



# AnomalousPatchCore: Exploring the Use of Anomalous Samples in Industrial Anomaly Detection

## Motivation

### Anomaly Detection (AD)

Detect anomalous samples and locate the anomaly

#### Industrial Setting

- In industrial settings, AD is usually a screening task with a human in the loop
- A few images of anomalous samples are mostly available or easy to acquire

#### How is AD addressed?

- Most feature-embedding systems rely on general ImageNet features (e.g., PatchCore [1])
- Existing data of anomalous samples is mostly ignored since it's sparse

#### Our idea: AnomalousPatchCore (APC)

- Improve detection in AD by leveraging information from anomalous samples
- Few anomalous samples will not cover all anomalies, but improve the extracted features

### Training of AD system



Normal samples

Used by most AD systems as only training data



Anomalous samples

We add few anomalous samples, which are usually available

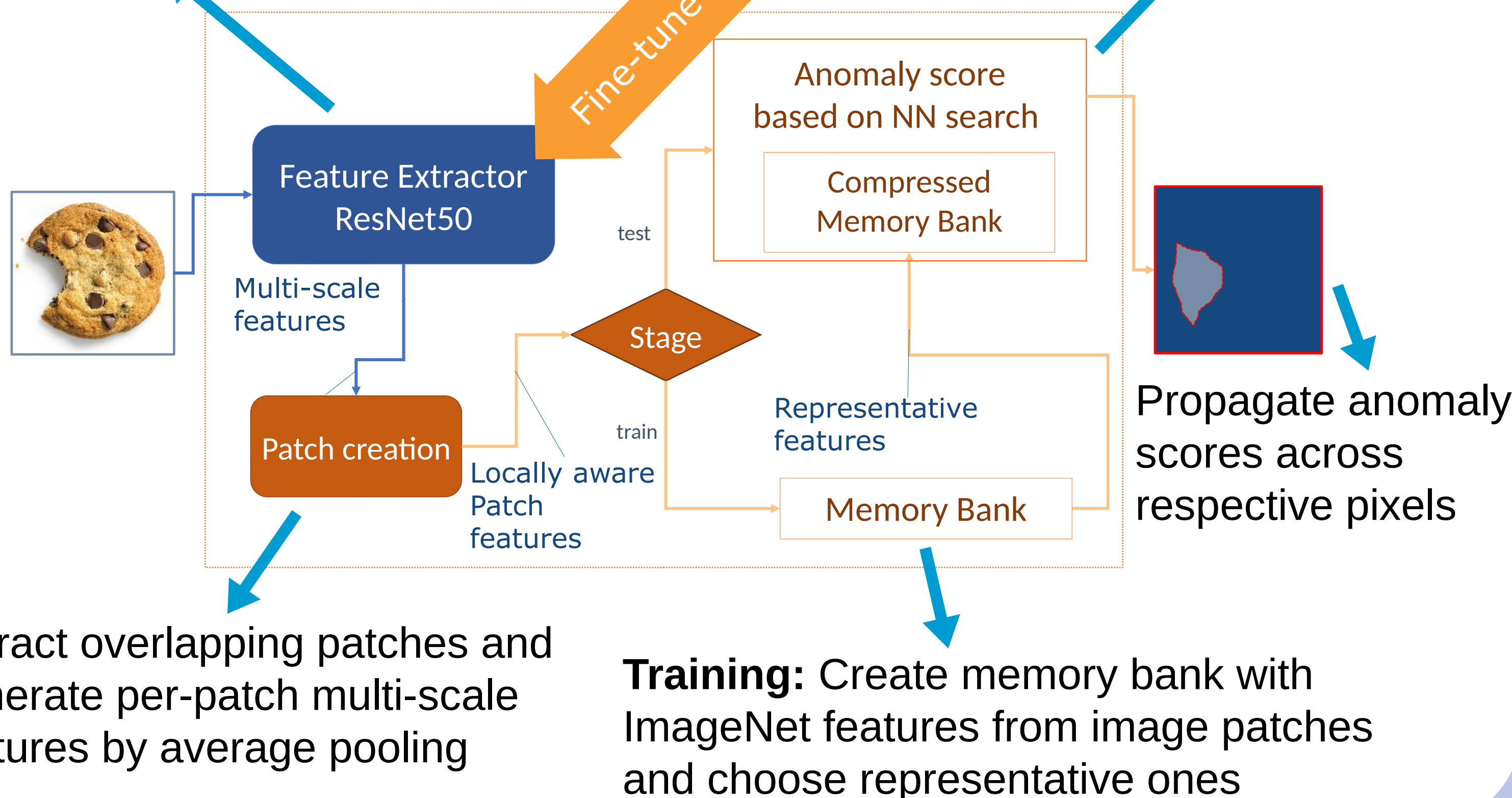
Anomaly detection system

## Baseline PatchCore

**PatchCore:** Feature-embedding anomaly detection method [1]

Feature extraction with ImageNet-trained ResNet50, no fine-tuning

**Testing:** Find most similar feature in memory bank, distance is anomaly score

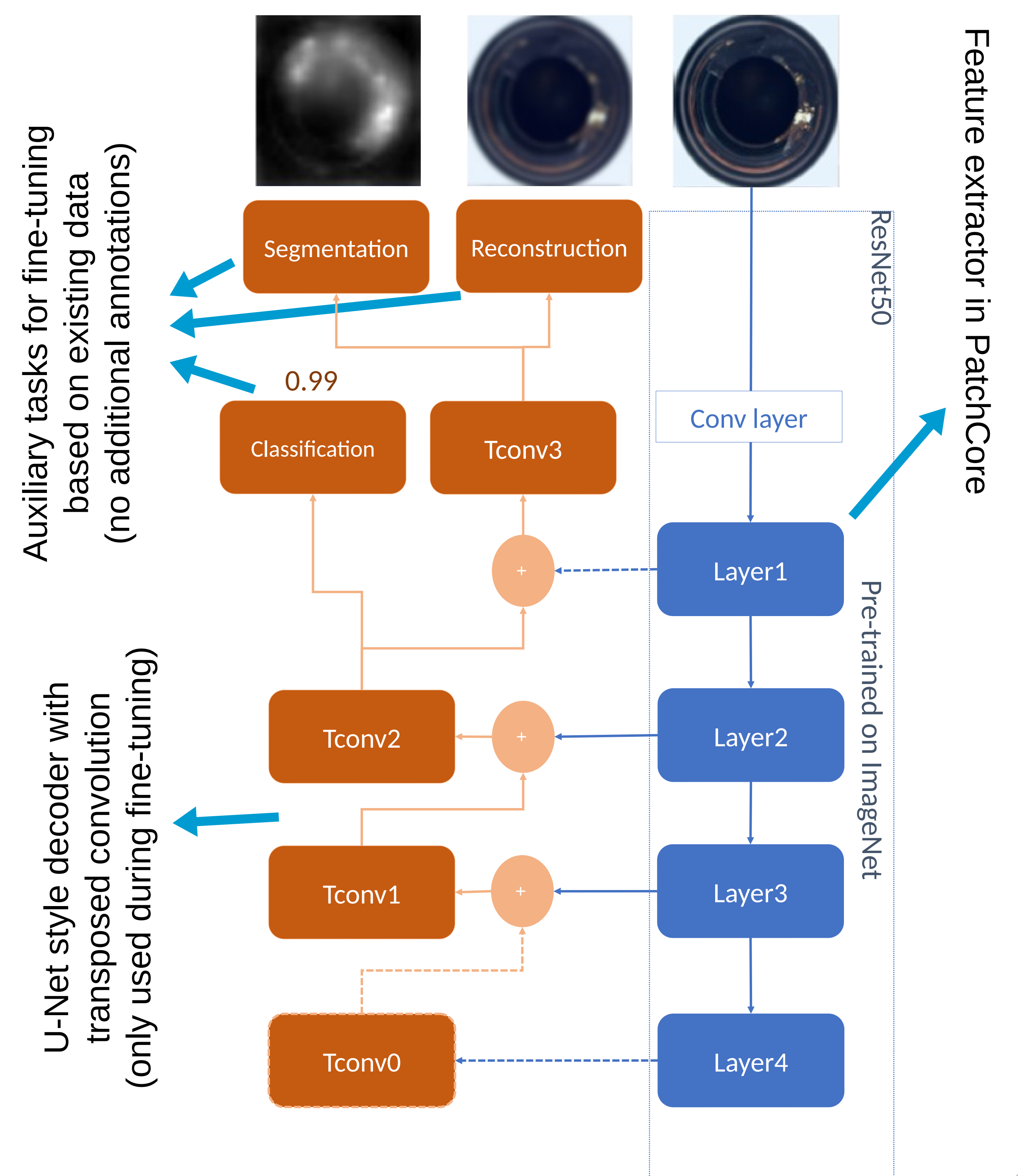


Extract overlapping patches and generate per-patch multi-scale features by average pooling

**Training:** Create memory bank with ImageNet features from image patches and choose representative ones

## AnomalousPatchCore (APC)

**APC** improves the feature extractor in PatchCore by fine-tuning leveraging few anomalous samples, the rest of PatchCore is kept

