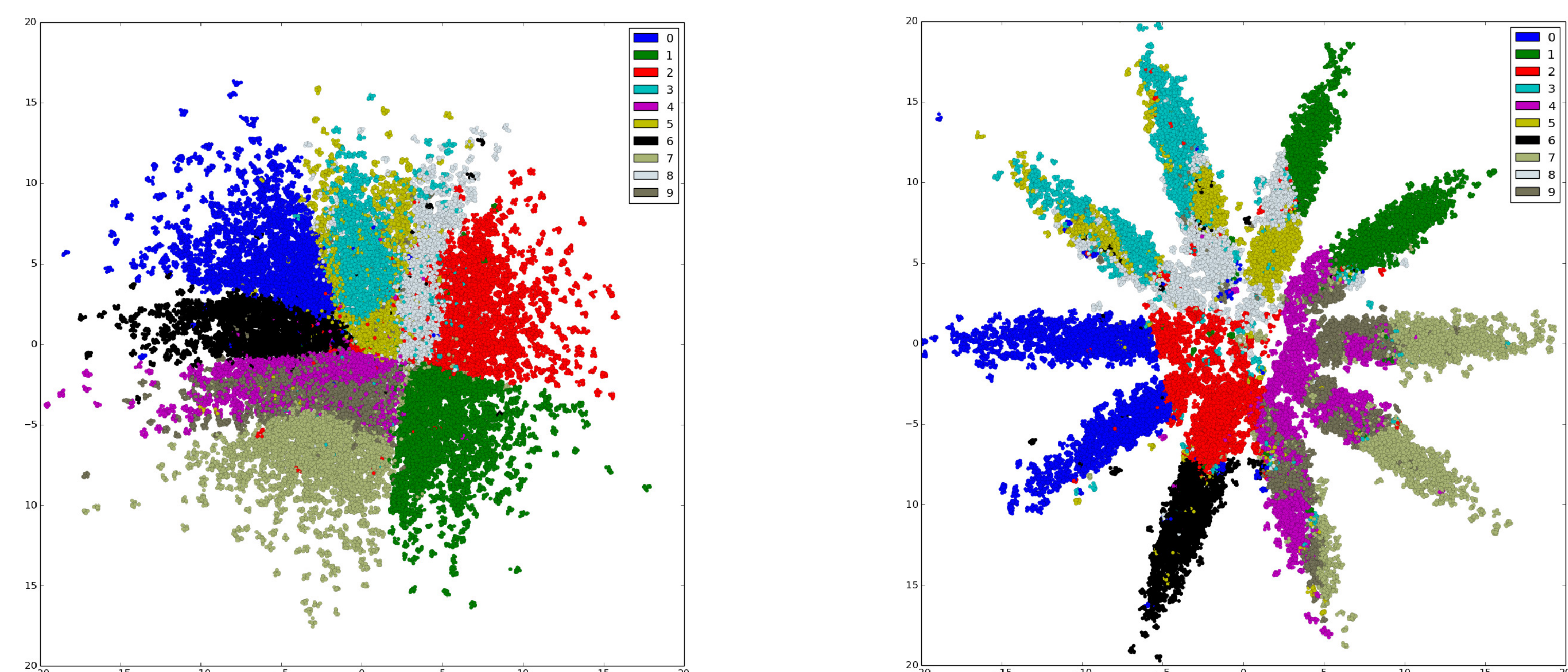
