GANomaly: Semi-Supervised Anomaly Detection via Adversarial Training

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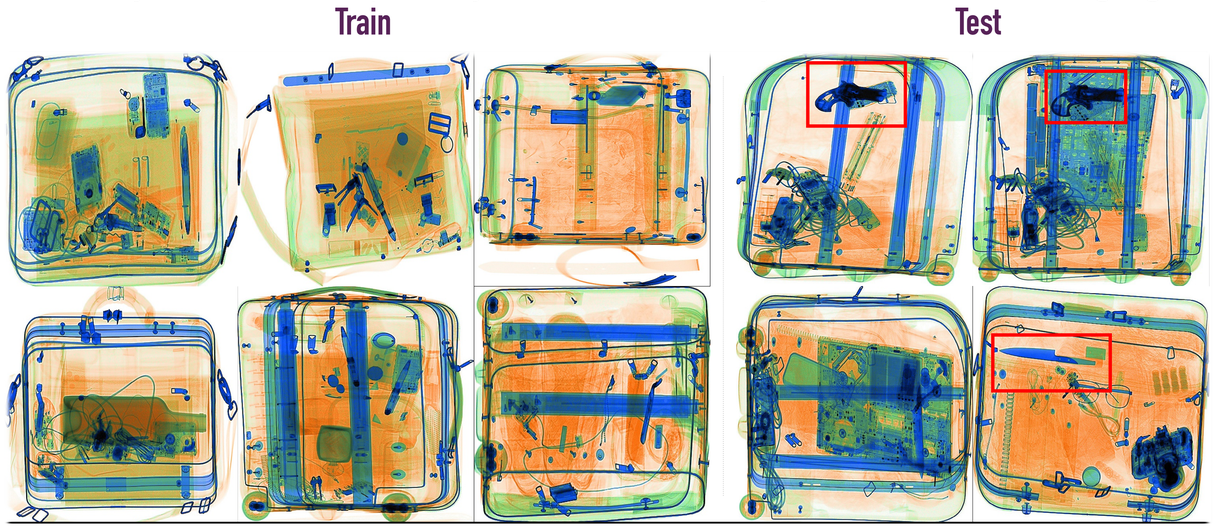
Motivation

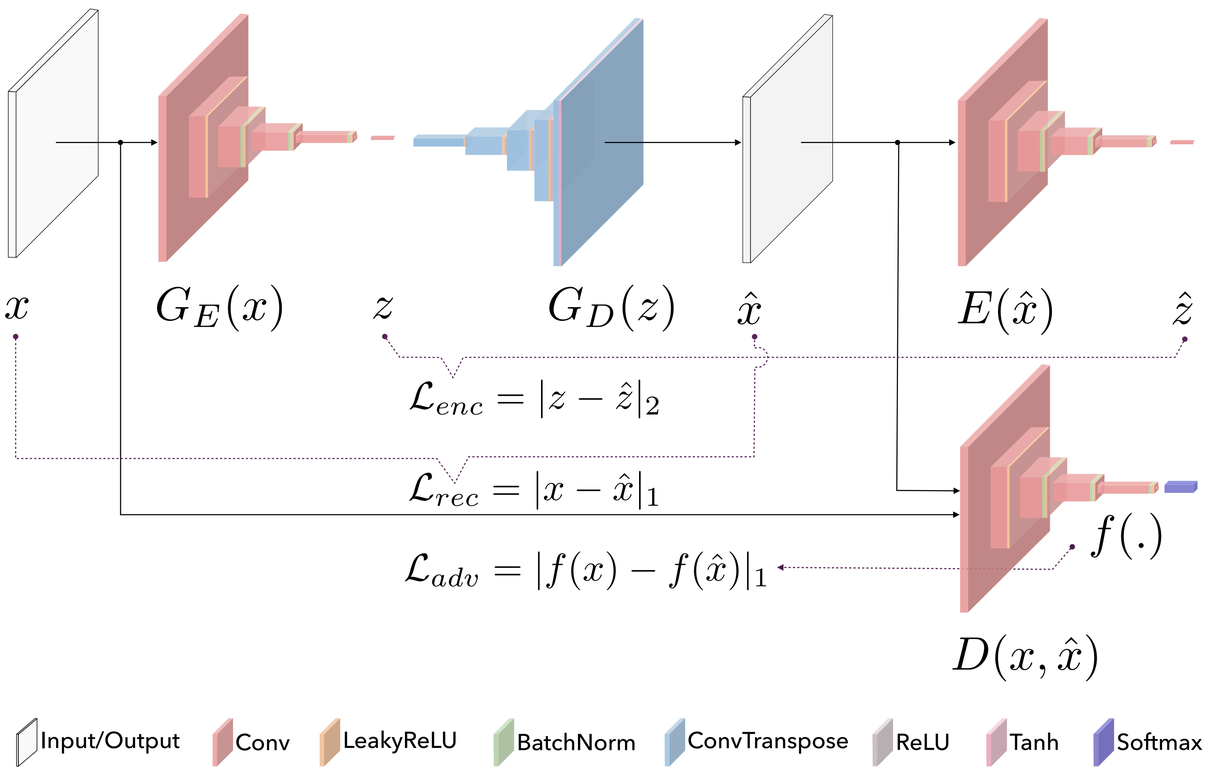
Datasets that are highly biased towards one class (normal) due to the insufficient sample size of the other class (abnormal) pose the task of anomaly detection - *especially when abnormality collection is challenging.*



