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Anomaly Detection for Security Imaging

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DSDS'16: *Anomaly Detection for Security Imaging*

Anomaly detection provides the **final line of defence** – identifying oddities that we have never seen before, but which a human operator would spot.

Non-intrusive inspection of cargo

Minimise false searches; maximise true searches

Appreciable visual challenge for humans
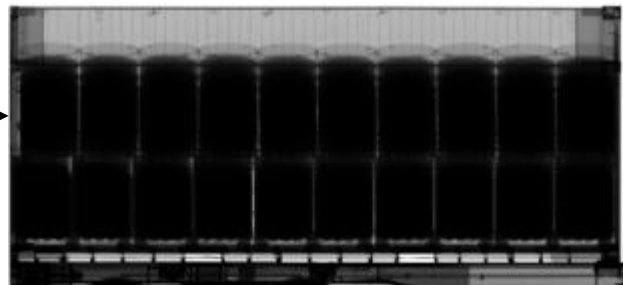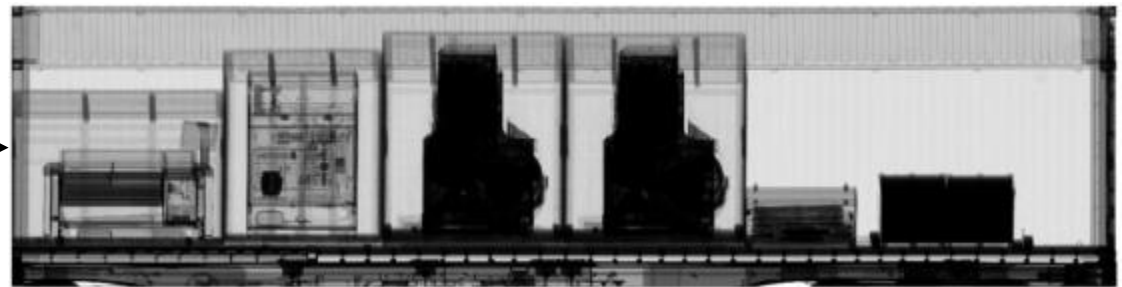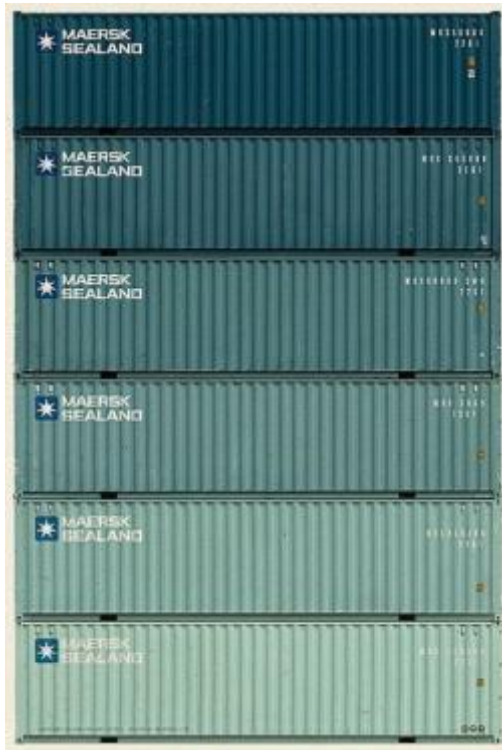
Existing approaches to automated image analysis
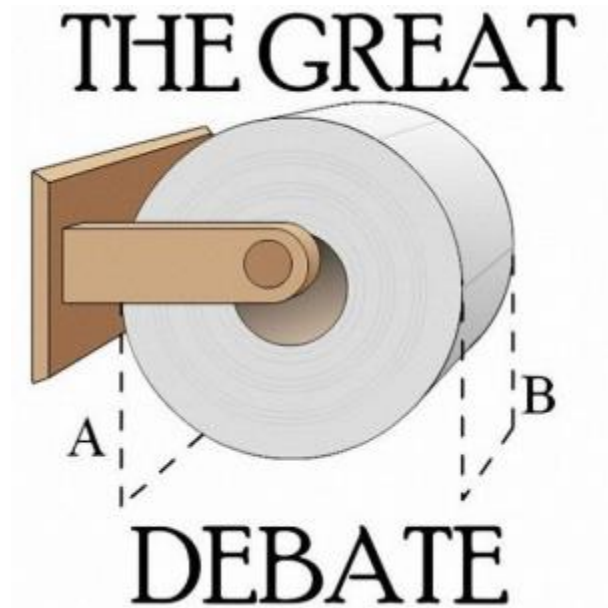
Existing approaches can be ineffectual

