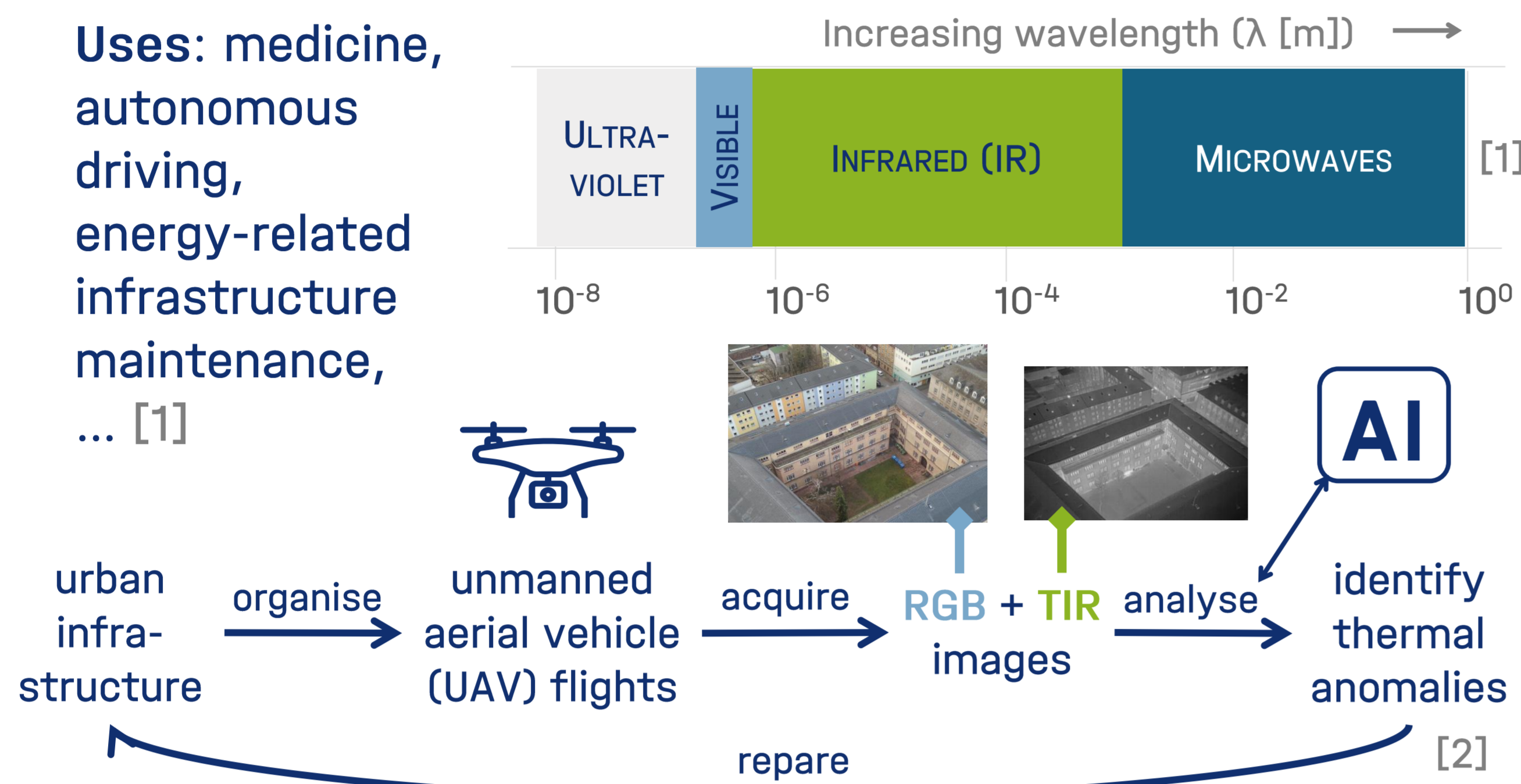


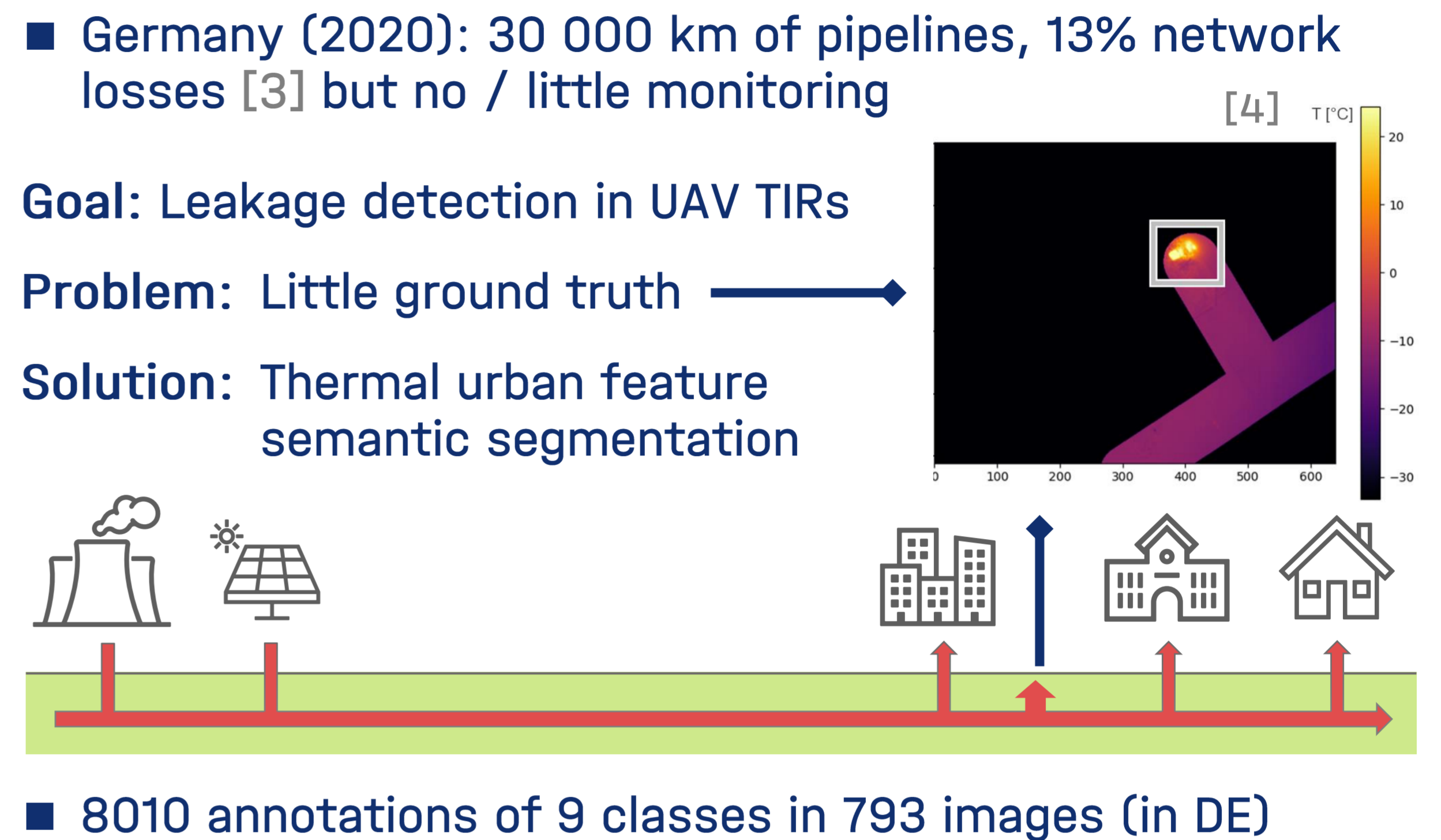
How Does Feature Engineering Impact UAV-based Multispectral Semantic Segmentation? An RGB and Thermal Image Ablation Study

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WHY RGB + THERMAL IMAGE DATA?



