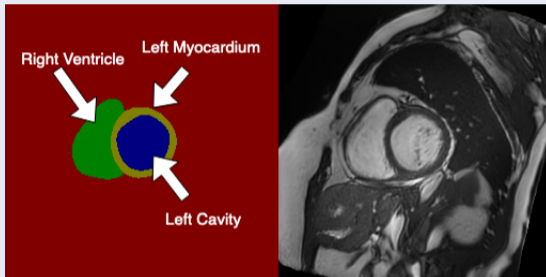# On the effectiveness of GAN generated cardiac MRIs for segmentation

Youssef Skandarani, Nathan Painchaud, Pierre-Marc Jodoin and Alain Lalande
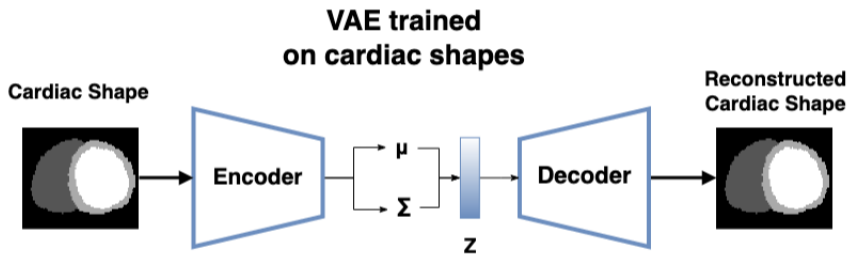
Introduction

Can we use GANs to generate cardiac MR images as well as their anatomical map?
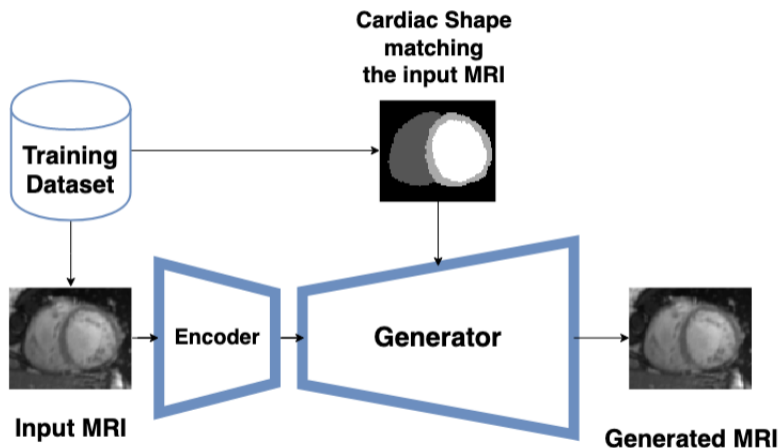
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Method: Training

We train the cVAE[1] to reconstruct cardiac shapes
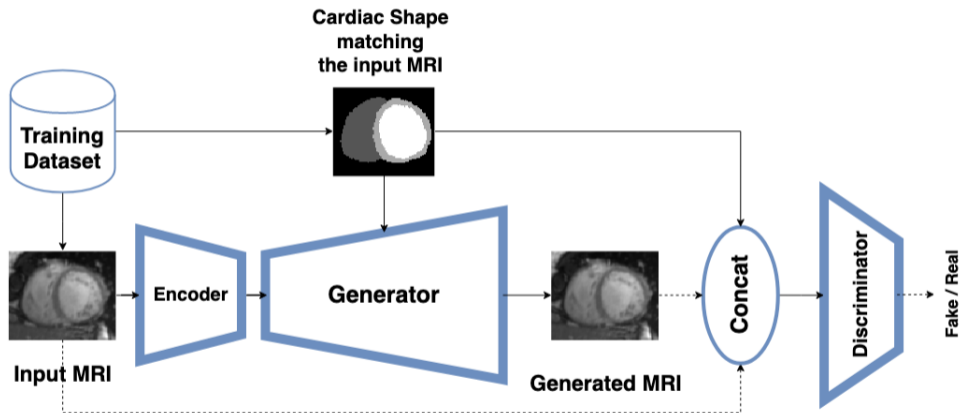
[1] Painchaud et al. 2019

