 1.3it/s 0.8s	4	0.539	0.85	0.856	
0.638							
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
6/100	0G	1.176	2.707	1.479	34	640:	100%
	1/1 2.0s/it 2.0s						
-95): 100%	all	1/1 1.4it/s 0.7s	4	0.817	0.646	0.859	
0.626							
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
7/100	0G	1.161	2.386	1.424	27	640:	100%
	1/1 3.4s/it 3.4s						
-95): 100%	all	1/1 1.3it/s 0.8s	4	0.557	0.85	0.873	
0.626							
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
8/100	0G	0.98	2.439	1.239	23	640:	100%
	1/1 2.2s/it 2.2s						
-95): 100%	all	1/1 1.2it/s 0.8s	4	0.58	0.865	0.86	
0.628							
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
9/100	0G	1.118	3.697	1.476	42	640:	100%
	1/1 2.5s/it 2.5s						
-95): 100%	all	1/1 1.0it/s 1.0s	4	0.78	0.65	0.894	
0.629							
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
10/100	0G	1	2.415	1.243	26	640:	100%
	1/1 2.3s/it 2.3s						

	Class	Images	Instances	Box(P)	R	mAP50	mAP50
-95): 100%	1/1 1.1s/it 1.1s						
0.631	all	4	17	0.77	0.65	0.894	
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
11/100	0G	1.131	2.82	1.395	42	640:	100%
1/1 2.1s/it 2.1s							
-95): 100%	1/1 1.3it/s 0.8s						
0.634	all	4	17	0.657	0.778	0.91	
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
12/100	0G	0.8918	2.15	1.281	32	640:	100%
1/1 2.9s/it 2.9s							
-95): 100%	1/1 1.1it/s 0.9s						
0.645	all	4	17	0.661	0.779	0.912	
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
13/100	0G	0.9101	1.898	1.432	17	640:	100%
1/1 2.3s/it 2.3s							
-95): 100%	1/1 1.2it/s 0.9s						
0.648	all	4	17	0.657	0.778	0.912	
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
14/100	0G	0.9912	2.223	1.386	34	640:	100%
1/1 2.5s/it 2.5s							
-95): 100%	1/1 1.4it/s 0.7s						
0.653	all	4	17	0.706	0.746	0.913	
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
15/100	0G	1.025	1.86	1.394	32	640:	100%
1/1 2.8s/it 2.8s							
-95): 100%	1/1 1.3it/s 0.8s						
0.648	all	4	17	0.707	0.748	0.913	
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
16/100	0G	1.046	2.224	1.56	19	640:	100%
1/1 2.7s/it 2.7s							
-95): 100%	1/1 1.1it/s 0.9s						
0.631	all	4	17	0.811	0.65	0.913	
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
17/100	0G	0.9335	2.226	1.35	22	640:	100%
1/1 2.1s/it 2.1s							

	Class	Images	Instances	Box(P)	R	mAP50	mAP50
-95): 100%	all	1/1 1.0it/s 1.0s	4	0.826	0.65	0.913	0.633
Epoch 18/100	GPU_mem 0G	box_loss 1.148	cls_loss 2.488	dfl_loss 1.466	Instances 43	Size 640: 100%	1/1 2.0s/it 2.0s
-95): 100%	all	1/1 1.3it/s 0.8s	4	0.826	0.65	0.913	0.633
Epoch 19/100	GPU_mem 0G	box_loss 1.058	cls_loss 1.514	dfl_loss 1.275	Instances 34	Size 640: 100%	1/1 2.8s/it 2.8s
-95): 100%	all	1/1 1.3s/it 1.3s	4	0.813	0.65	0.912	0.625
Epoch 20/100	GPU_mem 0G	box_loss 1.007	cls_loss 1.508	dfl_loss 1.286	Instances 23	Size 640: 100%	1/1 2.1s/it 2.1s
-95): 100%	all	1/1 1.3s/it 1.3s	4	0.813	0.65	0.912	0.625
Epoch 21/100	GPU_mem 0G	box_loss 1.164	cls_loss 3.179	dfl_loss 1.505	Instances 38	Size 640: 100%	1/1 2.3s/it 2.3s
-95): 100%	all	1/1 1.0s/it 1.0s	4	0.825	0.65	0.911	0.627
Epoch 22/100	GPU_mem 0G	box_loss 0.9773	cls_loss 1.773	dfl_loss 1.497	Instances 20	Size 640: 100%	1/1 1.9s/it 1.9s
-95): 100%	all	1/1 1.3it/s 0.8s	4	0.825	0.65	0.911	0.627
Epoch 23/100	GPU_mem 0G	box_loss 1.044	cls_loss 2.015	dfl_loss 1.304	Instances 34	Size 640: 100%	1/1 2.0s/it 2.0s
-95): 100%	all	1/1 1.3it/s 0.7s	4	0.825	0.65	0.855	0.612
Epoch 24/100	GPU_mem 0G	box_loss 1.055	cls_loss 1.653	dfl_loss 1.382	Instances 28	Size 640: 100%	1/1 1.8s/it 1.8s