USE CASE: DISTRICT HEATING

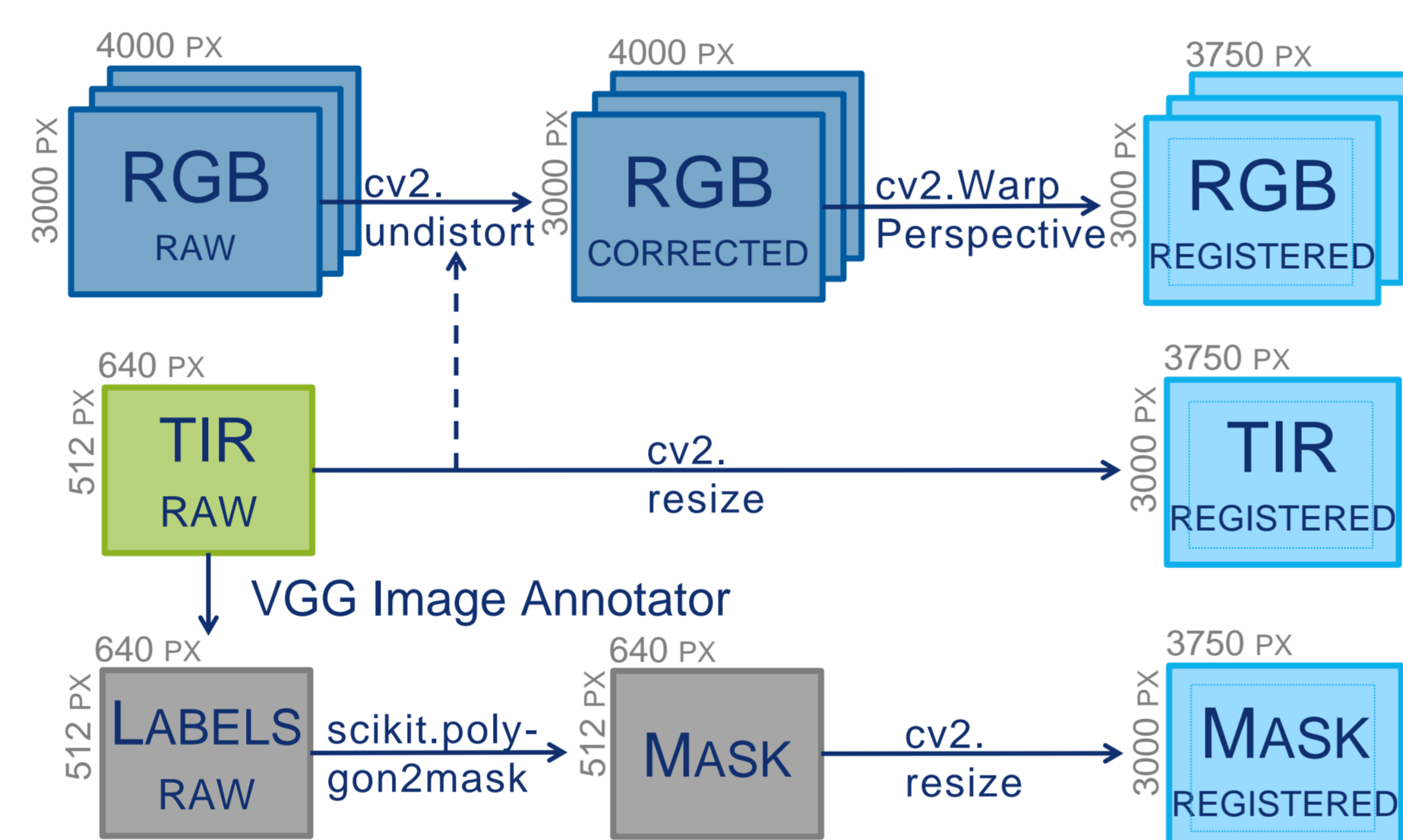


FEATURE ENGINEERING INSTEAD OF MODEL ABLATION

Common assumption: Model will compensate low resolution, quality, & artefacts [5, 6]