1. Threat data is rare

3. Never-before-seen-threats

2. X-ray smart adversaries

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Inspired by the practice of customs officers, we are developing algorithms to discover visual anomalies, in X-ray images, that are **historically atypical with respect to expected patterns**.
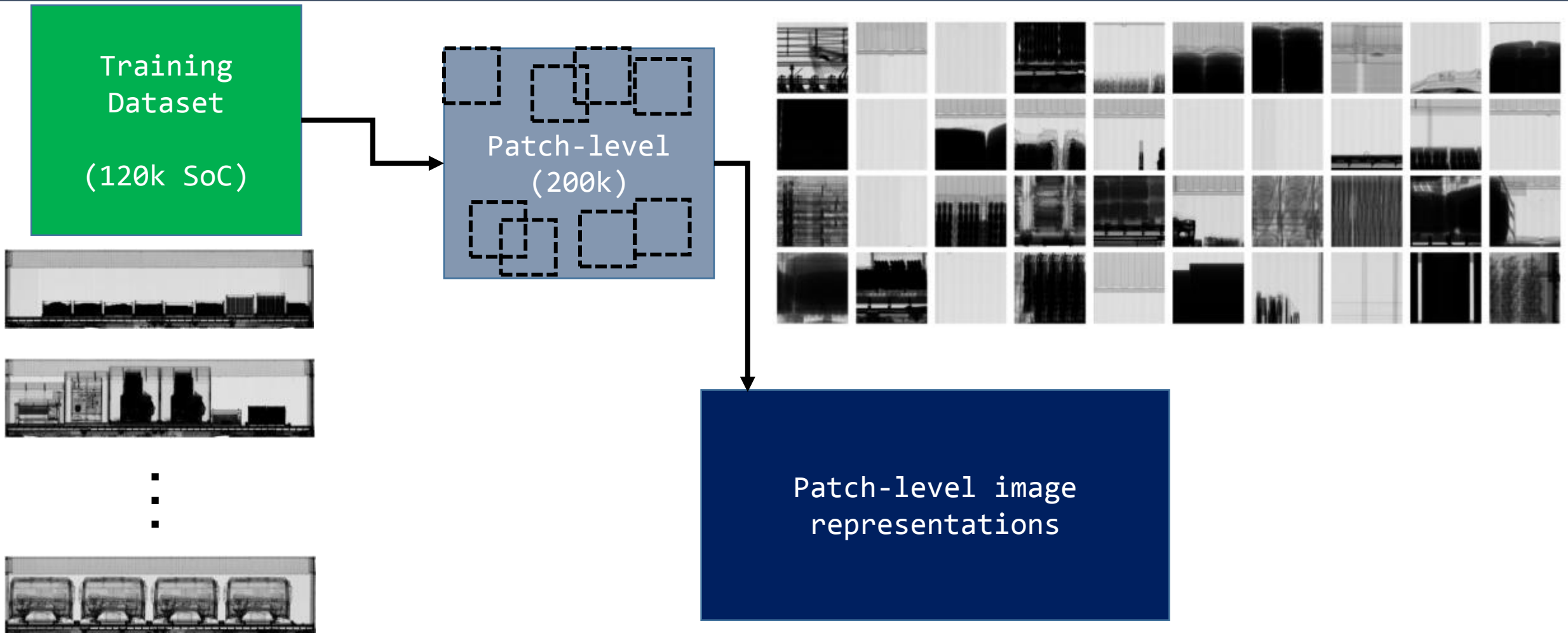
Our anomaly detection framework is based on:
1. Image representations
2. Anomaly detection relative to those representations