	Class	Images	Instances	Box(P)	R	mAP50	mAP50
-95): 100%	all	1/1 1.3it/s 0.7s	4	0.825	0.65	0.855	0.612
0.6	Epoch 25/100	GPU_mem 0G	box_loss 0.8872	cls_loss 1.985	dfl_loss 1.252	Instances 25	Size 640: 100%
	1/1 2.1s/it 2.1s						
-95): 100%	all	1/1 1.2it/s 0.9s	4	0.829	0.65	0.855	0.6
0.6	Epoch 26/100	GPU_mem 0G	box_loss 0.9622	cls_loss 1.6	dfl_loss 1.398	Instances 30	Size 640: 100%
	1/1 2.0s/it 2.0s						
-95): 100%	all	1/1 1.4it/s 0.7s	4	0.829	0.65	0.855	0.6
0.6	Epoch 27/100	GPU_mem 0G	box_loss 0.8908	cls_loss 1.543	dfl_loss 1.239	Instances 38	Size 640: 100%
	1/1 1.9s/it 1.9s						
-95): 100%	all	1/1 1.4it/s 0.7s	4	0.827	0.65	0.855	0.6
0.6	Epoch 28/100	GPU_mem 0G	box_loss 0.8649	cls_loss 1.51	dfl_loss 1.225	Instances 31	Size 640: 100%
	1/1 2.1s/it 2.1s						
-95): 100%	all	1/1 1.2it/s 0.9s	4	0.827	0.65	0.855	0.6
0.6	Epoch 29/100	GPU_mem 0G	box_loss 1.217	cls_loss 1.757	dfl_loss 1.423	Instances 23	Size 640: 100%
	1/1 1.9s/it 1.9s						
-95): 100%	all	1/1 1.5it/s 0.7s	4	0.801	0.65	0.852	0.599
0.599	Epoch 30/100	GPU_mem 0G	box_loss 0.7865	cls_loss 1.375	dfl_loss 1.141	Instances 42	Size 640: 100%
	1/1 1.8s/it 1.8s						
-95): 100%	all	1/1 1.4it/s 0.7s	4	0.801	0.65	0.852	0.599
0.599	Epoch 31/100	GPU_mem 0G	box_loss 0.8638	cls_loss 1.452	dfl_loss 1.266	Instances 32	Size 640: 100%
	1/1 2.1s/it 2.1s						