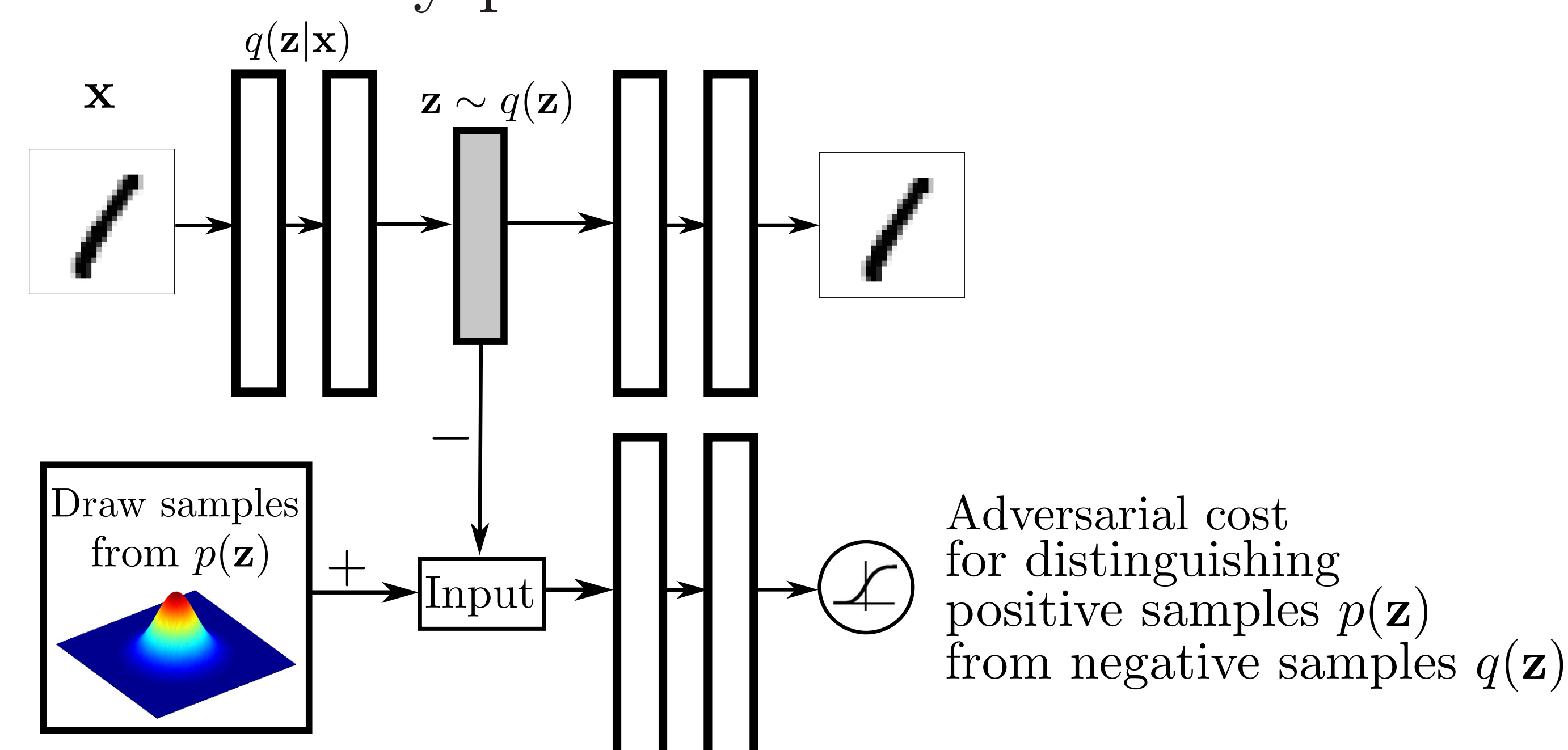