Generation of normal samples

Patch-level image representations

Convolution neural network (CNN)
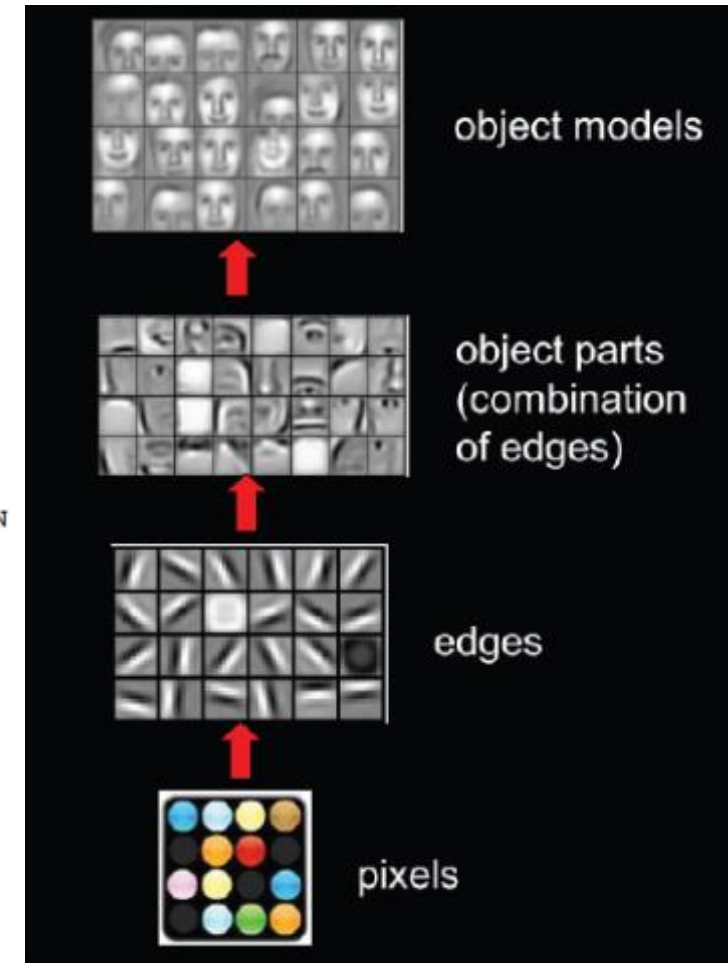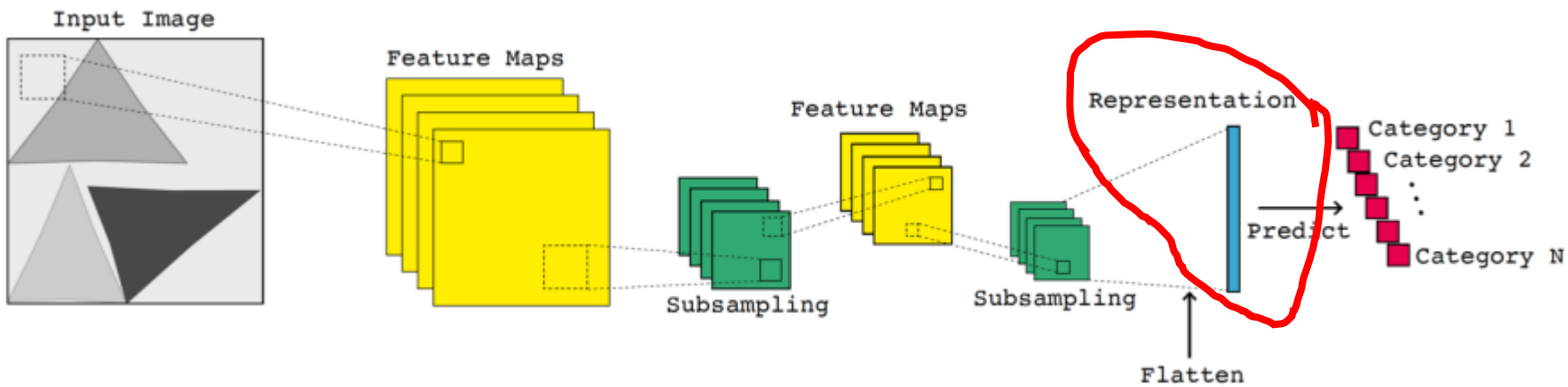
Image representations we use…