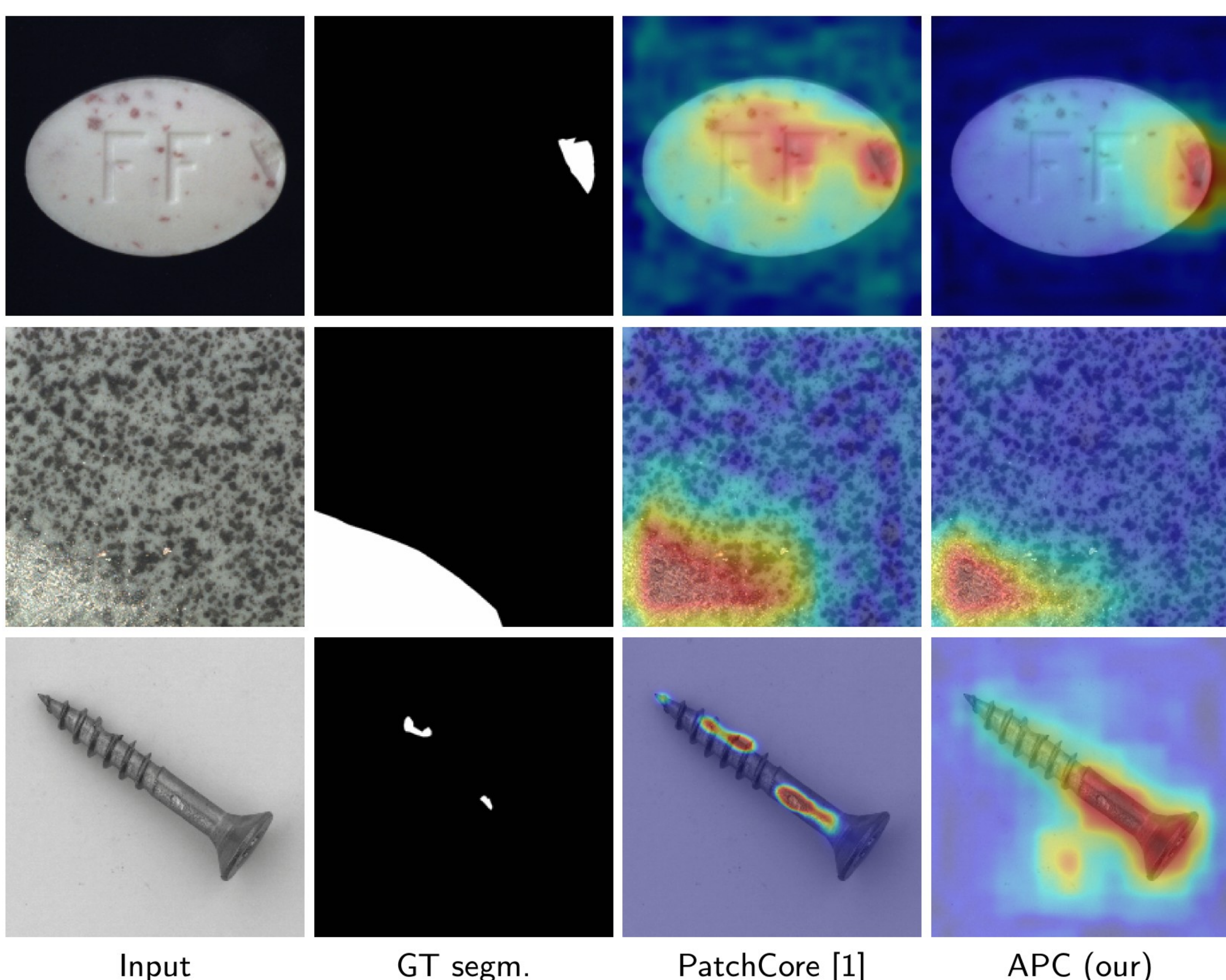


## Evaluation

Image-level detection      Pixel-level detection/localization

System	AUROC <sub>im</sub>	F1 <sub>im</sub>	AUROC <sub>px</sub>	F1 <sub>px</sub>
PatchCore [1]	97.21	96.36	<b>97.59</b>	<b>54.70</b>
PRNet [2]	90.39	91.47	93.44	54.49
APC (our)	<b>98.83</b>	<b>97.87</b>	94.45	39.04

Train/test on MVTec dataset, 15 categories, 10 anomalous samples per cat.



## Conclusion

- APC fine-tunes the feature extractor of AD method PatchCore with limited anomalous samples
- Fine-tuning is based on segmentation, reconstruction, and classification tasks
- APC improves image-level AD, which is important in industrial applications (human in the loop)

## References

- [1] Roth, K., Pemula, L., Zepeda, J., Schölkopf, B., Brox, T., Gehler, P.: Towards total recall in industrial anomaly detection. CVPR (2022)
- [2] Zhang, H.M., Wu, Z., Wang, Z., Chen, Z., Jiang, Y.: Prototypical residual networks for anomaly detection and localization. CVPR (2022)

## Acknowledgment

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