	Class	Images	Instances	Box(P)	R	mAP50	mAP50
-95): 100%	all	1/1 1.4it/s 0.7s	4	0.794	0.65	0.774	0.523
Epoch 32/100	GPU_mem 0G	box_loss 0.9842	cls_loss 1.376	dfl_loss 1.267	Instances 33	Size 640: 100%	1/1 1.8s/it 1.8s
-95): 100%	all	1/1 1.3it/s 0.7s	4	0.794	0.65	0.774	0.523
Epoch 33/100	GPU_mem 0G	box_loss 0.8453	cls_loss 1.556	dfl_loss 1.314	Instances 30	Size 640: 100%	1/1 2.0s/it 2.0s
-95): 100%	all	1/1 1.4it/s 0.7s	4	0.781	0.65	0.767	0.524
Epoch 34/100	GPU_mem 0G	box_loss 0.7734	cls_loss 1.429	dfl_loss 1.24	Instances 20	Size 640: 100%	1/1 2.1s/it 2.1s
-95): 100%	all	1/1 1.2it/s 0.8s	4	0.781	0.65	0.767	0.524
Epoch 35/100	GPU_mem 0G	box_loss 0.8991	cls_loss 1.489	dfl_loss 1.194	Instances 39	Size 640: 100%	1/1 2.6s/it 2.6s
-95): 100%	all	1/1 1.4s/it 1.4s	4	0.784	0.65	0.767	0.524
Epoch 36/100	GPU_mem 0G	box_loss 0.7814	cls_loss 1.429	dfl_loss 1.161	Instances 49	Size 640: 100%	1/1 2.3s/it 2.3s
-95): 100%	all	1/1 1.1it/s 0.9s	4	0.784	0.65	0.767	0.524
Epoch 37/100	GPU_mem 0G	box_loss 0.9138	cls_loss 1.36	dfl_loss 1.358	Instances 16	Size 640: 100%	1/1 2.4s/it 2.4s
-95): 100%	all	1/1 1.4it/s 0.7s	4	0.77	0.65	0.736	0.499
Epoch 38/100	GPU_mem 0G	box_loss 1.003	cls_loss 1.702	dfl_loss 1.339	Instances 43	Size 640: 100%	1/1 1.9s/it 1.9s

	Class	Images	Instances	Box(P)	R	mAP50	mAP50
-95): 100%	all	1/1 1.3it/s 0.8s	4	0.77	0.65	0.736	0.499
Epoch 39/100	GPU_mem 0G	box_loss 1.006	cls_loss 2.117	dfl_loss 1.417	Instances 33	Size 640: 100%	1/1 2.0s/it 2.0s
-95): 100%	all	1/1 1.3it/s 0.8s	4	0.656	0.687	0.709	0.473
Epoch 40/100	GPU_mem 0G	box_loss 1.04	cls_loss 1.139	dfl_loss 1.45	Instances 11	Size 640: 100%	1/1 1.8s/it 1.8s
-95): 100%	all	1/1 1.4it/s 0.7s	4	0.656	0.687	0.709	0.473
Epoch 41/100	GPU_mem 0G	box_loss 0.7884	cls_loss 1.227	dfl_loss 1.153	Instances 31	Size 640: 100%	1/1 1.9s/it 1.9s
-95): 100%	all	1/1 1.3it/s 0.8s	4	0.649	0.7	0.7	0.482
Epoch 42/100	GPU_mem 0G	box_loss 0.9144	cls_loss 1.293	dfl_loss 1.298	Instances 28	Size 640: 100%	1/1 1.8s/it 1.8s
-95): 100%	all	1/1 1.4it/s 0.7s	4	0.649	0.7	0.7	0.482
Epoch 43/100	GPU_mem 0G	box_loss 0.5248	cls_loss 2.463	dfl_loss 1.107	Instances 13	Size 640: 100%	1/1 1.9s/it 1.9s
-95): 100%	all	1/1 1.3it/s 0.8s	4	0.57	0.517	0.585	0.368
Epoch 44/100	GPU_mem 0G	box_loss 0.9218	cls_loss 1.06	dfl_loss 1.271	Instances 26	Size 640: 100%	1/1 1.8s/it 1.8s
-95): 100%	all	1/1 1.2it/s 0.8s	4	0.57	0.517	0.585	0.368
Epoch 45/100	GPU_mem 0G	box_loss 0.6535	cls_loss 0.8938	dfl_loss 1.157	Instances 23	Size 640: 100%	1/1 1.9s/it 1.9s