BACKGROUND: ADVERSARIAL AUTOENCODERS

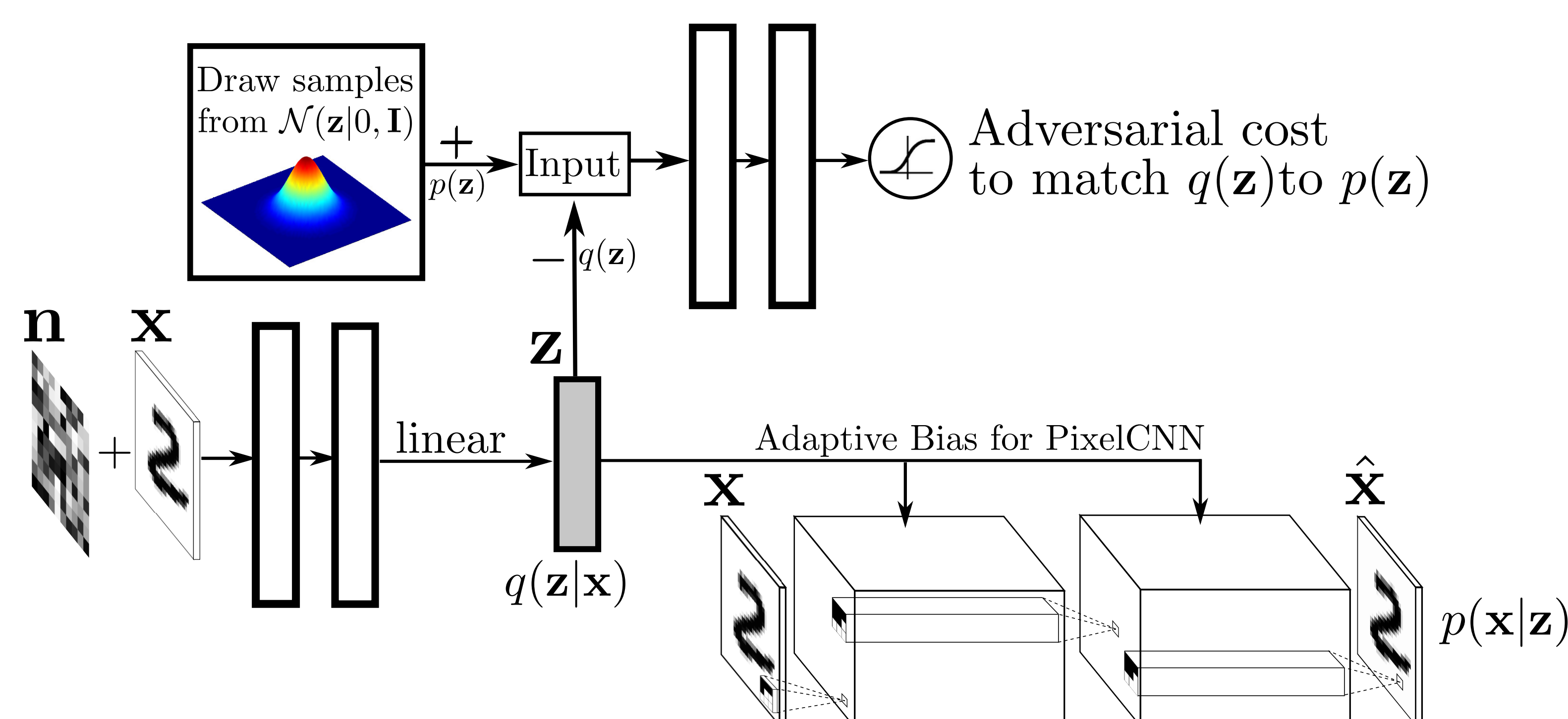
Adversarial autoencoders (Makhzani et al., 2016) are generative autoencoders that use the GAN framework to impose an arbitrary prior on the latent code.



