Image domain translation with GANS

Hidde Lekanne gezegd Deprez

Motivation

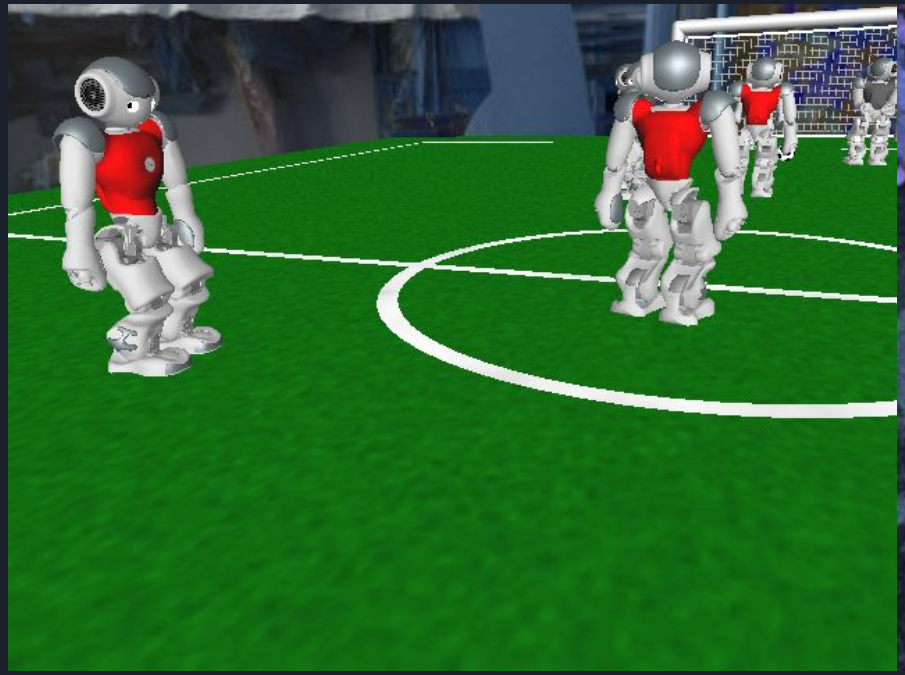
- There are lots of simulations
- Improve them all

Acknowledgements

- Big thanks to the HULKs
- Thank you B-Human

What did I do?

Tried to close this reality gap with a GAN architecture



How did I do it?