Intensity histograms (baseline)

CNN trained on ImageNet

CNN trained on auxiliary task
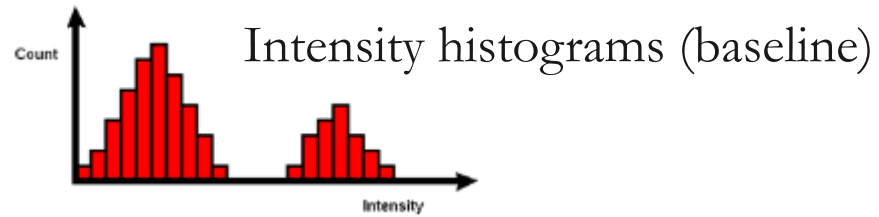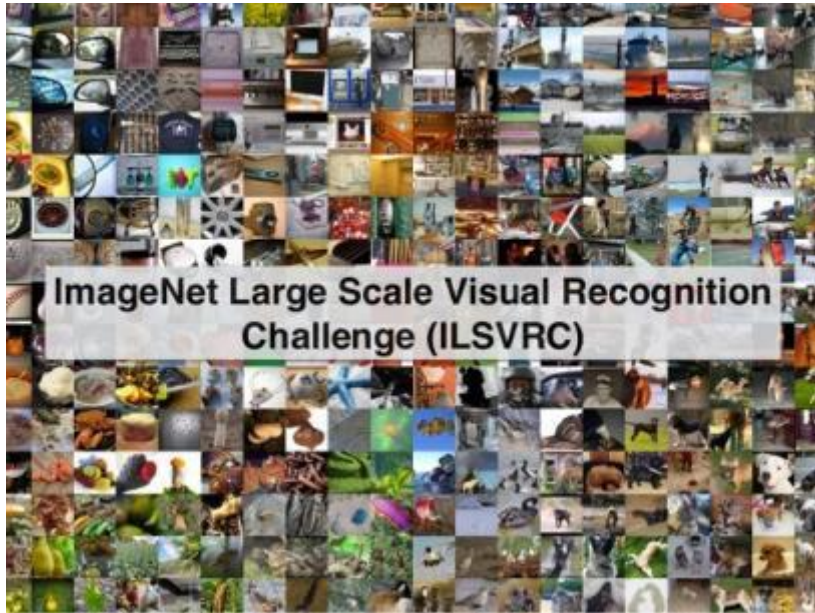