MNIST code space: (a) Gaussian prior (b) Mixture of Gaussians prior

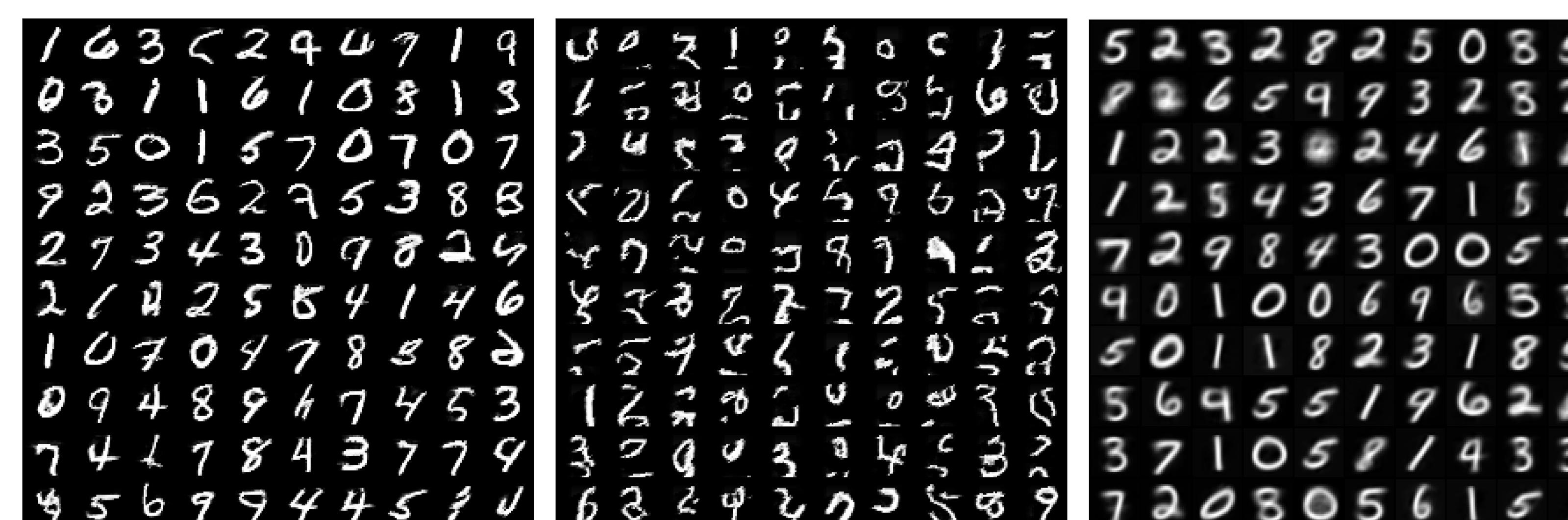
PIXELGAN AUTOENCODERS

In PixelGAN autoencoders, the image statistics are jointly captured by the latent code and the autoregressive decoder.

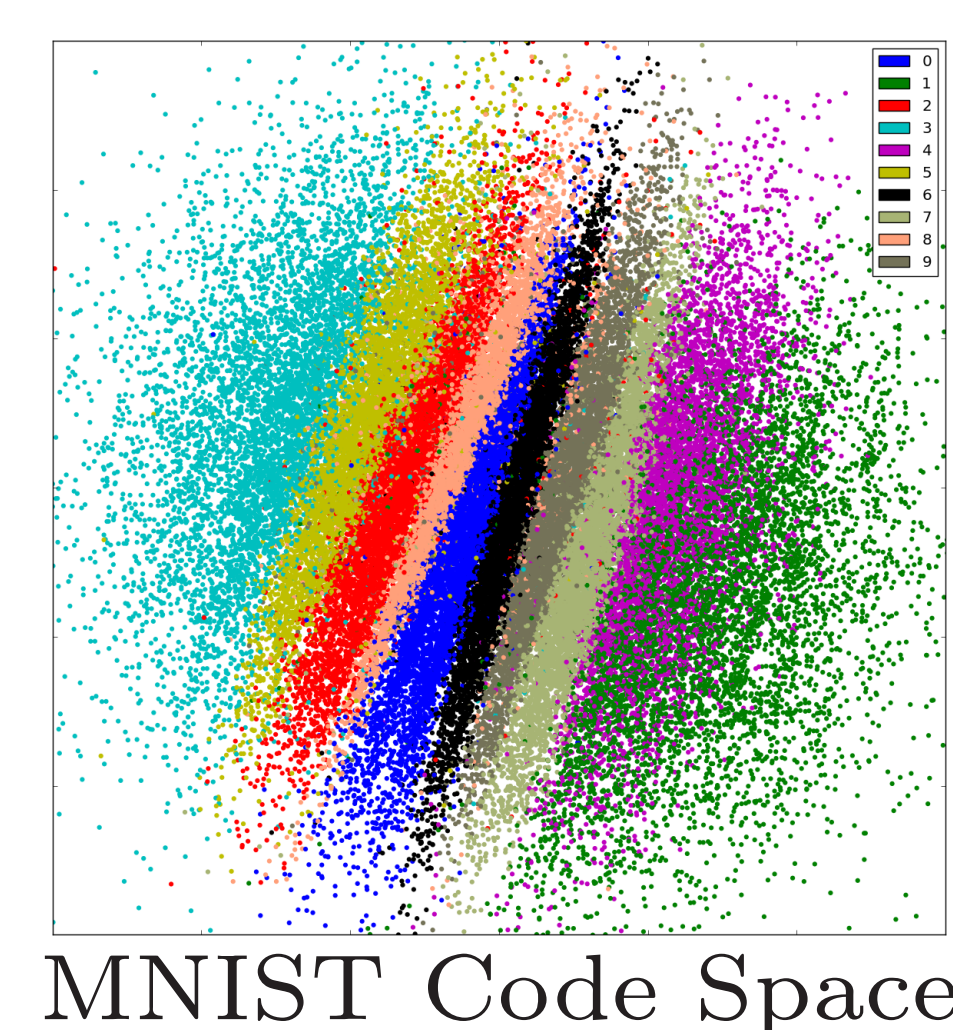


PIXELGAN AUTOENCODER WITH GAUSSIAN PRIOR

PixelGAN autoencoders with Gaussian prior achieve a **global vs. local decomposition** of information:



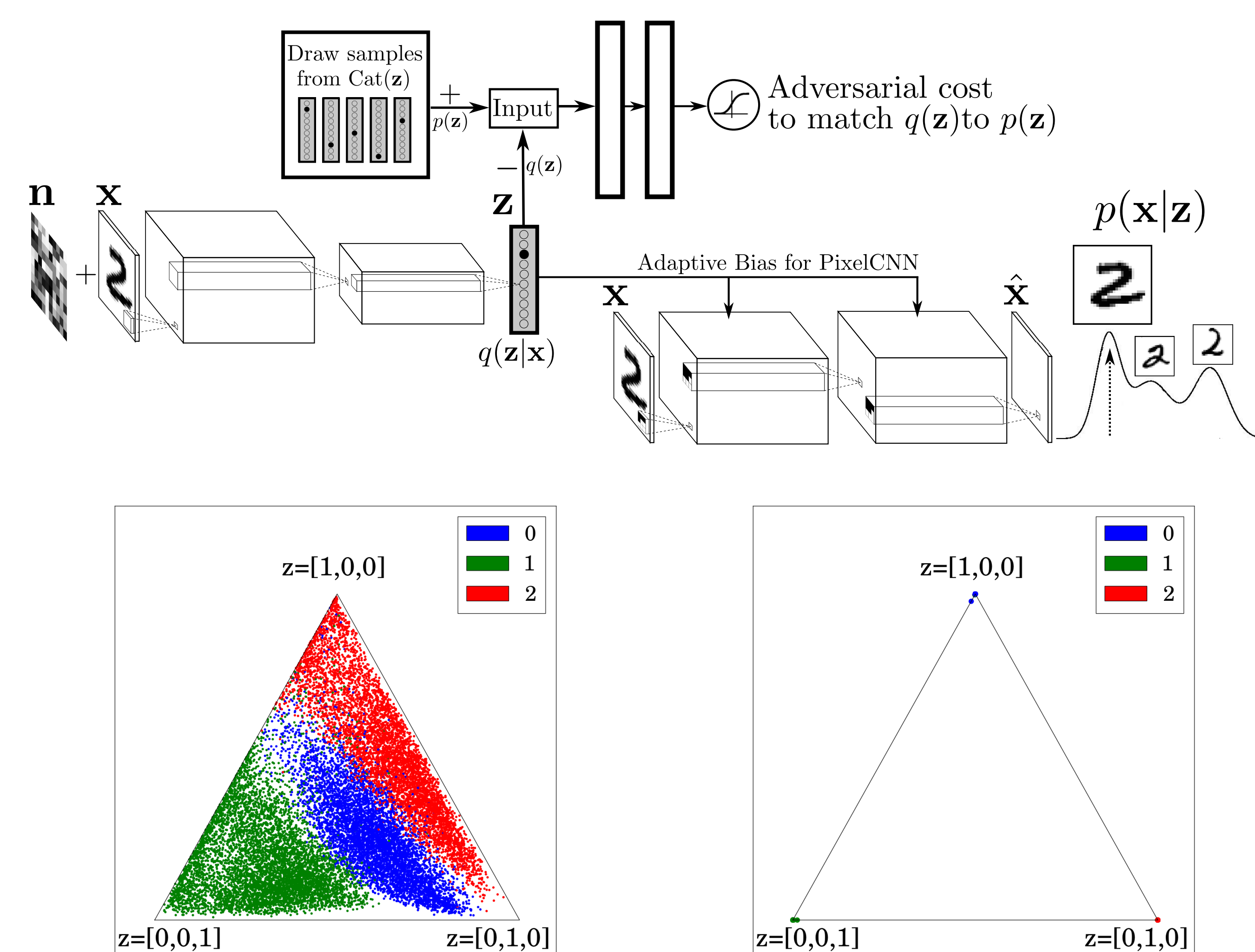
(a) PixelGAN Autoencoder (2D code, limited receptive field) (b) PixelCNN (limited receptive field) (c) Adversarial Autoencoder (2D code)