Proposed Approach

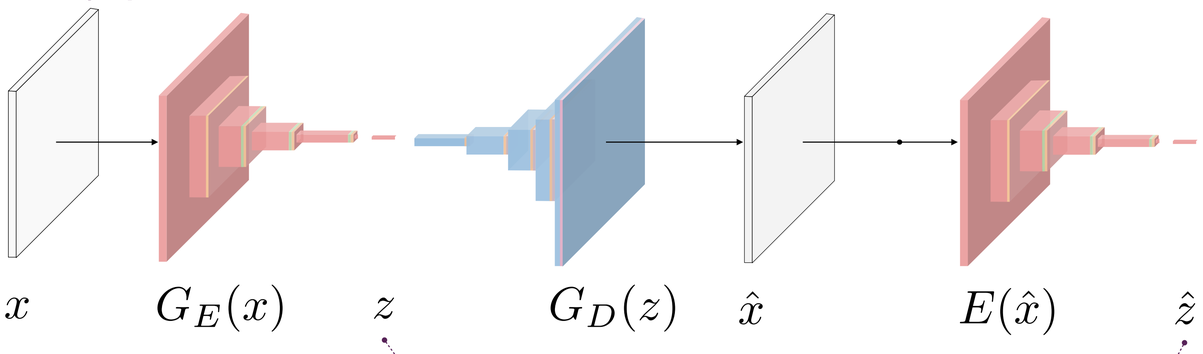
(i) **Train a novel encoder-decoder-encoder network** to jointly capture the distribution of the normal data via the generation of high-dimensional image space and the inference of latent space.

Training Pipeline



(ii) **Test anomalies within the latent space.** Anomaly detection is performed by computing the difference between latent vector representation of real and fake images.

