WISDET: A WINDSHIELD-GUIDED FEW-SHOT FRAMEWORK FOR DETECTING CAR STICKERS IN THE WILD

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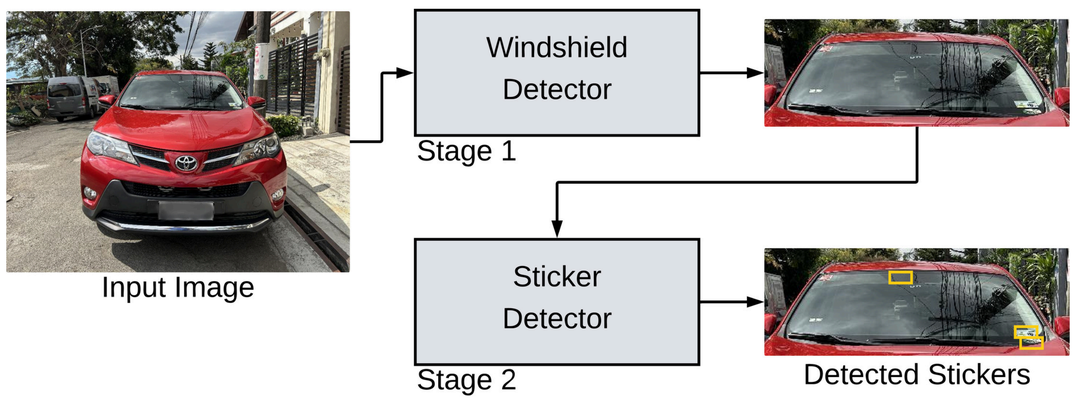
INTRODUCTION

- 📌 **Challenge**: Car stickers are small, visually diverse, and embedded in complex windshield regions, making few-shot detection challenging.
- 🧬 **Approach**: WiSDet - framework that localizes the windshield before sticker detection, evaluated with FsDet and YOLOv8 across different shots on FewCarStickerPH dataset

FewCarStickerPH DATASET

- **Crowdsourced Dataset:** 312 images from 78 unique vehicles, captured from four viewpoints.
- **Privacy & Annotation:** License plates, conduction stickers, and faces are anonymized; 1,134 car stickers are tightly annotated.
- **Tiny Objects:** Stickers occupy only 0.023% average image area (0.016% median), making detection highly challenging.
- **Few-Shot Settings:** Four configurations—31-, 10-, 5-, and 2-shot—with remaining images used for testing.

WINDSHIELD-TO-STICKER (WISDET) FRAMEWORK



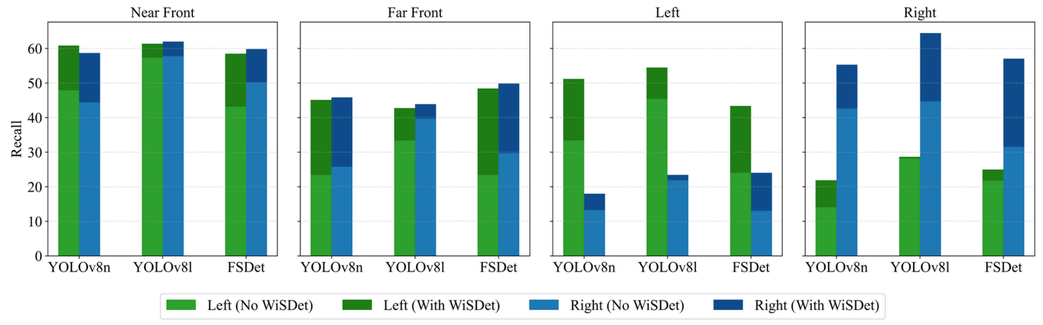
- **Two-Stage:** First detects the windshield, then performs sticker detection only within predicted windshield regions.
- **Windshield cropping** reduce background clutter and improve the effective resolution of tiny stickers.
- **Few-Shot Detection:** Evaluated with FsDet and YOLOv8, using transfer learning and selective fine-tuning.
- **False Positive Reduction:** Restricting detection to windshield regions reduces background-induced false predictions.

RESULTS AND CONCLUSIONS

Few-Shot Car Sticker Detection with and without the proposed WiSDet Framework on the FewCarStickerPH Dataset

Model	31-shot	10-shot	5-shot	2-shot
YOLOv8n [9]	0.2524	0.1670	0.1551	0.1539
+ WiSDet (Ours)	0.4014	0.3350	0.3108	0.3147
	(+14.90%)	(+16.80%)	(+ 15.57%)	(+16.08%)
YOLOv8l [9]	0.4330	0.3839	0.3229	0.2874
+ WiSDet (Ours)	0.4937	0.4200	0.3397	0.3049
	(+6.07%)	(+3.61%)	(+1.68%)	(+1.75%)
FSDet [8]	0.2892	0.1407	0.1839	0.1773
+ WiSDet (Ours)	0.5050	0.3180	0.3400	0.3320
	(+21.58%)	(+17.73%)	(+15.61%)	(+15.47%)

Recall per Viewpoint and Sticker Location



Out-Of-Windshield Predictions

Model	31-shot	10-shot	5-shot	2-shot
YOLOv8n [9]	0.7013	0.8399	0.8823	0.8635
+ WiSDet (Ours)	0.1338	0.1830	0.0873	0.0586
	(-56.75%)	(-65.69%)	(-79.50%)	(-80.49%)
YOLOv8l [9]	0.5112	0.5533	0.6443	0.7774
+ WiSDet (Ours)	0.0837	0.0797	0.0939	0.1043
	(-42.75%)	(-47.36%)	(-55.04%)	(-67.31%)
FsDet [8]	0.4389	0.2603	0.3344	0.1749
+ WiSDet (Ours)	0.2298	0.0769	0.2184	0.1257
	(-20.91%)	(-18.34%)	(-8.60%)	(-4.92%)

- **Detection Performance:** WiSDet consistently improves AP across all few-shot settings, with gains up to +16.80% for YOLOv8n and +21.58% for FsDet.
- **Viewpoint Robustness:** WiSDet consistently improves recall across viewpoints and sticker locations, with the largest gains in challenging side-view captures and for stickers positioned on the windshield side nearest to the camera.
- **Error Reduction:** Reduces out-of-windshield predictions by up to 80.49% for YOLOv8n and 67.31% for YOLOv8l, with larger reductions in lower-shot settings.

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