

# Evaluation of Polarimetric Fusion for Semantic Segmentation in Aquatic Environments

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## Summary



(a) RGB.

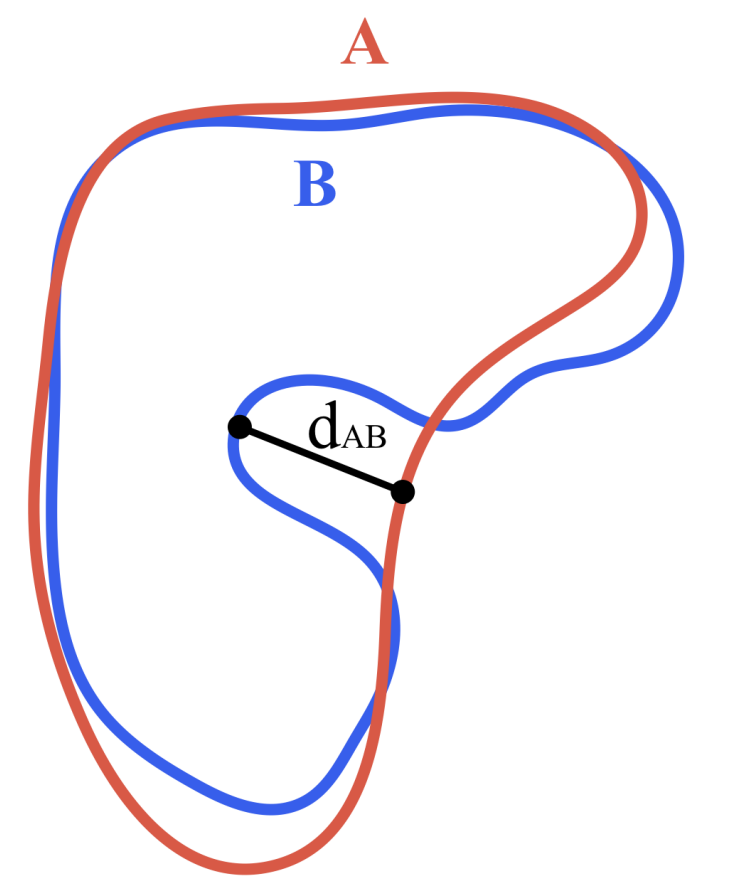
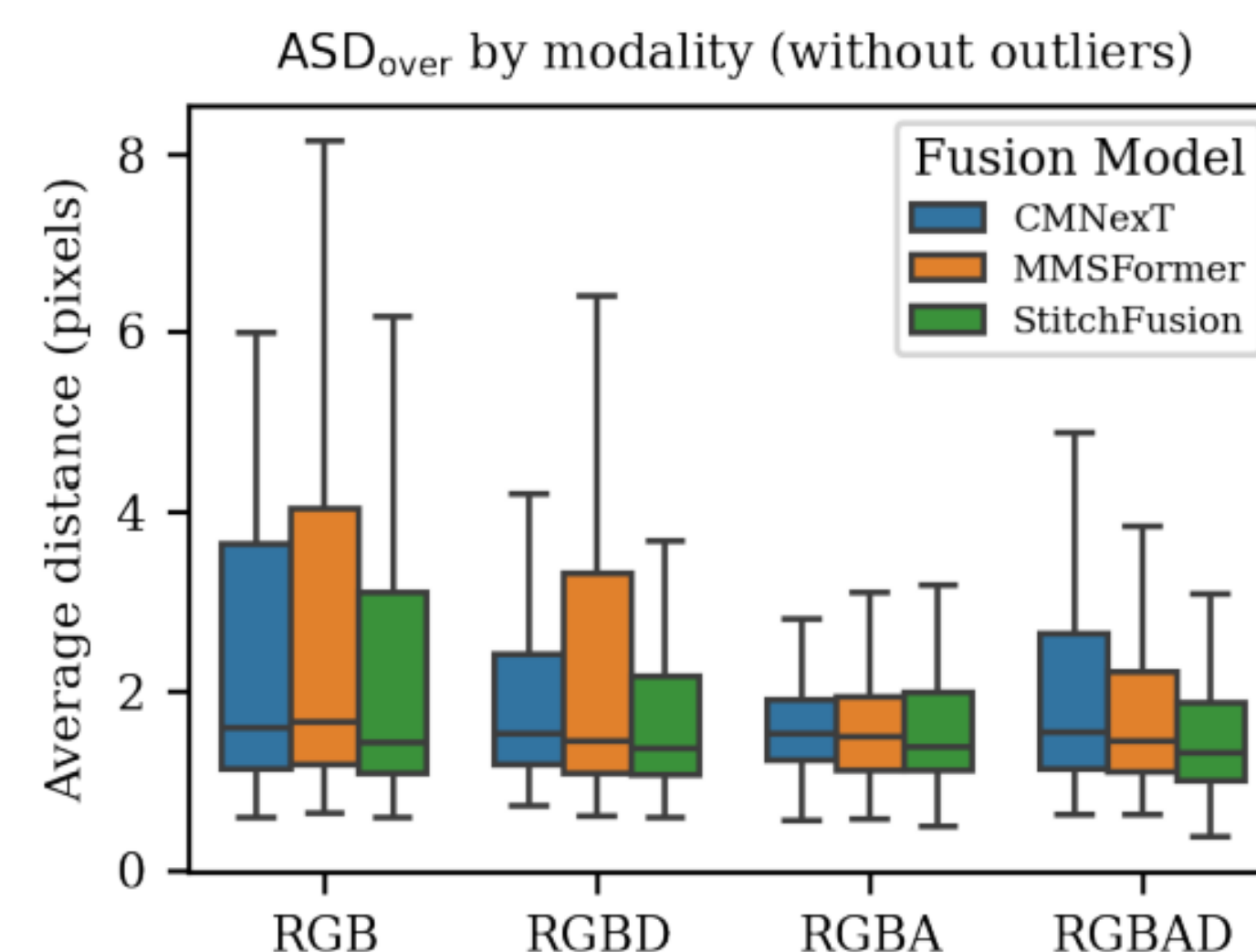
(b) DIF.