	Class	Images	Instances	Box(P)	R	mAP50	mAP50
-95): 100%	all	1/1 1.3it/s 0.8s	4	0.595	0.483	0.528	0.302
Epoch 46/100	GPU_mem 0G	box_loss 0.9411	cls_loss 1.261	dfl_loss 1.438	Instances 20	Size 640: 100%	1/1 1.8s/it 1.8s
-95): 100%	all	1/1 1.4it/s 0.7s	4	0.595	0.483	0.528	0.302
Epoch 47/100	GPU_mem 0G	box_loss 0.844	cls_loss 0.8524	dfl_loss 1.122	Instances 28	Size 640: 100%	1/1 2.0s/it 2.0s
-95): 100%	all	1/1 1.3it/s 0.8s	4	0.584	0.483	0.527	0.311
Epoch 48/100	GPU_mem 0G	box_loss 0.7341	cls_loss 1.071	dfl_loss 1.132	Instances 44	Size 640: 100%	1/1 2.5s/it 2.5s
-95): 100%	all	1/1 1.1s/it 1.1s	4	0.584	0.483	0.527	0.311
Epoch 49/100	GPU_mem 0G	box_loss 0.9238	cls_loss 1.159	dfl_loss 1.262	Instances 25	Size 640: 100%	1/1 2.1s/it 2.1s
-95): 100%	all	1/1 1.2it/s 0.8s	4	0.6	0.498	0.525	0.308
Epoch 50/100	GPU_mem 0G	box_loss 0.8365	cls_loss 0.9124	dfl_loss 1.182	Instances 32	Size 640: 100%	1/1 2.0s/it 2.0s
-95): 100%	all	1/1 1.4it/s 0.7s	4	0.6	0.498	0.525	0.308
Epoch 51/100	GPU_mem 0G	box_loss 0.7772	cls_loss 1.058	dfl_loss 1.16	Instances 40	Size 640: 100%	1/1 2.2s/it 2.2s
-95): 100%	all	1/1 1.1it/s 0.9s	4	0.601	0.498	0.525	0.307
Epoch 52/100	GPU_mem 0G	box_loss 0.8283	cls_loss 0.8986	dfl_loss 1.173	Instances 26	Size 640: 100%	1/1 2.3s/it 2.3s

	Class	Images	Instances	Box(P)	R	mAP50	mAP50
-95): 100%	all	1/1 1.2it/s 0.8s	4	0.601	0.498	0.525	0.525
0.307							
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
53/100	0G	0.6579	0.7836	1.187	20	640:	100%
	1/1 2.1s/it 2.1s						
-95): 100%	all	1/1 1.3it/s 0.8s	4	0.601	0.498	0.525	0.525
0.307							
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
54/100	0G	0.8406	1.172	1.24	22	640:	100%
	1/1 2.6s/it 2.6s						
-95): 100%	all	1/1 1.2it/s 0.8s	4	0.767	0.5	0.525	0.525
0.309							
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
55/100	0G	0.8968	0.7855	1.189	45	640:	100%
	1/1 1.9s/it 1.9s						
-95): 100%	all	1/1 1.2it/s 0.9s	4	0.767	0.5	0.525	0.525
0.309							
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
56/100	0G	0.7981	1.036	1.14	23	640:	100%
	1/1 2.2s/it 2.2s						
-95): 100%	all	1/1 1.3it/s 0.8s	4	0.767	0.5	0.525	0.525
0.309							
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
57/100	0G	0.6324	0.8528	1.065	39	640:	100%
	1/1 2.1s/it 2.1s						
-95): 100%	all	1/1 1.1it/s 0.9s	4	0.756	0.5	0.526	0.526
0.306							
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
58/100	0G	0.6974	0.7232	1.145	34	640:	100%
	1/1 2.3s/it 2.3s						
-95): 100%	all	1/1 1.1it/s 0.9s	4	0.756	0.5	0.526	0.526
0.306							
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
59/100	0G	0.8325	0.9796	1.241	20	640:	100%
	1/1 2.3s/it 2.3s						

	Class	Images	Instances	Box(P)	R	mAP50	mAP50
-95): 100%	all	1/1 1.4it/s 0.7s	4	0.756	0.5	0.526	0.306
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
60/100	0G	1.016	1.117	1.418	26	640:	100%
	1/1 3.3s/it 3.3s						
-95): 100%	all	1/1 1.4it/s 0.7s	4	0.755	0.5	0.518	0.305
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
61/100	0G	0.6297	0.8029	1.092	37	640:	100%
	1/1 2.4s/it 2.4s						
-95): 100%	all	1/1 1.2it/s 0.9s	4	0.755	0.5	0.518	0.305
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
62/100	0G	0.6612	0.7211	1.126	21	640:	100%
	1/1 2.3s/it 2.3s						
-95): 100%	all	1/1 1.4it/s 0.7s	4	0.755	0.5	0.518	0.305
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
63/100	0G	1.356	1.7	1.775	16	640:	100%
	1/1 2.1s/it 2.1s						
-95): 100%	all	1/1 1.1it/s 0.9s	4	0.764	0.5	0.521	0.303
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
64/100	0G	0.7941	0.9336	1.147	45	640:	100%
	1/1 2.2s/it 2.2s						
-95): 100%	all	1/1 1.1it/s 0.9s	4	0.764	0.5	0.521	0.303
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
65/100	0G	0.8658	0.7239	1.152	26	640:	100%
	1/1 1.9s/it 1.9s						
-95): 100%	all	1/1 1.3it/s 0.8s	4	0.764	0.5	0.521	0.303
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
66/100	0G	0.7033	0.6873	1.156	25	640:	100%
	1/1 2.3s/it 2.3s						