Testing Pipeline

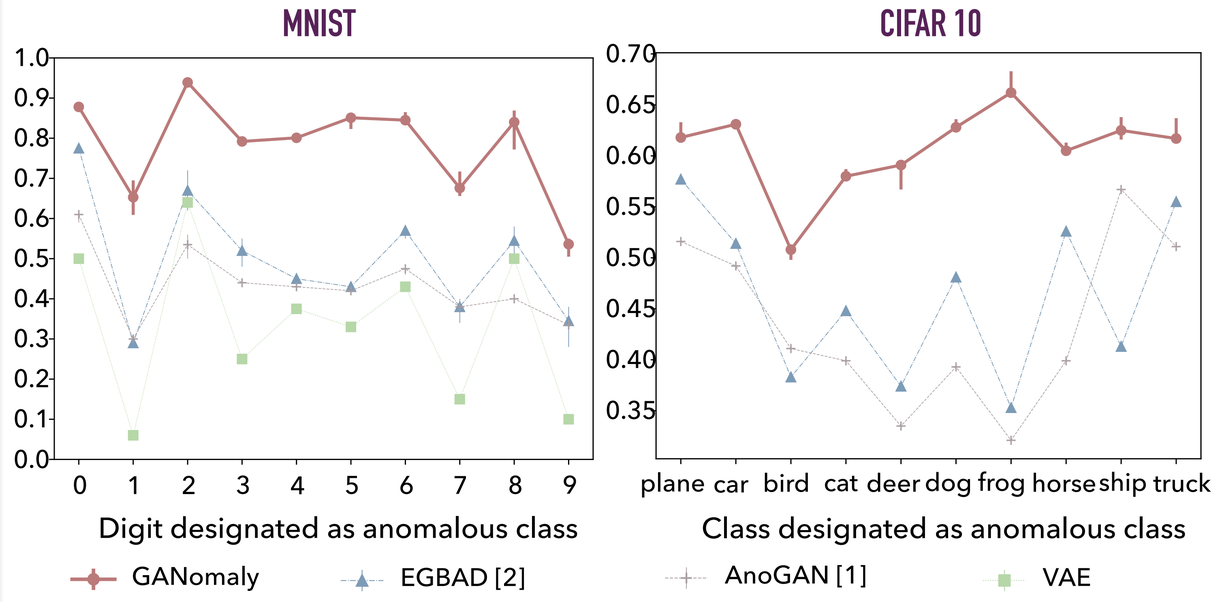


Results

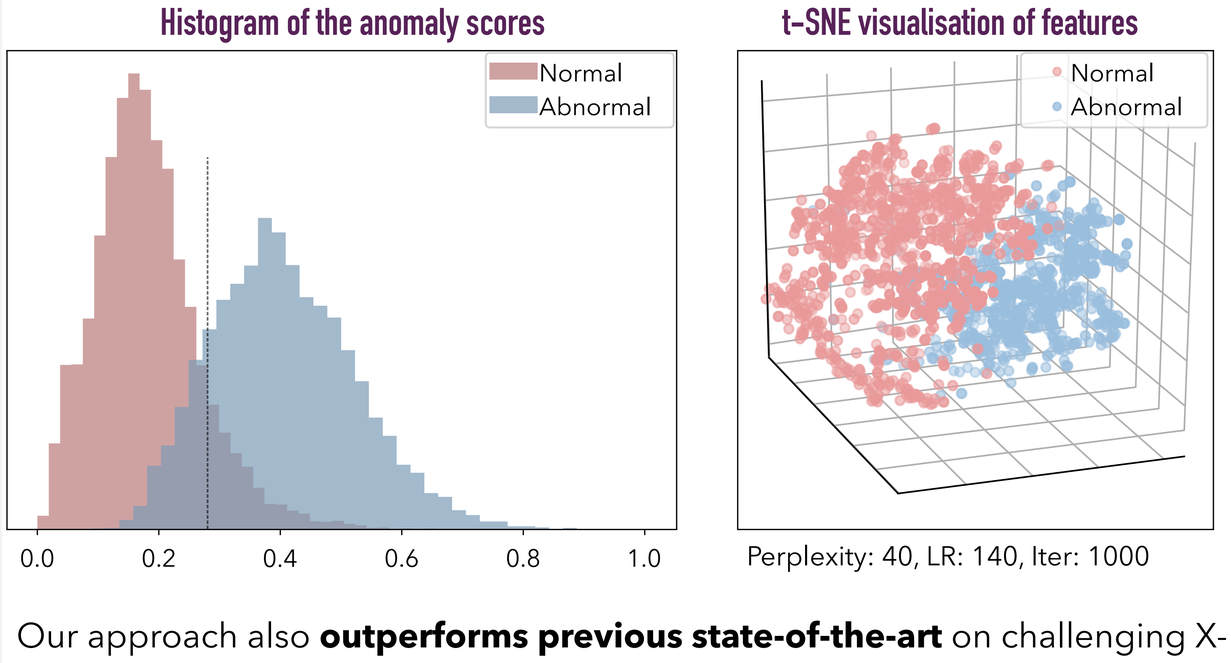
Our approach yields **quantitatively and computationally superior** performance in terms of run-time (ms) and abnormality detection (AUC).

Runtime (ms)	MNIST	CIFAR	UBA	FFOB
AnoGAN [1]	7120	7120	7110	7223
EGBAD [2]	8.92	8.71	8.88	8.87
GANomaly	**2.79**	**2.21**	**2.66**	**2.53**

