A Detailed comparison of models for weapons detection

YOLO Models Performance Comparison
Model Specifications Overview

Model	Layers	Parameters	GFLOPs	File Size
YOLOv8l	112	43.6M	164.8	1353 KB
YOLOv8m	92	25.8M	78.7	1558 KB
YOLOv9m	151	20.0M	76.5	1669 KB
YOLOv10l	174	24.3M	120.0	1545 KB
YOLOv10m	136	15.3M	58.9	1688 KB
YOLOv11m	125	20.0M	67.6	1528 KB
YOLOv11l	190	25.3M	86.6	1118 KB
RT-DETR	-	-	-	-

Detection Performance Metrics

Model	Precision	Recall	mAP50	mAP50-95
RT-DETR	**0.933**	0.533	**0.672**	0.277
YOLOv9m	0.809	0.500	0.573	**0.324**
YOLOv8m	0.545	**0.577**	0.582	0.273
YOLOv11m	0.606	0.533	0.563	0.322
YOLOv10l	0.769	0.423	0.542	0.322
YOLOv11l	0.583	0.385	0.491	0.297
YOLOv10m	**0.975**	0.308	0.461	0.263
YOLOv8l	0.368	0.500	0.403	0.217

Speed Performance (Inference Time)

Model	Preprocess	Inference	Postprocess	Total
YOLOv8m	0.5ms	**7.0ms**	8.1ms	**15.6ms**
YOLOv10l	0.5ms	7.9ms	0.6ms	**9.0ms**
YOLOv8l	0.5ms	8.3ms	11.8ms	20.6ms
YOLOv11l	0.8ms	8.7ms	10.6ms	20.1ms
YOLOv11m	0.6ms	9.1ms	8.0ms	17.7ms
YOLOv10m	0.5ms	9.1ms	0.7ms	10.3ms
YOLOv9m	0.5ms	11.4ms	6.5ms	18.4ms
RT-DETR	0.9ms	**26.5ms**	1.3ms	28.7ms

Detailed Analysis

Best Overall Accuracy: RT-DETR

- **Highest Precision**: 0.933 (93.3% of detections are correct)
- **Highest mAP50**: 0.672 (best overall detection performance)
- **Trade-off**: Significantly slower inference (26.5ms vs 7-11ms for YOLO models)

Best Speed-Accuracy Balance: YOLOv8m

- **Fastest inference**: 7.0ms
- **Highest recall**: 0.577 (finds 57.7% of all objects)
- **Good mAP50**: 0.582 (second-best among YOLO models)
- **Moderate precision**: 0.545

Best Precision Among YOLO Models: YOLOv10m

- **Highest precision**: 0.975 (97.5% accuracy when detecting)
- **Very fast**: 9.1ms inference, 10.3ms total
- **Limitation**: Low recall (0.308) - misses many objects

Performance Rankings

By Accuracy (mAP50)

1. **RT-DETR**: 0.672 ⭐
2. **YOLOv8m**: 0.582
3. **YOLOv9m**: 0.573

By Speed (Total Processing Time)

1. **YOLOv10l**: 9.0ms ⚡
2. **YOLOv10m**: 10.3ms
3. **YOLOv8m**: 15.6ms

Final Verdict

For maximum accuracy: **RT-DETR** is superior but comes with significant speed penalty.

For real-time applications: **YOLOv10l** provides the fastest processing with acceptable accuracy.