	Class	Images	Instances	Box(P)	R	mAP50	mAP50
-95): 100%	all	1/1 1.1it/s 0.9s	4	17	0.756	0.5	0.519
0.302							
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
67/100	0G	0.6801	0.5971	1.043	44	640:	100%
	1/1 2.3s/it 2.3s						
-95): 100%	all	1/1 1.2s/it 1.2s	4	17	0.756	0.5	0.519
0.302							
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
68/100	0G	0.8983	1.028	1.245	33	640:	100%
	1/1 2.3s/it 2.3s						
-95): 100%	all	1/1 1.3it/s 0.8s	4	17	0.756	0.5	0.519
0.302							
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
69/100	0G	0.7341	0.717	1.151	25	640:	100%
	1/1 2.0s/it 2.0s						
-95): 100%	all	1/1 1.2s/it 1.2s	4	17	0.771	0.5	0.518
0.298							
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
70/100	0G	1.081	1.258	1.481	17	640:	100%
	1/1 2.2s/it 2.2s						
-95): 100%	all	1/1 1.3it/s 0.8s	4	17	0.771	0.5	0.518
0.298							
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
71/100	0G	0.6288	0.6687	1.024	25	640:	100%
	1/1 2.4s/it 2.4s						
-95): 100%	all	1/1 1.2it/s 0.8s	4	17	0.771	0.5	0.518
0.298							
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
72/100	0G	0.806	0.6084	1.039	25	640:	100%
	1/1 2.3s/it 2.3s						
-95): 100%	all	1/1 1.0s/it 1.0s	4	17	0.696	0.453	0.473
0.297							
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
73/100	0G	0.7385	0.8473	1.141	40	640:	100%
	1/1 2.4s/it 2.4s						

	Class	Images	Instances	Box(P)	R	mAP50	mAP50
-95): 100%	all	1/1 1.1it/s 0.9s	4	0.696	0.453	0.473	0.473
0.297							
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
74/100	0G	0.7806	0.7593	1.162	39	640:	100%
	1/1 3.0s/it 3.0s						
-95): 100%	all	1/1 1.1s/it 1.1s	4	0.696	0.453	0.473	0.473
0.297							
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
75/100	0G	0.8782	0.7467	1.334	24	640:	100%
	1/1 2.5s/it 2.5s						
-95): 100%	all	1/1 1.3it/s 0.7s	4	0.7	0.453	0.475	0.475
0.291							
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
76/100	0G	0.6992	0.6736	1.082	36	640:	100%
	1/1 2.0s/it 2.0s						
-95): 100%	all	1/1 1.3it/s 0.8s	4	0.7	0.453	0.475	0.475
0.291							
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
77/100	0G	0.6813	0.6758	1.13	30	640:	100%
	1/1 2.1s/it 2.1s						
-95): 100%	all	1/1 1.0it/s 1.0s	4	0.7	0.453	0.475	0.475
0.291							
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
78/100	0G	0.892	1.074	1.262	44	640:	100%
	1/1 2.3s/it 2.3s						
-95): 100%	all	1/1 1.3it/s 0.8s	4	0.9	0.372	0.461	0.461
0.287							
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
79/100	0G	0.6628	0.6705	1.047	33	640:	100%
	1/1 2.2s/it 2.2s						
-95): 100%	all	1/1 1.1it/s 0.9s	4	0.9	0.372	0.461	0.461
0.287							
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
80/100	0G	0.6333	0.5855	0.9879	28	640:	100%
	1/1 1.9s/it 1.9s						