CNN trained to detect cars
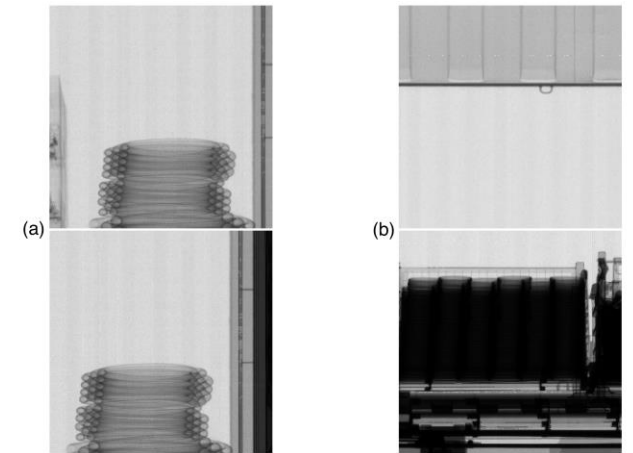
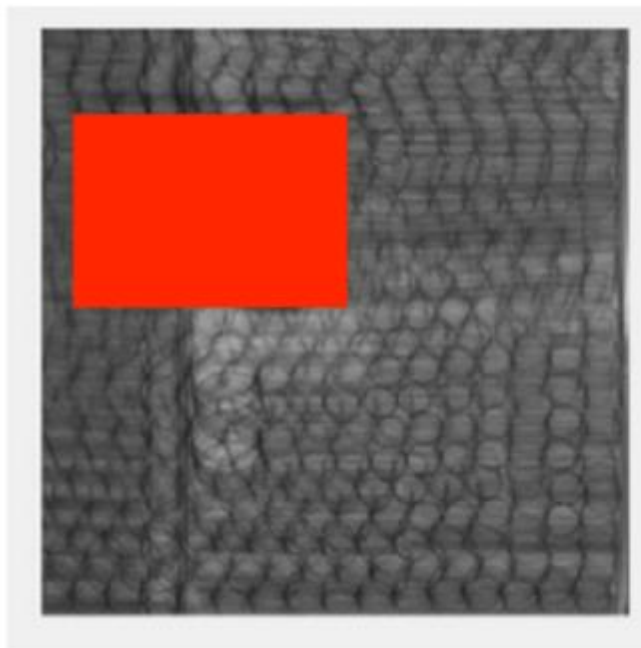# Forest of random-split trees anomaly detector