Generative Adversarial Networks

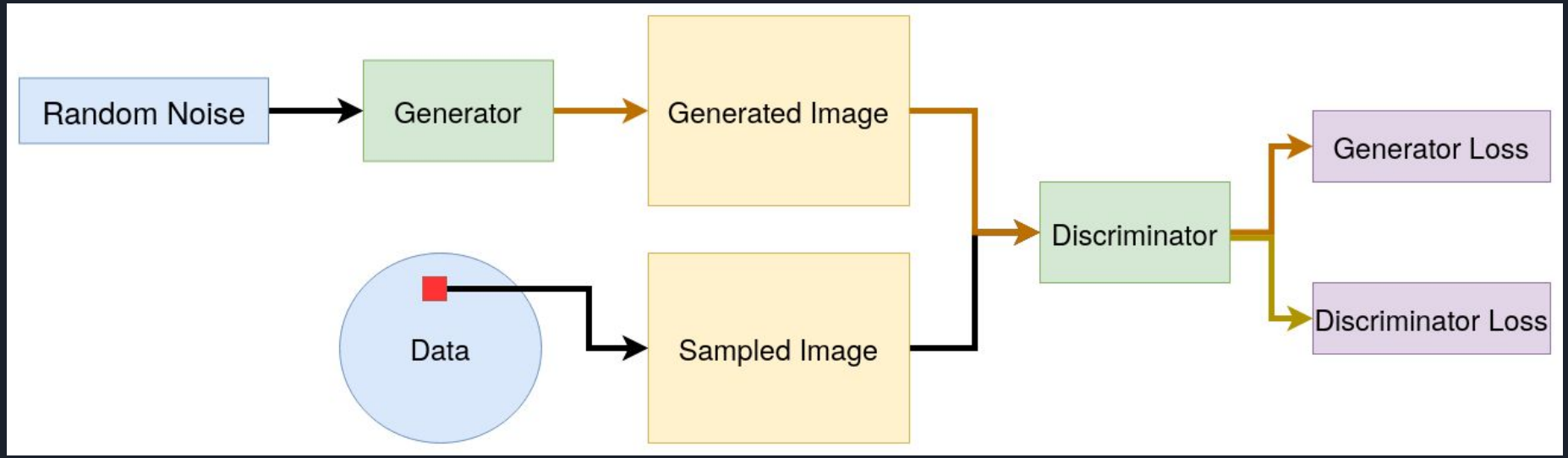


Image-to-image translation

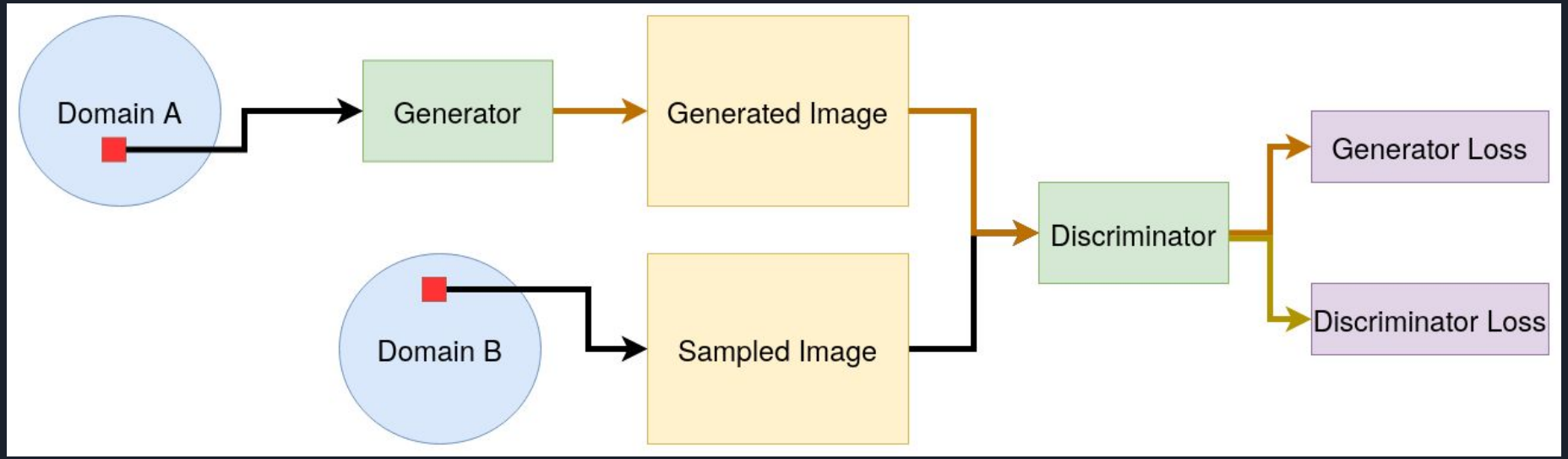
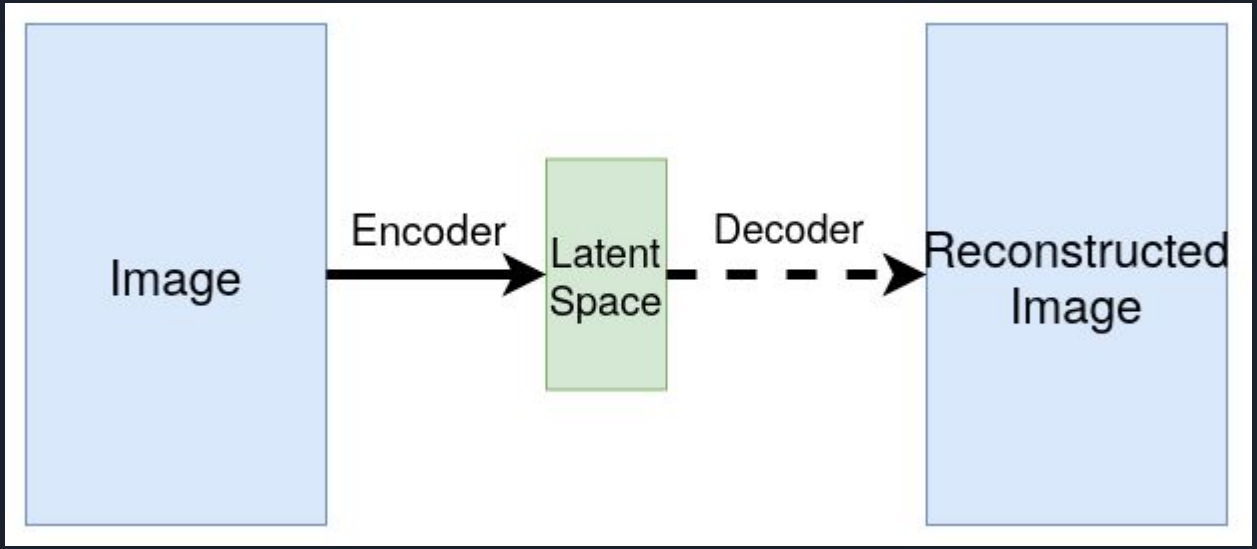