	Class	Images	Instances	Box(P)	R	mAP50	mAP50
-95): 100%	all	1/1 1.2it/s 0.8s	4	17	0.9	0.372	0.461
0.287							
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
81/100	0G	0.6988	0.8724	1.215	25	640:	100%
	1/1 2.9s/it 2.9s						
-95): 100%	all	1/1 1.1s/it 1.1s	4	17	0.703	0.449	0.475
0.294							
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
82/100	0G	0.6251	0.5093	1.087	29	640:	100%
	1/1 2.1s/it 2.1s						
-95): 100%	all	1/1 1.1it/s 0.9s	4	17	0.703	0.449	0.475
0.294							
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
83/100	0G	0.7288	0.8696	1.134	27	640:	100%
	1/1 2.1s/it 2.1s						
-95): 100%	all	1/1 1.1it/s 0.9s	4	17	0.703	0.449	0.475
0.294							
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
84/100	0G	0.4932	0.5399	1.007	24	640:	100%
	1/1 2.5s/it 2.5s						
-95): 100%	all	1/1 1.2it/s 0.8s	4	17	0.903	0.371	0.458
0.285							
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
85/100	0G	0.6806	0.828	1.072	45	640:	100%
	1/1 2.0s/it 2.0s						
-95): 100%	all	1/1 1.1s/it 1.1s	4	17	0.903	0.371	0.458
0.285							
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
86/100	0G	0.9212	0.9609	1.43	18	640:	100%
	1/1 2.0s/it 2.0s						
-95): 100%	all	1/1 1.3it/s 0.8s	4	17	0.903	0.371	0.458
0.285							
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
87/100	0G	0.8915	0.9405	1.268	41	640:	100%
	1/1 2.1s/it 2.1s						

	Class	Images	Instances	Box(P)	R	mAP50	mAP50
-95): 100%	all	1/1 1.2it/s 0.8s	4	17	0.903	0.371	0.458
0.285							
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
88/100	0G	0.7884	0.6187	1.24	20	640:	100%
	1/1 2.0s/it 2.0s						
-95): 100%	all	1/1 1.4it/s 0.7s	4	17	0.906	0.371	0.456
0.285							
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
89/100	0G	0.8578	0.8715	1.211	22	640:	100%
	1/1 1.9s/it 1.9s						
-95): 100%	all	1/1 1.3it/s 0.7s	4	17	0.906	0.371	0.456
0.285							
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
90/100	0G	0.7057	0.7937	1.049	50	640:	100%
	1/1 2.2s/it 2.2s						
-95): 100%	all	1/1 1.2it/s 0.8s	4	17	0.906	0.371	0.456
0.285							
Closing dataloader mosaic							
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
91/100	0G	0.5423	0.5974	1.122	13	640:	100%
	1/1 2.3s/it 2.3s						
-95): 100%	all	1/1 1.2it/s 0.9s	4	17	0.906	0.371	0.456
0.285							
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
92/100	0G	0.4571	0.4354	0.8671	13	640:	100%
	1/1 2.3s/it 2.3s						
-95): 100%	all	1/1 1.3it/s 0.8s	4	17	0.794	0.5	0.512
0.293							
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
93/100	0G	0.6399	0.5526	1.249	13	640:	100%
	1/1 2.1s/it 2.1s						
-95): 100%	all	1/1 1.0s/it 1.0s	4	17	0.794	0.5	0.512
0.293							
Epoch	GPU_mem	box_loss	cls_loss	dfl_loss	Instances	Size	
94/100	0G	0.6205	0.5001	1.02	13	640:	100%

