CARL-ODD: A Vision Benchmark Dataset of Asia for On-Road Vehicle Detection and Recognition

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The Autonomous Blind Spot

Current self-driving models are trained on highly organized Western datasets (like COCO and KITTI), rendering them virtually blind to the congested, chaotic realities of Asian traffic.

The Rickshaw Problem

The Standard

The Anomaly

The Anomaly

Missing Data = Fatal Outcomes.

Existing literature completely omits localized Asian vehicles **(3-wheelers)** and diverse pedestrian dressing cultures.

Introducing CARL-ODD

Asia’s First Comprehensive Stereo-Vision Dataset.

Context

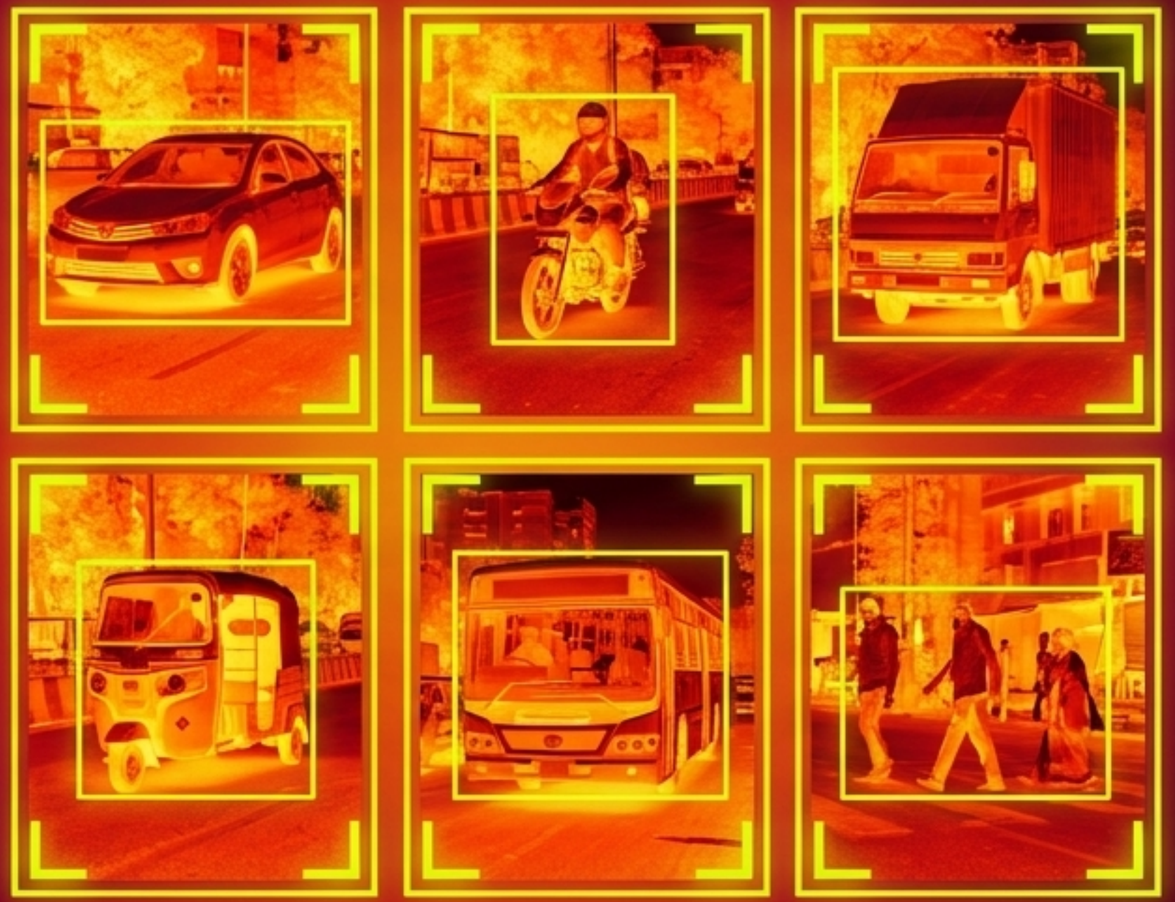
Captured during peak and off-peak traffic hours to ensure extreme congestion modeling.

Classes

Encompasses 2-wheelers, 3-wheelers (rickshaws), 4-plus-wheelers (minibuses, vans, trucks), and pedestrians.

Technology

High-definition stereo-vision for depth perception, utilizing the principle of binocular disparity.