MNIST Code Space

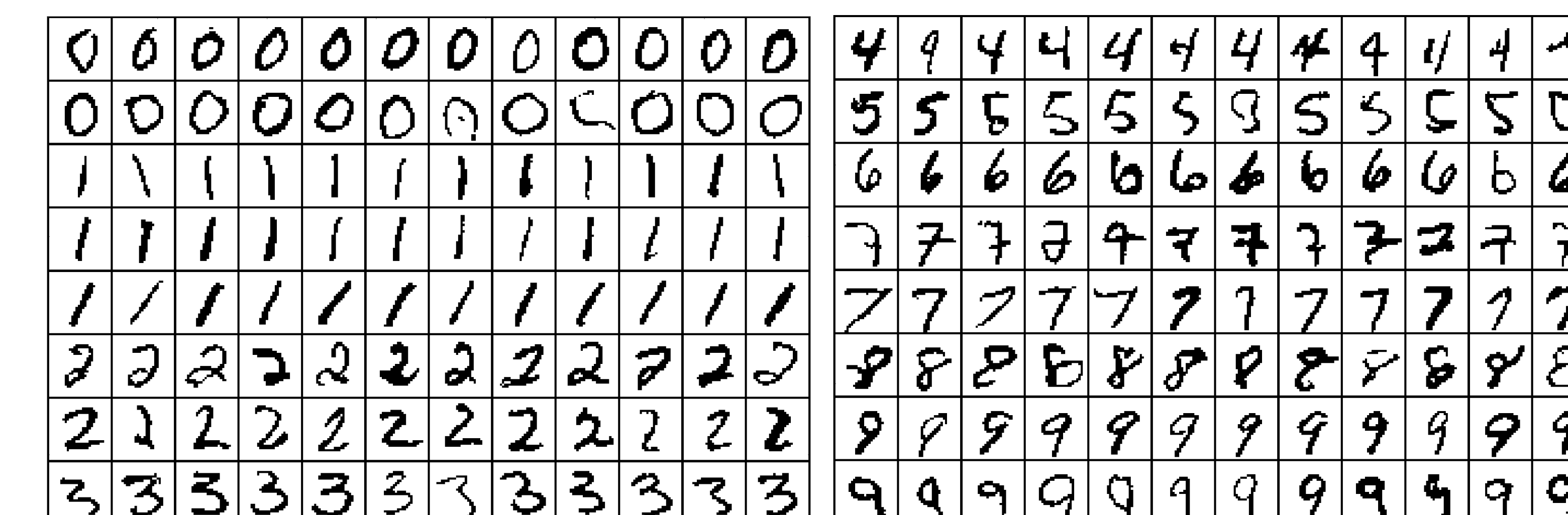
PIXELGAN AUTOENCODER WITH CATEGORICAL PRIOR

PixelGAN autoencoders with categorical prior achieve a **discrete vs. continuous decomposition** of information:



Code space of the first 3 digits of MNIST (a) without adversarial regularization (b) with adversarial regularization

CLUSTERING



Disentangling the content and style in an unsupervised fashion with PixelGAN autoencoders. Each row shows samples of the model from one of the learnt clusters.

SEMI-SUPERVISED LEARNING



Conditional samples of the semi-supervised PixelGAN autoencoder (a) SVHN (1000 labels) (b) MNIST (100 labels) (c) NORB (1000 labels)

	MNIST (Unsupervised)	MNIST (20 labels)	MNIST (50 labels)	MNIST (100 labels)
VAE	-	-	-	3.33 (± 0.14)
VAT	-	-	-	2.33
ADGM	-	-	-	0.96 (± 0.02)
SDGM	-	-	-	1.32 (± 0.07)
Adversarial Autoencoder	4.10 (± 1.13)	-	-	1.90 (± 0.10)
Ladder Networks	-	-	-	0.89 (± 0.50)
Convolutional CatGAN	4.27	-	-	1.39 (± 0.28)
InfoGAN	5.00	-	-	-
Feature Matching GAN	-	16.77 (± 4.52)	2.21 (± 1.36)	0.93 (± 0.06)
PixelGAN Autoencoders	5.27 (± 1.81)	12.08 (± 5.50)	1.16 (± 0.17)	1.08 (± 0.15)

	SVHN (500 labels)	SVHN (1000 labels)	NORB (1000 labels)
VAE	-	36.02 (± 0.10)	18.79 (± 0.05)
VAT	-	24.63	9.88
ADGM	-	22.86	10.06 (± 0.05)
SDGM	-	16.61 (± 0.24)	9.40 (± 0.04)
Adversarial Autoencoder	-	17.70 (± 0.30)	-
Feature Matching GAN	18.44 (± 4.80)	8.11 (± 1.30)	-
Temporal Ensembling	7.05 (± 0.30)	5.43 (± 0.25)	-
PixelGAN Autoencoders	10.47 (± 1.80)	6.96 (± 0.55)	8.90 (± 1.0)

Semi-supervised Classification Results