Method: Training

We condition the generator of the SPADE[1] based GAN on anatomical maps
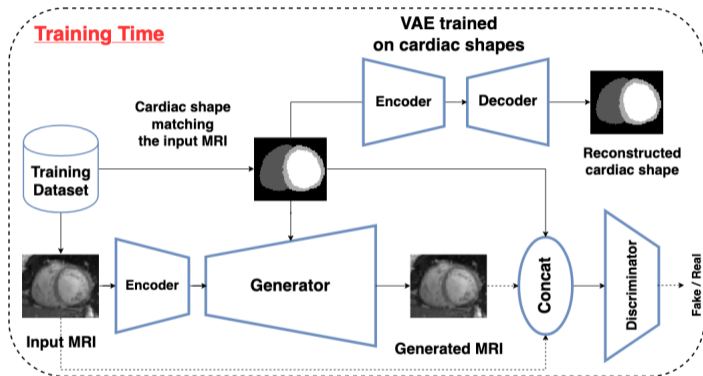
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[1]Park et al. 2019

Method: Training

We train the SPADE[1] based GAN on MRIs and their segmentation maps
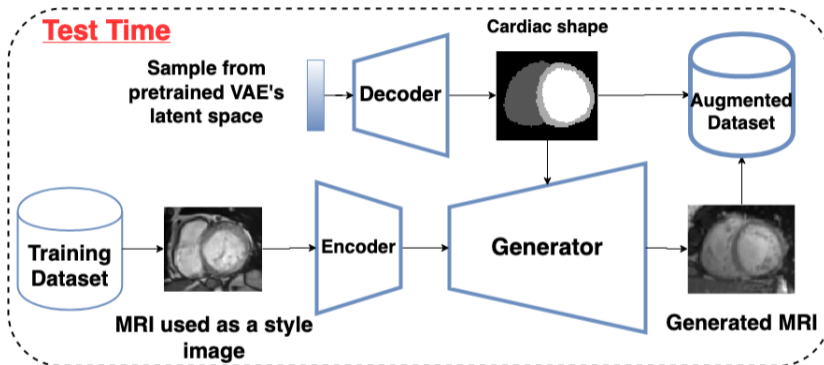
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[1]Park et al. 2019

Method: Training

We train the VAE on cardiac shapes in parallel with the SPADE[1] based GAN on MRIs

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[1]Park et al. 2019

Method: Dataset Generation

To generate a large number of annotated MRIs, we leverage the decoder of the cardiac shapes VAE and the generator of the SPADE based GAN

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Experimental results

Testing	Dataset	
ACDC	ACDC	0.854
	Gen. ACDC[*]	**0.888**

Testing	Dataset	
Sunnybrook	Sunnybrook	0.798
	Gen. Sunny[*]	**0.816**

Dice scores of segmentation using ENet[1] on ACDC and Sunnybrook datasets

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[1]Paszke et al. 2016

[*]The generated datasets contain 100k images

ACDC: https://acdc.creatis.insa-lyon.fr/description/

Sunnybrook: http://www.cardiacatlas.org/studies/sunnybrook-cardiac-data/

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Experimental results

Dataset	Original	Fine-Tuning on ACDC
ACDC	0.854	—
Gen. ACDC	0.888	**0.908**

Dataset	Original	Fine-Tuning on Sunnybrook
Sunnybrook	0.798	—
Gen. Sunny	0.816	**0.874**

Dice scores of segmentation using ENet[1] on ACDC and Sunnybrook datasets[*]

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[1]Paszke et al. 2016

[*]For more results, please refer to the paper

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Experimental results

Cardiac shapes and their corresponding MRI, all generated by our method

Summary and remarks

Take home message

- Conditional GANs can effectively generate cardiac MRIs as well as their associated groundtruth
- GANs are good for data augmentation

Future work

- Conditional GANs for class imbalanced datasets
- Investigate GANs on other modalities

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