Image-to-image translation

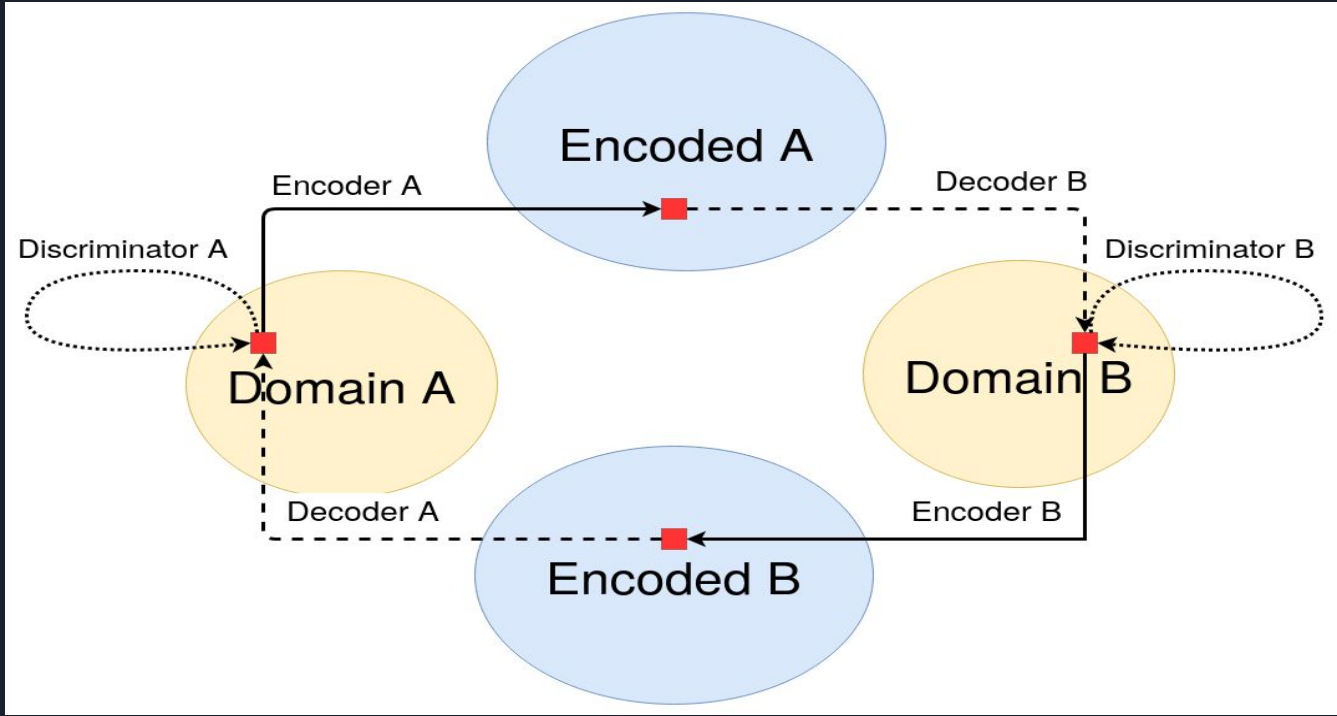
Some considerations:

- Unsupervised vs supervised
- One to many vs one to one
- Detangled or not

Variational Autoencoders



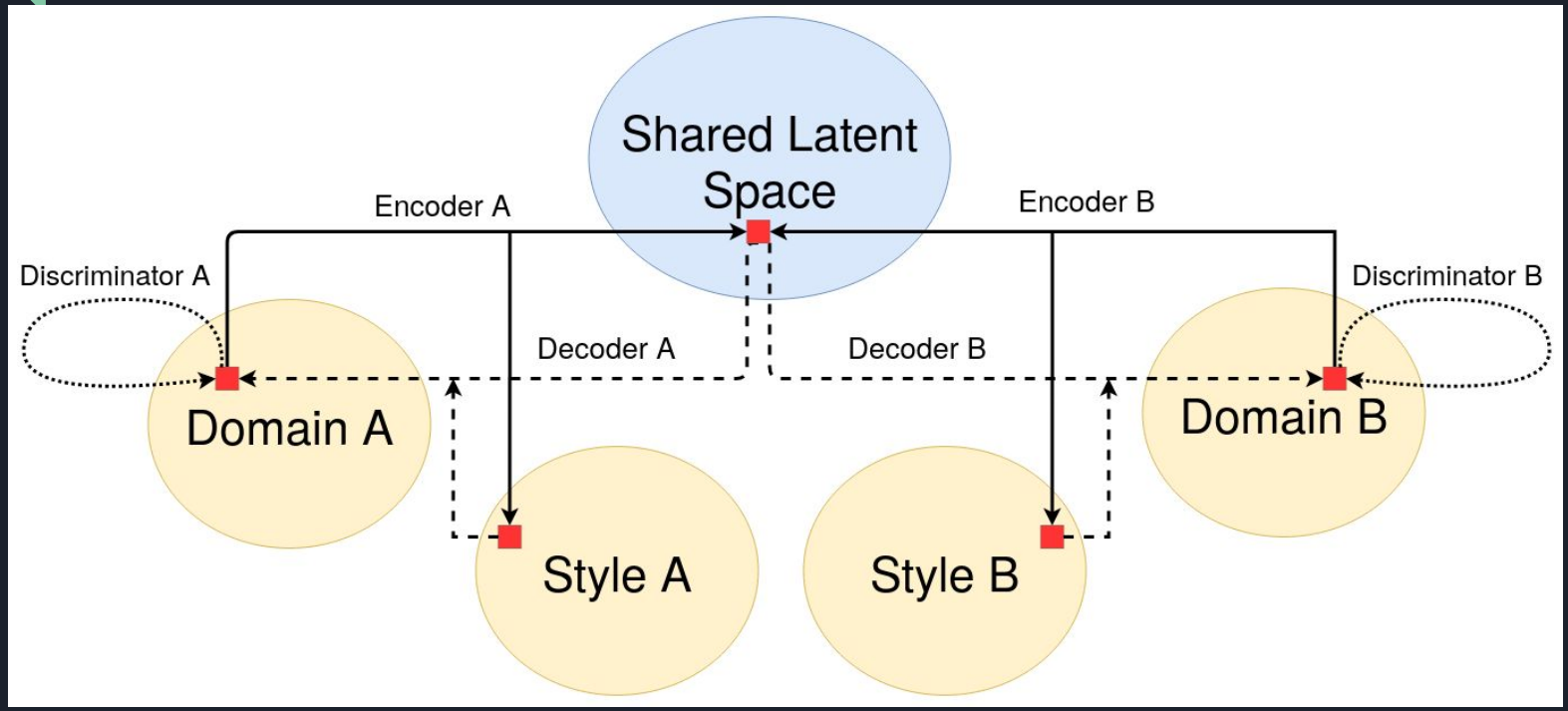
CycleGan


Encoded A
Encoder A
Decoder B
Discriminator A
Discriminator B
Domain A
Domain B
Decoder A
Encoder B
Encoded B

CycleGan

- Cycle loss A->B->A’ = A
- Identity loss A->A’ = A
- Discriminator loss A->B = Sample of B

MUNIT


Shared Latent Space
Encoder A
Encoder B
Discriminator A
Discriminator B
Decoder A
Decoder B
Domain A
Domain B
Style A
Style B

Adjusted loss

- Only do the A->B->A from the simulation
- Increase the weights of cycle loss

How good did I do?

Evaluation

- Frechet Inception Distance (FID)
- Train a Instance Segmenter

FIDs

- Curvature similarity over datasets
- Datasets approximated as multivariate gaussian

	Simulation	Real
CycleGan	207.270	52.773
CycleGan adjusted loss	**176.545**	38.085
MUNIT	212.587	38.982
MUNIT adjusted loss	202.637	**28.096**

MASK-RCNN

- Instance segmenter
- Bounding boxes first, then segmentation
- RCNN = Region convolutional neural net (not recurrent)

MASK-RCNN

- Segmentions Average Precision scores

	lines	robots	goalframe	goalnet	field	ball	background
Pure Simulation	4.603	**72.623**	**50.758**	**81.292**	**92.158**	**80.130**	**92.364**
CycleGan	4.76	64.572	41.892	73.729	92.424	70.392	90.300
CycleGan adjusted loss	**4.88**	67.298	44.736	76.739	92.539	72.374	90.936
MUNIT	3.803	54.248	29.565	63.974	90.921	49.814	86.036
MUNIT adjusted loss	4.201	58.058	33.557	66.484	91.227	61.317	87.351

	robots	ball
Pure Simulation	0	0
CycleGan	47.479	49.497
CycleGan adjusted loss	49.232	42.327
MUNIT	55.926	50.835
MUNIT adjusted loss	**56.705**	**50.910**

Panoptic Segmentation

- Fusion of semantic segmentation and object segmentation

Questions?

Bonus

Bonus