GANomaly achieves the **highest AUC** on public datasets – MNIST and CIFAR



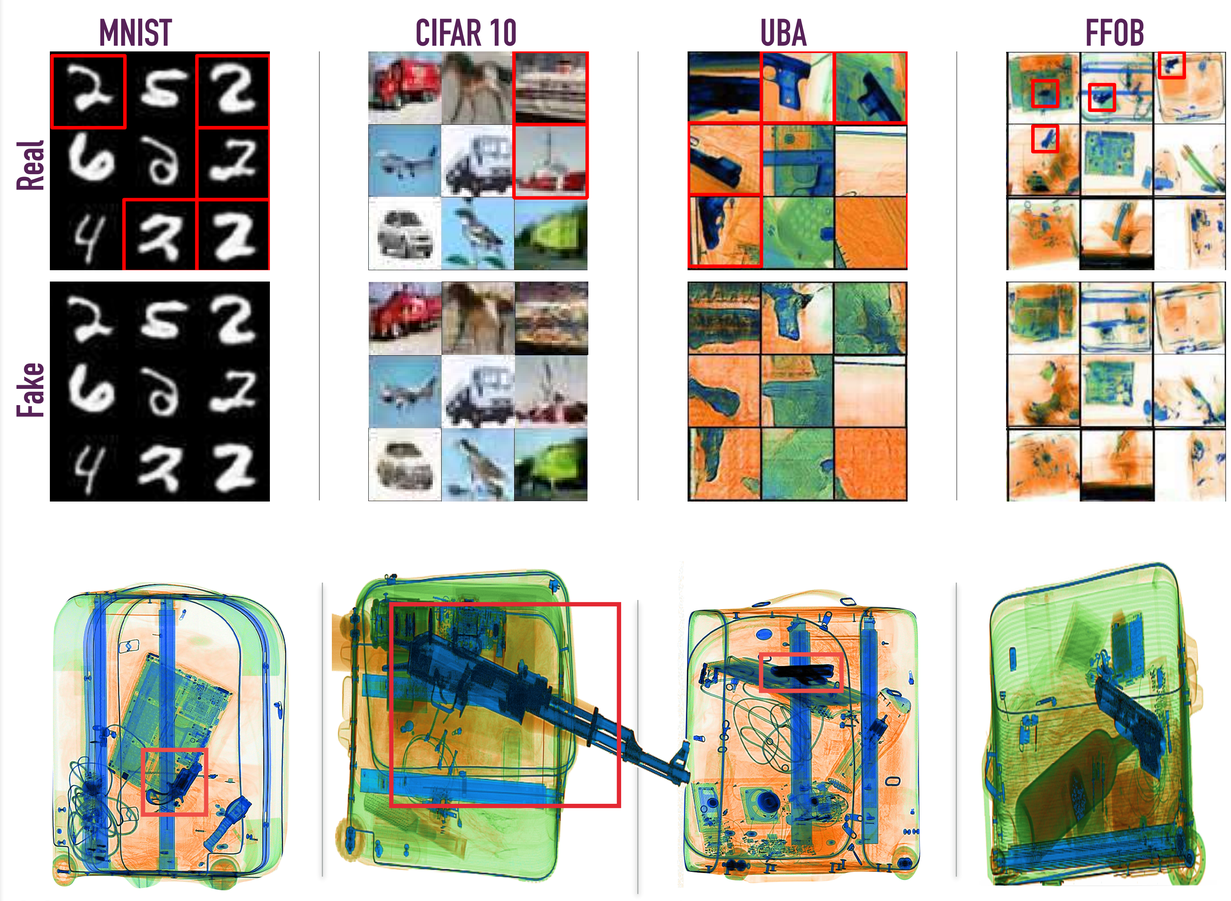
The model provides an **optimal feature space classification/separation.**



Our approach also **outperforms previous state-of-the-art** on challenging X-ray baggage security screening domain.

X-ray Datasets	UBA				FFOB
Model	gun	gun parts	knife	overall	full weapon
AnoGAN [1]	0.598	0.511	**0.599**	0.569	0.703
EGBAD [2]	0.614	0.591	0.587	0.597	0.712
GANomaly	**0.747**	**0.662**	0.520	**0.643**	**0.882**

Our GAN approach generates normal samples but fails to produce abnormal ones - illustrating **effective capture of the normal class distribution**.



[1] Schlegl, T., Seeböck, P., Waldstein, S. M., Schmidt-Erfurth, U., & Langs, G. (2017). Unsupervised anomaly detection with generative adversarial networks to guide marker discovery. Lecture Notes in Computer Science, 10265 LNCS, 146–147.

[2] Zenati, H., Foo, C. S., Lecouat, B., Manek, G., & Chandrasekhar, V. R. (2018). Efficient GAN-Based Anomaly Detection. http://arxiv.org/abs/1802.06222

https://github.com/samet-akcay/ganomaly

Paper

Code