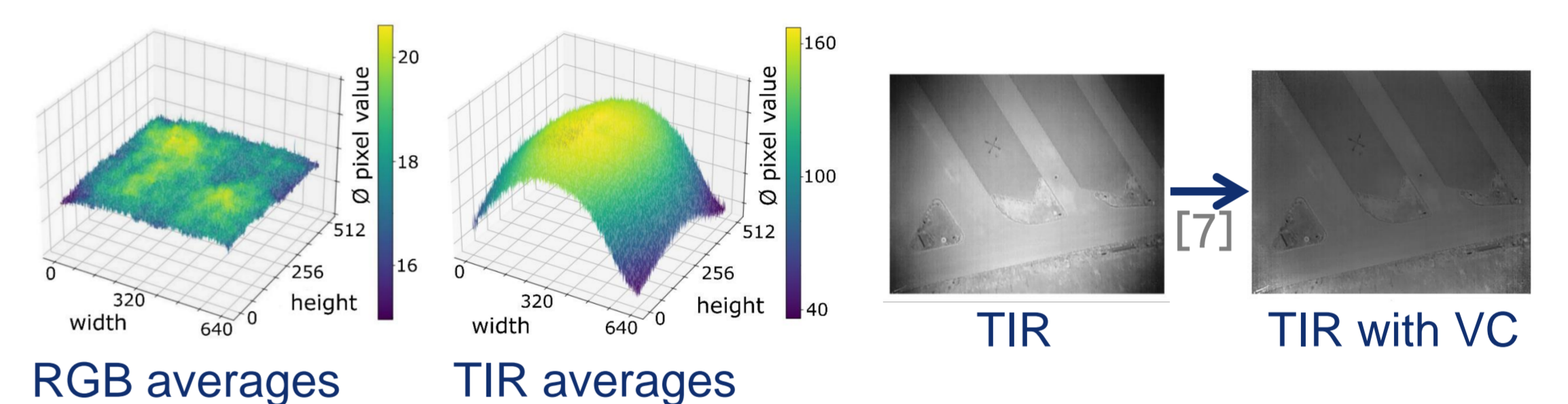
What about RGB+T feature engineering for performance improvement?

1. Image registration for differing fields of view, aspect ratios, and resolution [2]

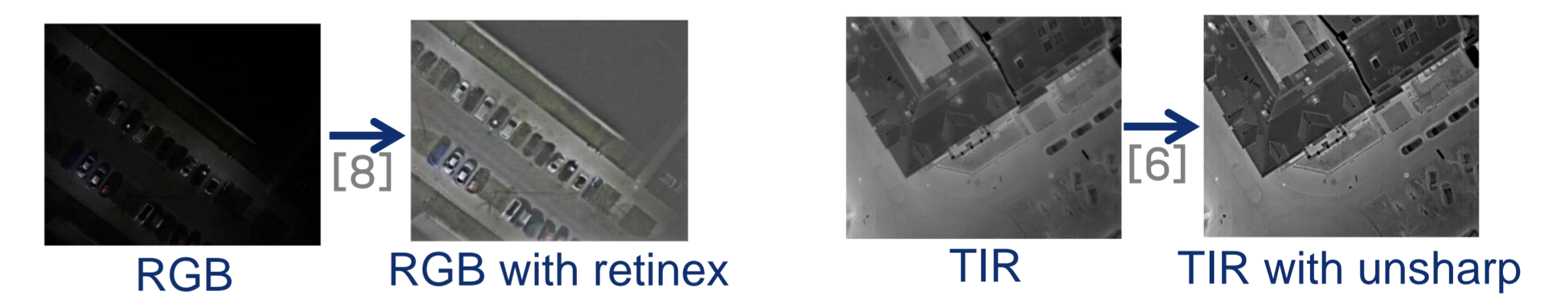


2. Feature engineering (FE) for low quality & artefacts

Platform-specific = vignetting correction (VC)



General enhancement = contrast + deblurring



ABLATION STUDY

Model from [2]: U-Net, ResNet-152 backbone, sigmoid focal cross-entropy loss, transfer learning with ImageNet