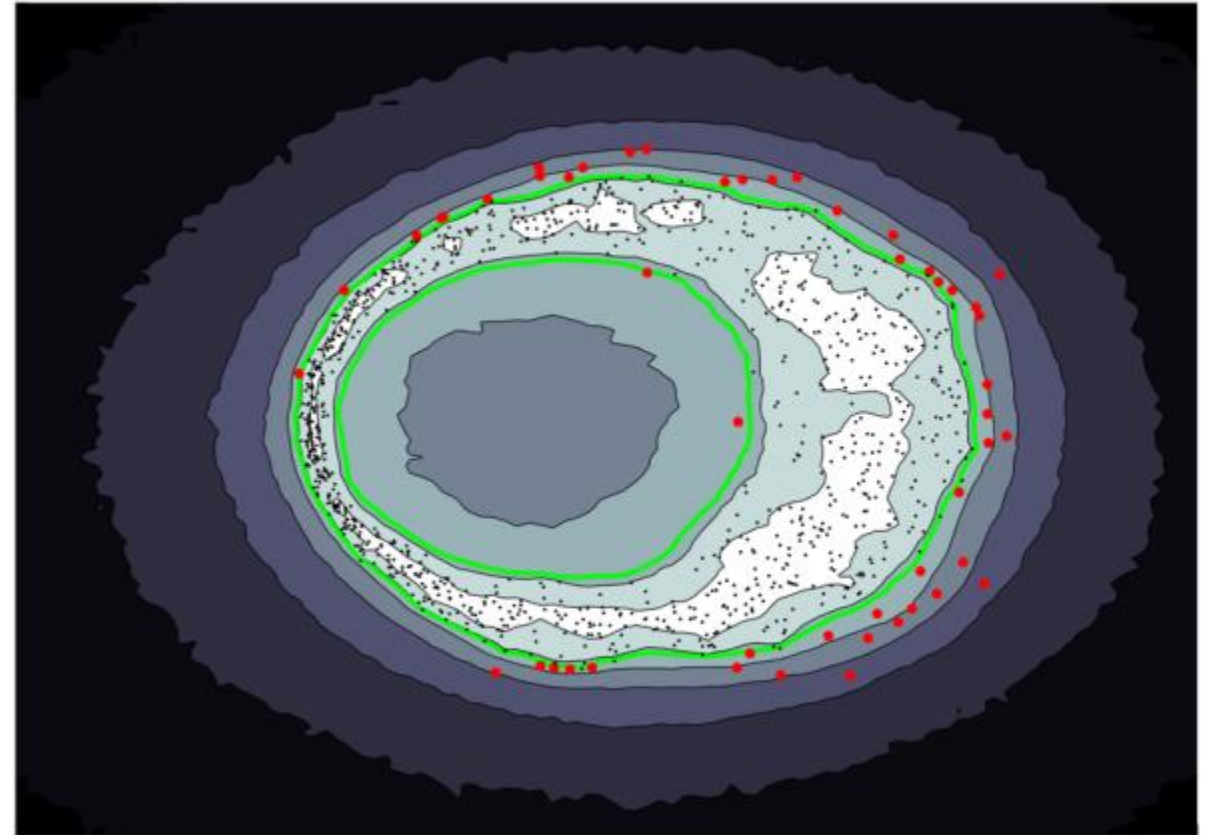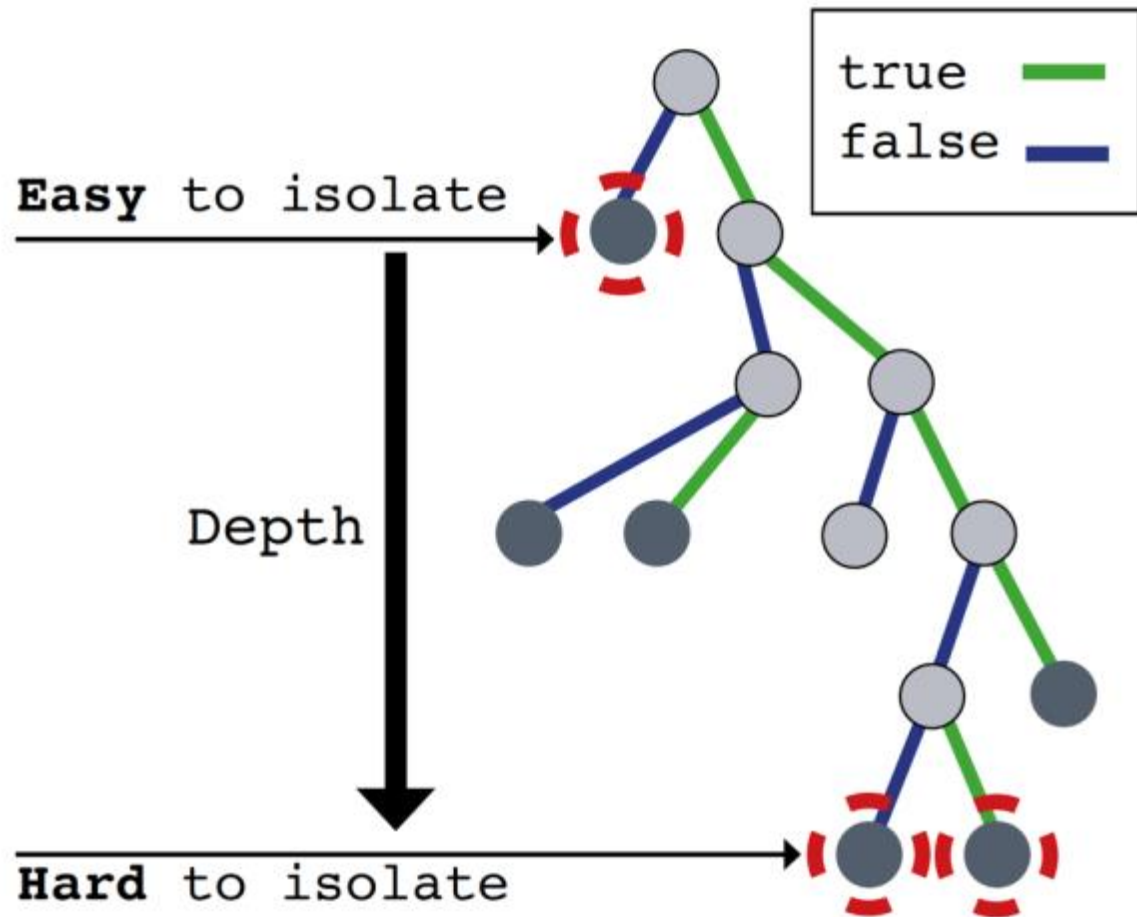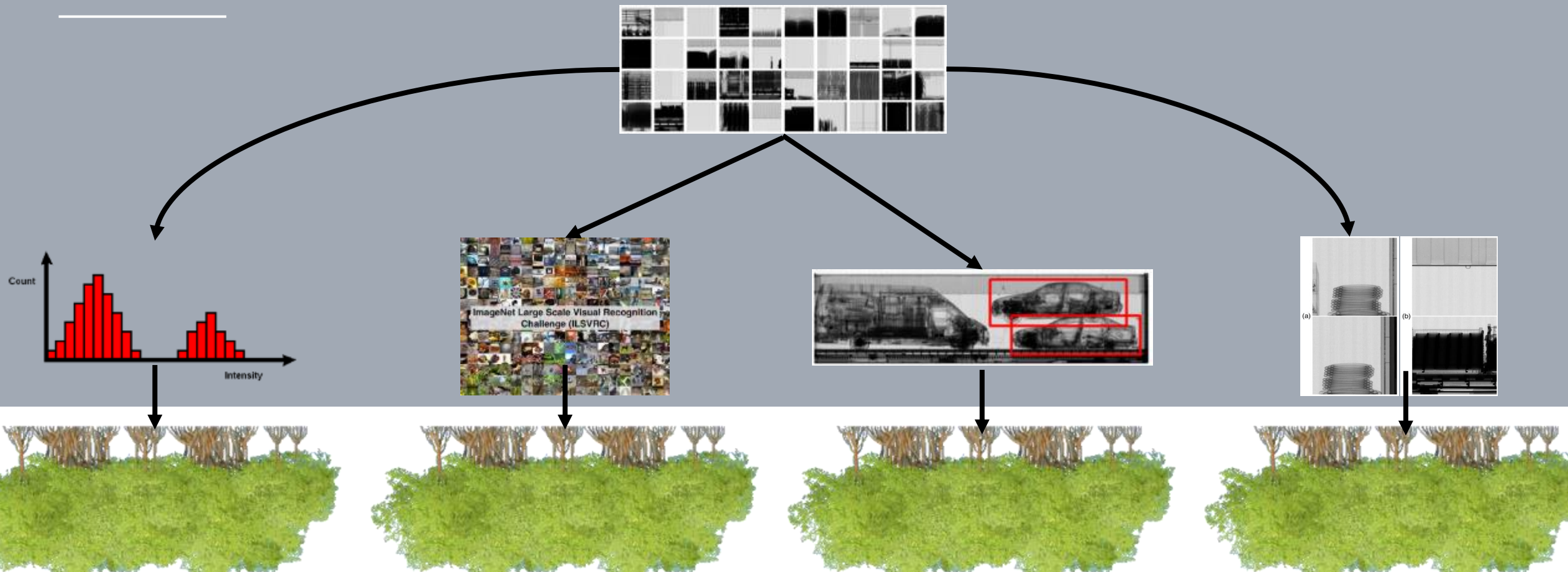