The Benchmark Gap

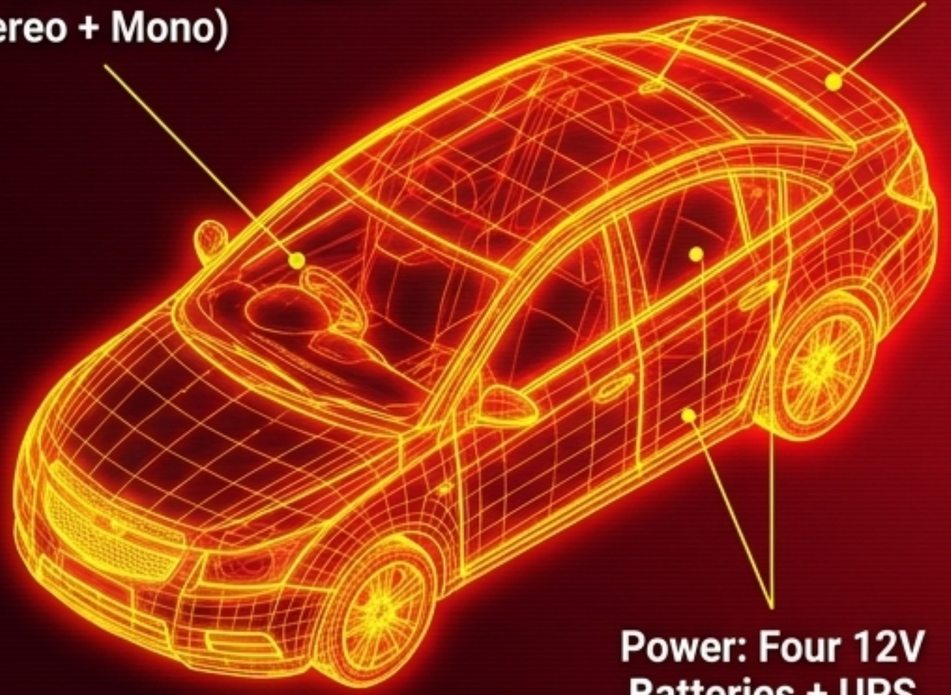
DATASET	RESOLUTION	2-WHEELERS	3-WHEELERS	PEDESTRIANS	DIVERSE TRAFFIC
KITTI	0.5 MP	✗	✗	✓	✓
UA-DETRAC	18 MP	✓	✗	✗	✓
nuScenes	1.4 MP	✓	✗	✓	✓
CARL-ODD	**12 MP**	✓	✓	✓	✓

Acquisition & Scale

The Rig

Front Dashboard:
Three 12MP 2K Cameras
(Stereo + Mono)

Rear Trailing:
5MP HD Camera



Power: Four 12V
Batteries + UPS

The Preprocessing Funnel

1,100 km driven across 80+ cities.

Decimate by 3 (extract every 3rd frame) + removing blurry/empty frames.

20,000 highly curated images.

55,000 manually annotated labels (YOLO & PASCAL VOC)

The AI Testing Ground: Validation Methodology

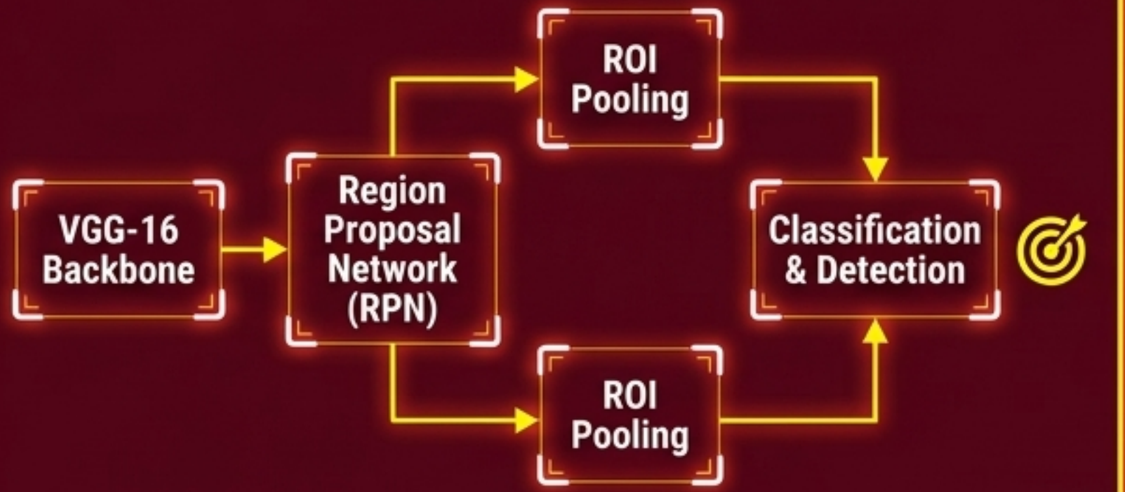
Stress-testing CARL-ODD across both single-stage agility and multi-stage precision.