Proc	Ch	Data	Ch1	Ch2	Ch3	Ch4
NONE	3	T	T	T	T	-
+PS	3	T	vc T	vc T	vc T	-
+GE	3	T	vc T	retinex T	unsharp T	-
NONE	3	RGBT	gray RGB	T	T	-
+PS	3	RGBT	gray RGB	vc T	vc T	-
+GE	3	RGBT	retinex RGB	retinex T	unsharp T	-
NONE	4	RGBT	R	G	B	T
+PS	4	RGBT	R	G	B	vc T
+GE	4	RGBT	retinex RGB	retinex T	unsharp RGB	unsharp T

+ resolution 3750 x 3000 / 640 x 512 / 320 x 256
 + seeds 42 / 1,000 / 1,234,567 / 10,110,110

Performance metrics

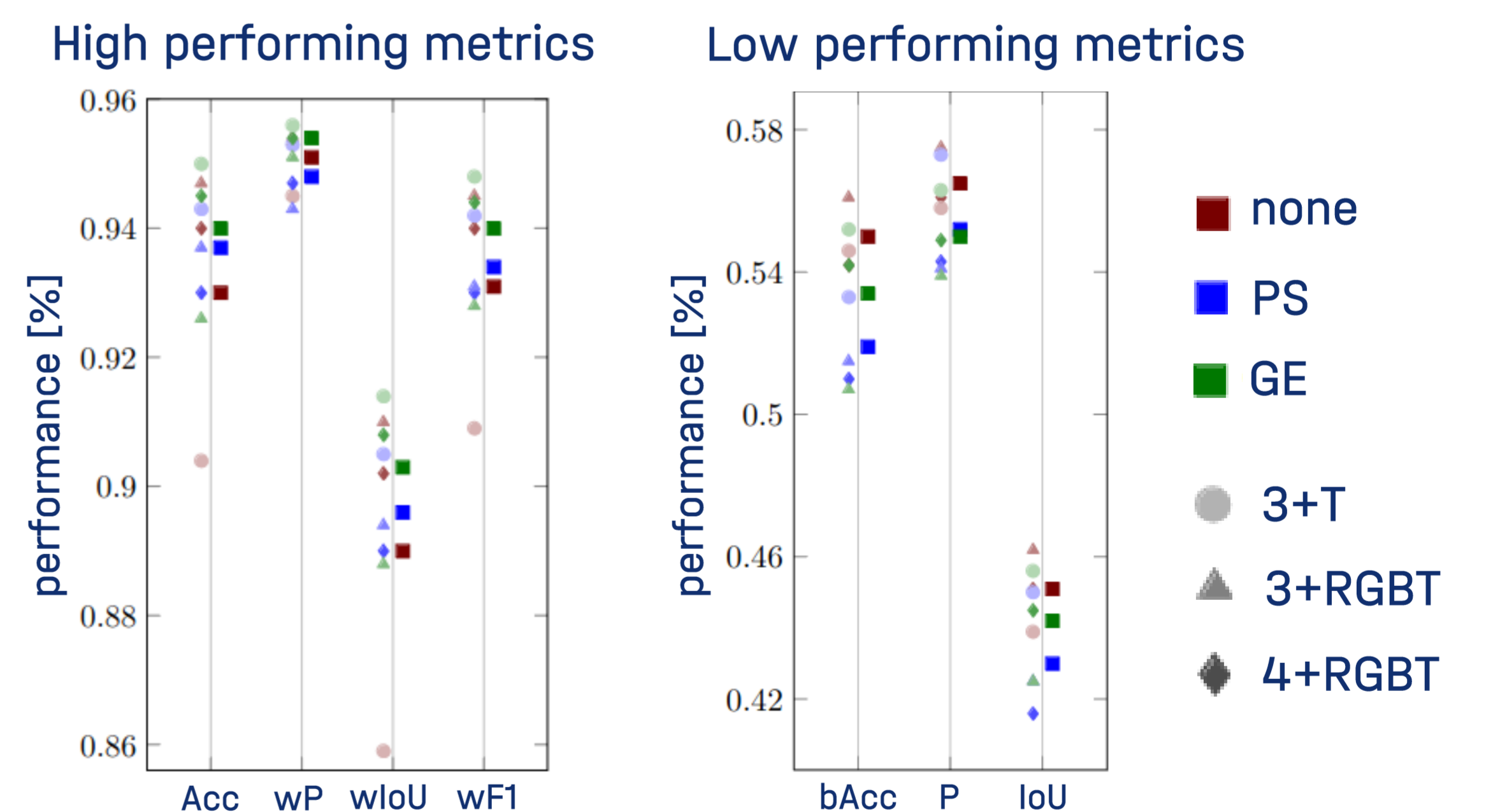
Accuracy, balanced Accuracy, Precision, weighted Precision, IoU, w IoU, w F1 [1, 5]

