

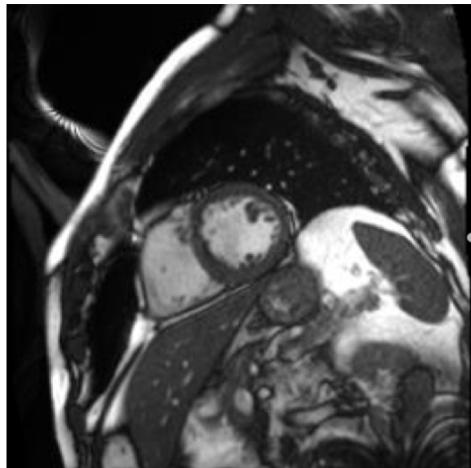
Compressed Sensing MRI Reconstruction using a Generative Adversarial Network With a Cyclic Loss

Huidong Xie

Main contributions

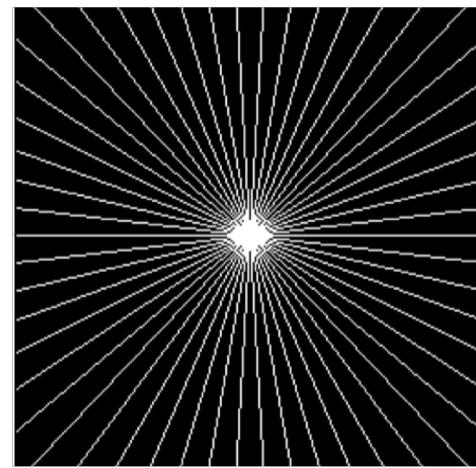
- This work proposes a deep learning based W-GAN model called *Refined GAN*, for CS-MRI.
- This is the first CS-MRI method employ a cyclic loss with fully residual convolutional GANs.
- Reconstruction speed is extremely rapid. Under 100 ms for a 256*256 image.
- Superior image quality (over 42 dB in average for 40% sampling)

Method

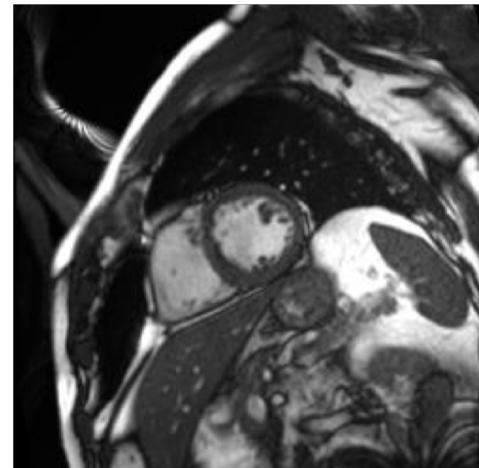
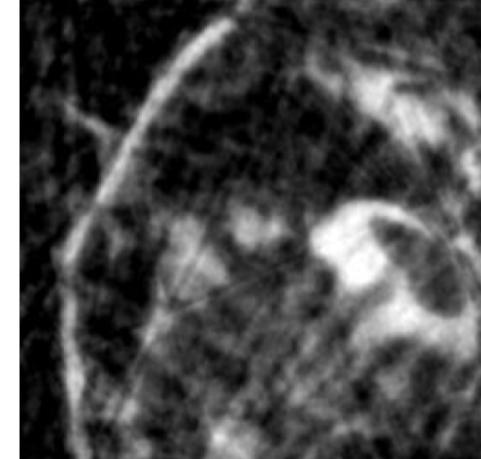