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Generation of anomaly samples for testing
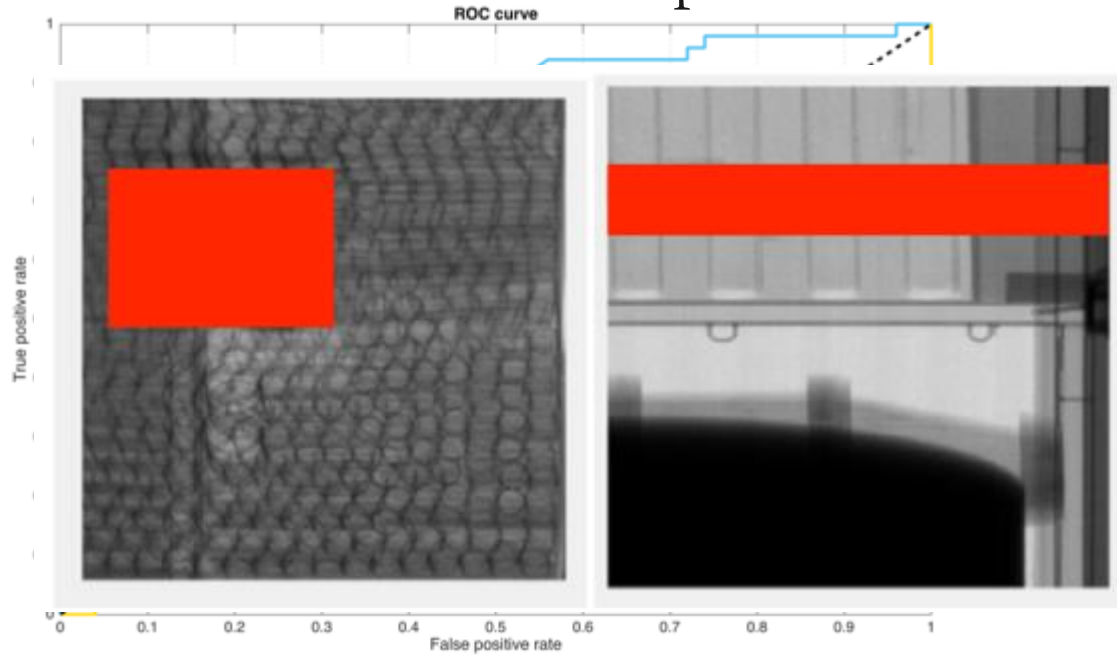
Example: Threats projected into SoC patches