One-Stage (YOLOv4)

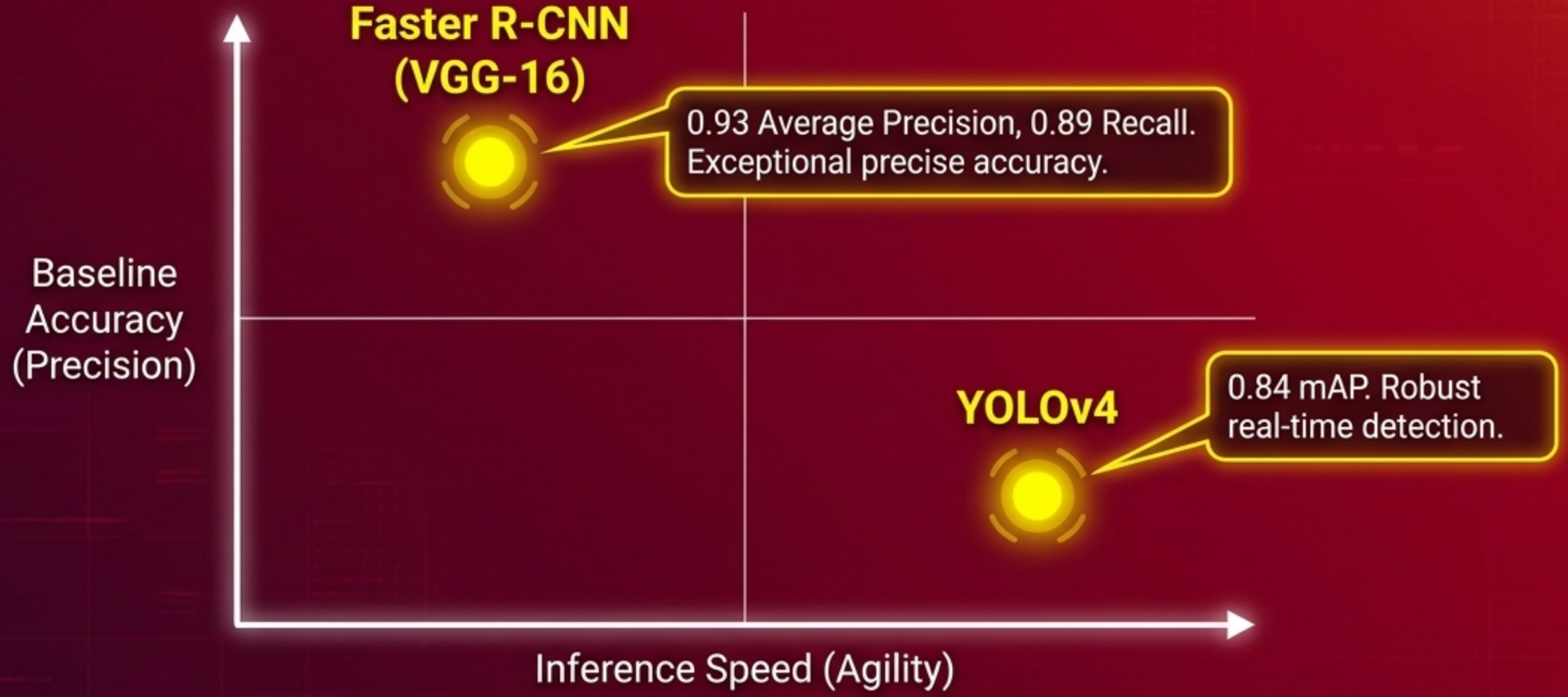
Prioritizes Inference Speed.
Ideal for real-time robotic navigation.

Two-Stage (Faster R-CNN)

Prioritizes Maximum Accuracy.
Ideal for complex scene understanding.



Performance Validation



Synthesis Takeaway: The dataset is universally robust. It successfully trains both highly agile systems for fast driving and highly precise analytical systems for complex scene comprehension.

The Road Ahead

Moving from Western conformity to localized precision.

- **CARL-ODD** successfully establishes the first intelligent perception baseline for Asian traffic environments
- Overcomes the critical “blind spot” of 3-wheelers and high-density congestion
- **Future Trajectory: Expanding deep learning models to map diverse weather conditions (fog, rain, snow) and dynamic road temperatures**