1/1 1.8s/it 1.8s							mAP50	mAP50
-95): 100%		Class	Images	Instances	Box(P)	R		
95/100	0G	all	4	17	0.794	0.5	0.512	0.293
95/100	0G	box_loss	0.7542	0.6787	dfl_loss 1.262	Instances 13	Size 640: 100%	1/1 2.1s/it 2.1s
1/1 1.3it/s 0.8s							mAP50	mAP50
-95): 100%		Class	Images	Instances	Box(P)	R		
95/100	0G	all	4	17	0.794	0.5	0.512	0.293
96/100	0G	box_loss	0.5652	0.5755	dfl_loss 1.049	Instances 13	Size 640: 100%	1/1 2.1s/it 2.1s
1/1 1.3it/s 0.8s							mAP50	mAP50
-95): 100%		Class	Images	Instances	Box(P)	R		
96/100	0G	all	4	17	0.794	0.5	0.52	0.293
97/100	0G	box_loss	0.4713	0.5284	dfl_loss 0.9375	Instances 13	Size 640: 100%	1/1 2.0s/it 2.0s
1/1 1.3it/s 0.8s							mAP50	mAP50
-95): 100%		Class	Images	Instances	Box(P)	R		
97/100	0G	all	4	17	0.794	0.5	0.52	0.293
98/100	0G	box_loss	0.6284	0.5569	dfl_loss 1.137	Instances 13	Size 640: 100%	1/1 1.9s/it 1.9s
1/1 1.4it/s 0.7s							mAP50	mAP50
-95): 100%		Class	Images	Instances	Box(P)	R		
98/100	0G	all	4	17	0.794	0.5	0.52	0.293
99/100	0G	box_loss	0.4799	0.4264	dfl_loss 0.8893	Instances 13	Size 640: 100%	1/1 1.8s/it 1.8s
1/1 1.2it/s 0.8s							mAP50	mAP50
-95): 100%		Class	Images	Instances	Box(P)	R		
99/100	0G	all	4	17	0.794	0.5	0.52	0.293
100/100	0G	box_loss	0.4918	0.4533	dfl_loss 0.9362	Instances 13	Size 640: 100%	1/1 2.3s/it 2.3s
1/1 1.1it/s 0.9s							mAP50	mAP50
-95): 100%		Class	Images	Instances	Box(P)	R		
100/100	0G	all	4	17	0.783	0.5	0.508	0.284

100 epochs completed in 0.098 hours.

Optimizer stripped from C:\Users\Bruno\Desktop\INF395 - IRN\tareas\tarea_3\runs\dete

```
ct\train4\weights\last.pt, 5.5MB
Optimizer stripped from C:\Users\bruno\Desktop\INF395 - IRN\tareas\tarea_3\runs\dete
ct\train4\weights\best.pt, 5.5MB
```

Validating C:\Users\bruno\Desktop\INF395 - IRN\tareas\tarea_3\runs\detect\train4\wei
ghts\best.pt...

Ultralytics 8.3.228 Python-3.11.4 torch-2.9.0+cpu CPU (Intel Core i5-9300H 2.40GHz)
YOLOv1n summary (fused): 100 layers, 2,616,248 parameters, 0 gradients, 6.5 GFLOPs

	Class	Images	Instances	Box(P)	R	mAP50	mAP50
-95): 100%	1/1 1.6it/s 0.6s						
0.652	all	4	17	0.705	0.746	0.912	
0.33	person	3	10	0.764	0.65	0.666	
0.796	dog	1	1	0.532	1	0.995	
0.676	horse	1	2	0.722	1	0.995	
0.322	elephant	1	2	0.608	0.825	0.828	
0.895	umbrella	1	1	0.604	1	0.995	
0.895	potted plant	1	1	1	0	0.995	

Speed: 2.6ms preprocess, 128.5ms inference, 0.0ms loss, 3.0ms postprocess per image
Results saved to C:\Users\bruno\Desktop\INF395 - IRN\tareas\tarea_3\runs\detect\tra
in4

```
In [7]: # Evaluamos el rendimiento
metrics = model.val()
```

Ultralytics 8.3.228 Python-3.11.4 torch-2.9.0+cpu CPU (Intel Core i5-9300H 2.40GHz)
YOLOv1n summary (fused): 100 layers, 2,616,248 parameters, 0 gradients, 6.5 GFLOPs

val: Fast image access (ping: 0.10.0 ms, read: 211.9134.7 MB/s, size: 54.0 KB)
val: Scanning C:\Users\bruno\Desktop\INF395 - IRN\tareas\datasets\coco8\labels\val.c
ache... 4 images, 0 backgrounds, 0 corrupt: 100% 4/4 4.0Kit/s 0.0s

	Class	Images	Instances	Box(P)	R	mAP50	mAP50
-95): 100%	1/1 1.6it/s 0.6s						
0.652	all	4	17	0.705	0.746	0.912	
0.33	person	3	10	0.764	0.65	0.666	
0.796	dog	1	1	0.532	1	0.995	
0.676	horse	1	2	0.722	1	0.995	
0.322	elephant	1	2	0.608	0.825	0.828	
0.895	umbrella	1	1	0.604	1	0.995	
0.895	potted plant	1	1	1	0	0.995	