Example: Thr   e bender

12.5k **threat** patches

12.5k **normal** patches

	Representation	AUC

In

CNN

CNN tr

CNN tra

(a)   (b)
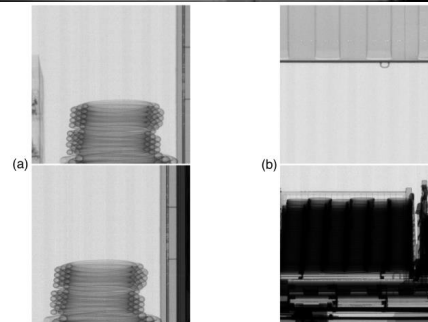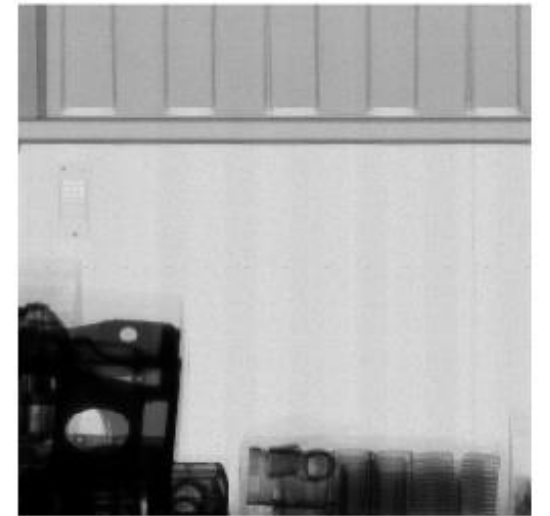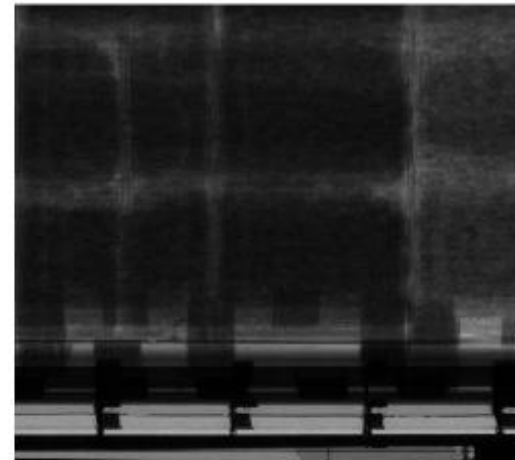
Summary:

Our *preliminary* results demonstrate that FRST is a viable approach to AD, when applied to representations learnt for a comparable task.

Future work:
1. CNN architecture and auxiliary task evaluation
2. Image-level heat maps by fusion of patch-level results

Thanks for listening!

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