+ Resource metrics

Time, energy consumption [9]

RESULTS AND OUTLOOK

Feature engineering (FE) → 7% - 10% impact

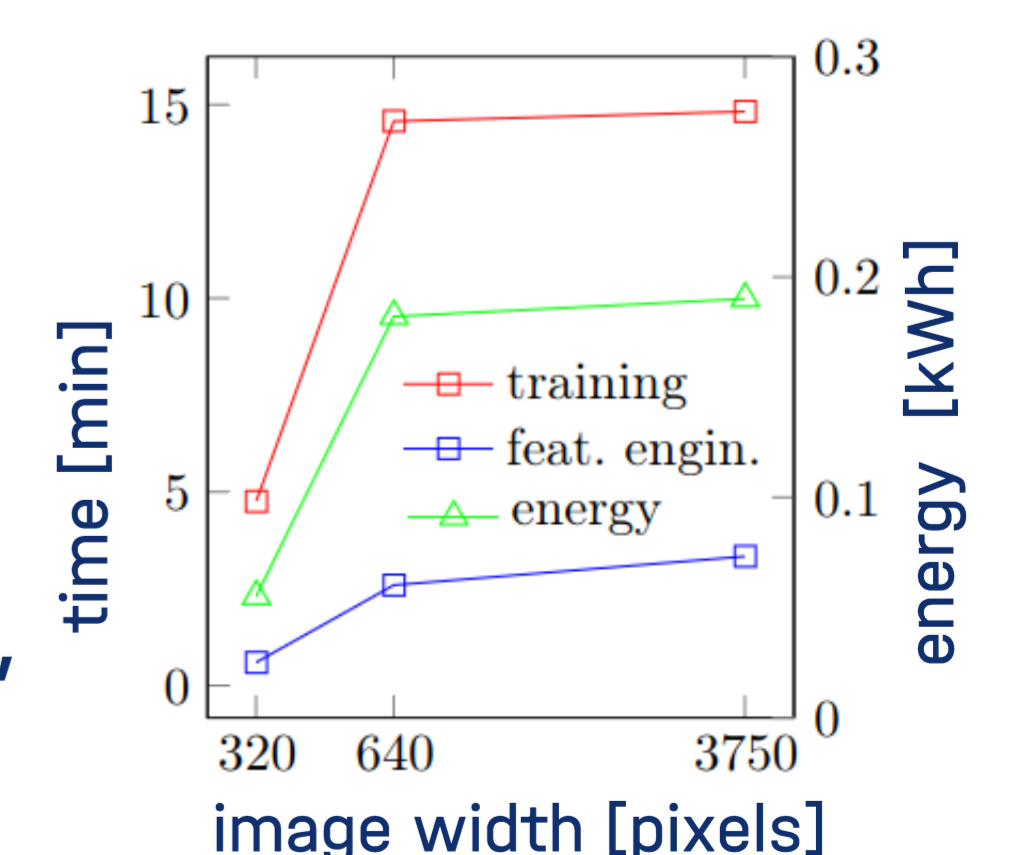


High results for None+3+RGBT; GE+3+T overall best

→ cheaper acquisition when FE counteracts lack of RGB

High resolution = winner

- best results most often,
- improves low performing metrics,
- needs little additional resources



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ACKNOWLEDGEMENTS

This work is funded by the European Union through the AI4EOSC project (Horizon Europe) under Grant number 101058593. [CLICK HERE](#) for more information, including associated publications. The authors acknowledge support by the state of Baden-Württemberg through bwHPC.