(c) POL.

- **Goal:** Leveraging polarimetric imaging to improve waste detection on water surfaces.
- **Problem:** Highly reflective environments make the object segmentation more challenging and lead to less accurate masks.
- **Contribution:** Evaluation of multimodal fusion models for integrating polarization information to enhance segmentation accuracy in highly reflective environments

## Metrics

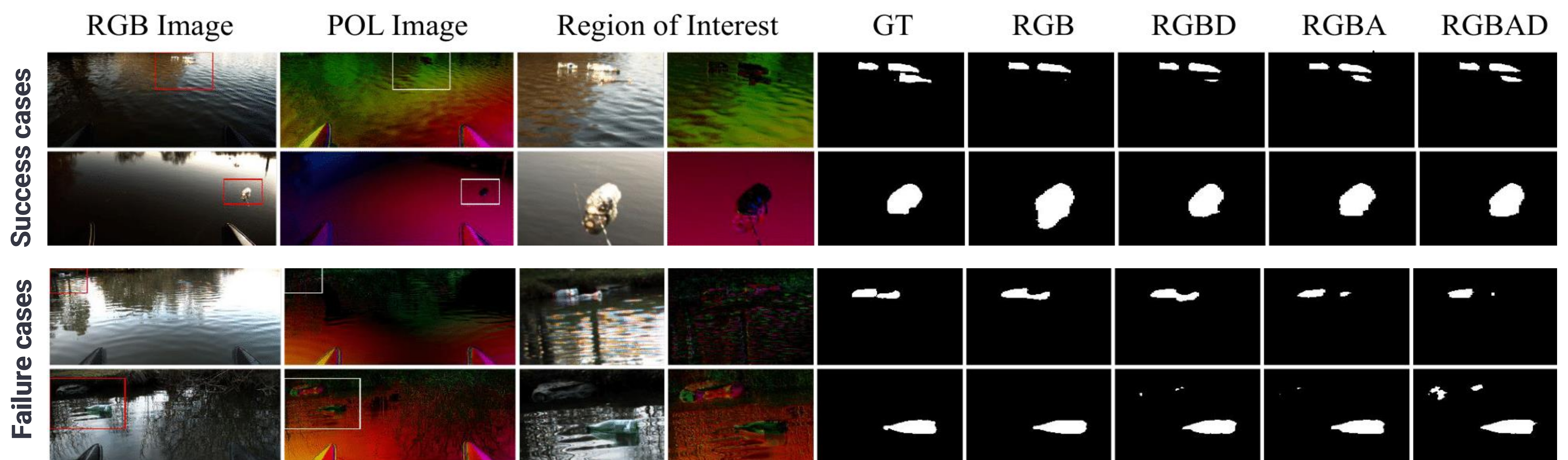
### Average Surface Distance



### Inference time

Model	RGB	RGBD	RGBA	RGBAD
U-Net	5.2 ms	-	-	-
DeepLab	<b>5.0 ms</b>	-	-	-
CMNeXt	24.3 ms	37.7 ms	37.8 ms	39.6 ms
MMSFormer	<b>18.2 ms</b>	<b>24.2 ms</b>	<b>24.3 ms</b>	<b>24.5 ms</b>
StitchFusion	22.1 ms	45.4 ms	45.7 ms	83.9 ms

## Qualitative Analysis



## Single-image Evaluation

Model	Modality	mIoU(%)	Precision	Recall	F1
U-Net	RGB	73.034	0.841	0.839	0.833
	POL	71.518	0.887	0.770	0.812
	DIF	<b>75.786</b>	0.875	0.848	0.854
DeepLab	RGB	70.946	0.838	0.818	0.817
	POL	<b>71.752</b>	0.874	0.783	0.819
	DIF	70.922	0.851	0.796	0.814
CMNeXt	RGB	76.081	0.868	0.861	0.857
	POL	73.394	0.832	0.848	0.832
	DIF	<b>76.646</b>	0.884	0.850	0.859
MMSFormer	RGB	75.679	0.867	0.857	0.853
	POL	72.361	0.819	0.849	0.825
	DIF	<b>76.729</b>	0.882	0.853	0.860
StitchFusion	RGB	77.043	0.871	0.866	0.862
	POL	71.944	0.833	0.830	0.821
	DIF	<b>77.197</b>	0.875	0.865	0.863

## Multi-modality Fusion Evaluation

Model	Modality	mIoU(%)	Precision	Recall	F1
StitchFusion	RGB	77.04	0.871	0.866	0.862
	RGBD	78.71	0.894	0.862	0.874
	RGBA	78.86	0.900	0.860	0.875
	RGBDA	<b>79.03</b>	0.902	0.862	0.876
MMSFormer	RGB	75.68	0.867	0.857	0.853
	RGBD	77.11	0.857	0.876	0.862
	RGBA	<b>78.20</b>	0.896	0.856	0.871
	RGBDA	77.42	0.883	0.855	0.864
CMNeXt	RGB	76.08	0.868	0.861	0.857
	RGBD	76.47	0.870	0.860	0.859
	RGBA	76.43	0.888	0.843	0.857
	RGBDA	<b>76.74</b>	0.883	0.849	0.860

## Conclusion

- Our experiments show that incorporating DoLP and AoLP information improved the mean IoU and reduced contour error by suppressing reflections and enhancing contrast.
- Future work should explore larger polarimetric datasets and lightweight fusion modules for real-time deployment.