Speed: 1.9ms preprocess, 129.5ms inference, 0.0ms loss, 3.7ms postprocess per image
Results saved to C:\Users\bruno\Desktop\INF395 - IRN\tareas\tarea_3\runs\detect\val3

```
In [11]: from PIL import Image
from IPython.display import display

# Ejemplo con mi perra "Negra" (La quiero mucho)
ruta_a_imagen_de_prueba = "negra.jpg"

# Mostramos la imagen original
original_image = Image.open(ruta_a_imagen_de_prueba)
print("Mostrando la imagen original:")
display(original_image)

# Ejecutamos la detección
results = model(ruta_a_imagen_de_prueba)

# Convertimos a un array para poder hacerle display en el notebook
im_array = results[0].plot()
im_pil = Image.fromarray(im_array)

# Mostramos en el notebook la predicción
print("Mostrando la imagen con la detección INLINE:")
display(im_pil)
```

Mostrando la imagen original:





image 1/1 c:\Users\Bruno\Desktop\INF395 - IRN\tareas\tarea_3\negra.jpg: 640x384 1 dog, 1 potted plant, 143.1ms

Speed: 5.8ms preprocess, 143.1ms inference, 1.4ms postprocess per image at shape (1, 3, 640, 384)

Mostrando la imagen con la detección INLINE:



dog 0.93

potted plant 0.26



Resultados de la Evaluación del Modelo YOLOv8n

La evaluación se realizó sobre el conjunto de validación del mini-dataset **COCO8** utilizando un modelo **YOLOv8n** ajustado (fine-tuned) y ejecutándose en CPU.

1. Métricas de Precisión

Las métricas mAP (mean Average Precision) indican el rendimiento del modelo en la localización y clasificación de objetos.

Métrica	Descripción	Valor
mAP50-95	Precisión Promedio Media en umbrales de Intersection over Union (IoU) desde 50% hasta 95% (Métrica estricta).	0.652
mAP50	Precisión Promedio Media con umbral de IoU de 50% (Métrica más relajada).	0.912
Precisión (P)	Proporción de predicciones correctas sobre el total de predicciones.	0.705
Recall (R)	Proporción de objetos reales detectados sobre el total de objetos reales.	0.746

Conclusión de Precisión: El modelo mantiene un rendimiento muy alto en detección básica (**mAP50: 91.2%**) y su rendimiento general en localización estricta es sólido (**mAP50-95: 65.2%**). En esta ejecución, la Precisión (0.705) mejoró ligeramente respecto al Recall (0.746).

2. Rendimiento por Clase (Detalle)

Clase	Imágenes	Instancias	mAP50-95	Notas Relevantes
all	4	17	0.652	Rendimiento promedio global.
person	3	10	0.330	Muestra el mAP más bajo, indicando dificultad en la localización precisa.
dog	1	1	0.796	Alta precisión y recall perfecto (1.0).

Clase	Imágenes	Instancias	mAP50-95	Notas Relevantes
horse	1	2	0.676	Buen rendimiento general.
elephant	1	2	0.322	Muestra dificultad con las clases más escasas o complejas.
umbrella	1	1	0.895	Excelente rendimiento.
potted plant	1	1	0.895	Excelente rendimiento.

3. Conclusiones

Conclusión 1: Es muy probable que la baja precisión se deba a que se hizo el entrenamiento con los "weights" básicos del modelo, y luego con un entrenamiento a 100 épocas sobre un dataset llamado COCO, pero solo 8 muestras del mismo, por lo que es esperable que el rendimiento no sea el mejor.

Conclusión 2: A su vez, YOLO es una arquitectura muy liviana y sencilla, lo que provoca que a su vez no sea tan robusta, por lo que se prioriza velocidad por sobre precisión, por eso las métricas de precisión son bajas.

Conclusión 3: A pesar de su baja precisión, su velocidad es superior, lo que genera que se puedan hacer detecciones en vivo, en webcams o videos, lo cual hace que YOLO siga siendo una opción muy interesante.