Fourier
Transform
And sampling

Radial sampling

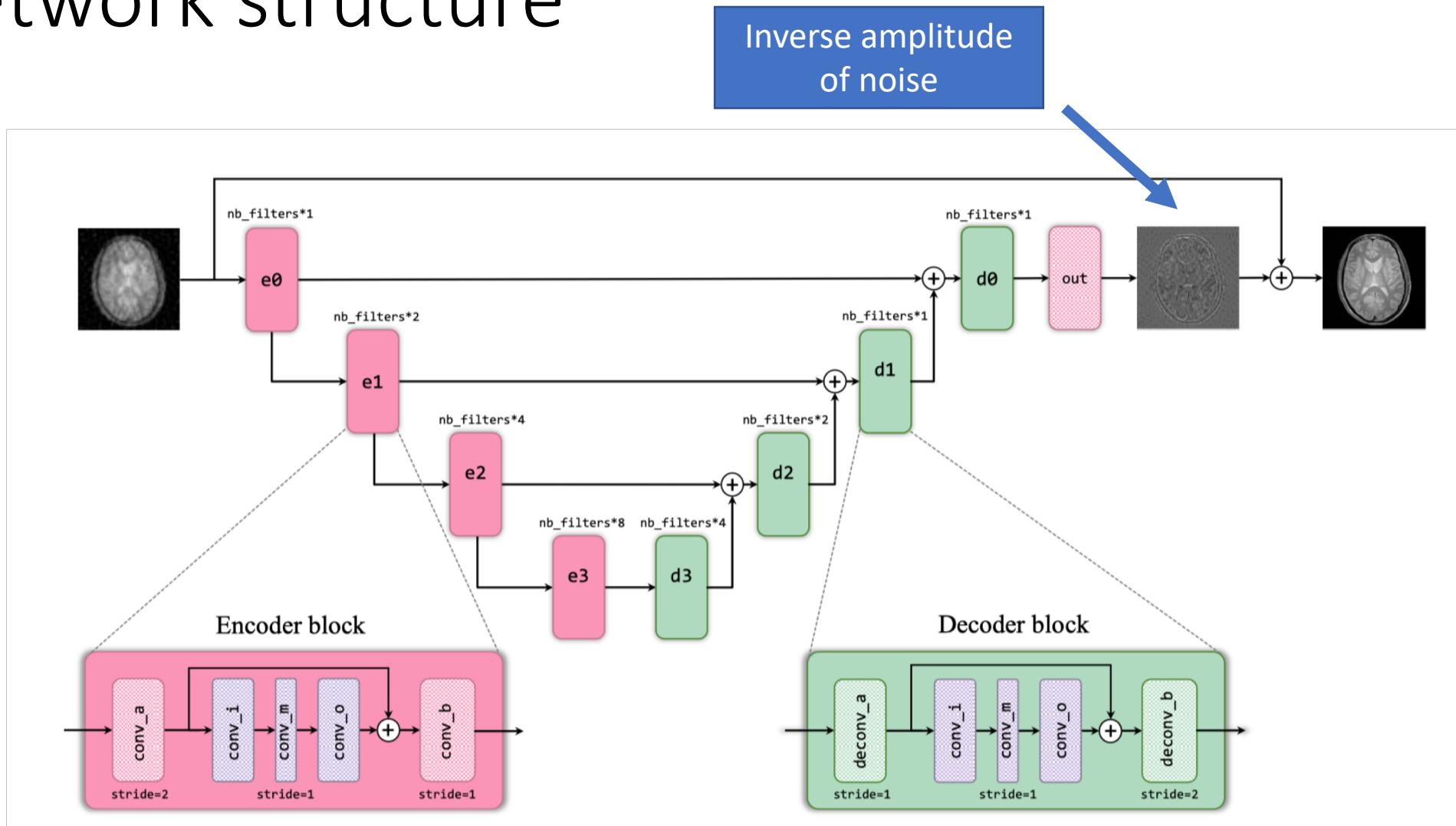


Zero Filling
Reconstruction

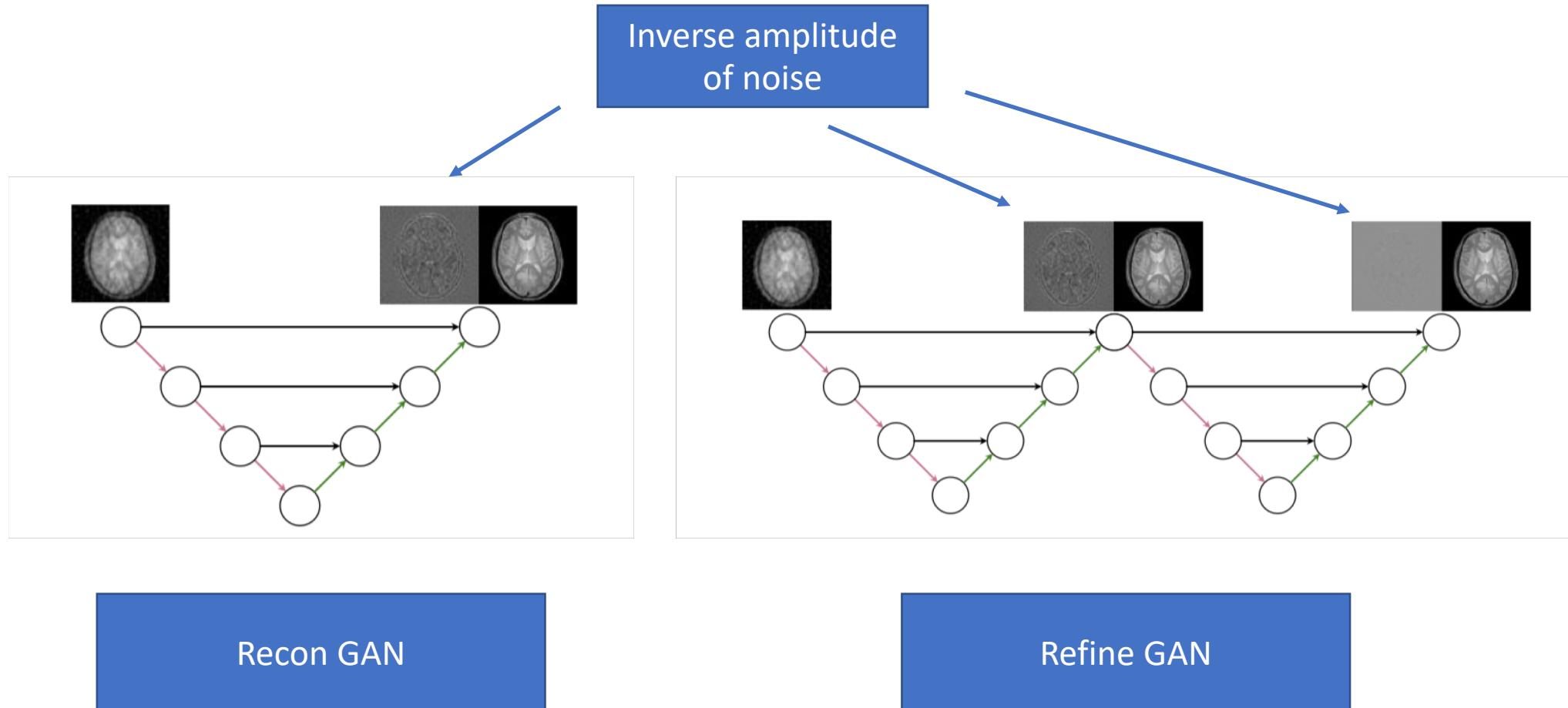


proposed network

Network structure



Network structure



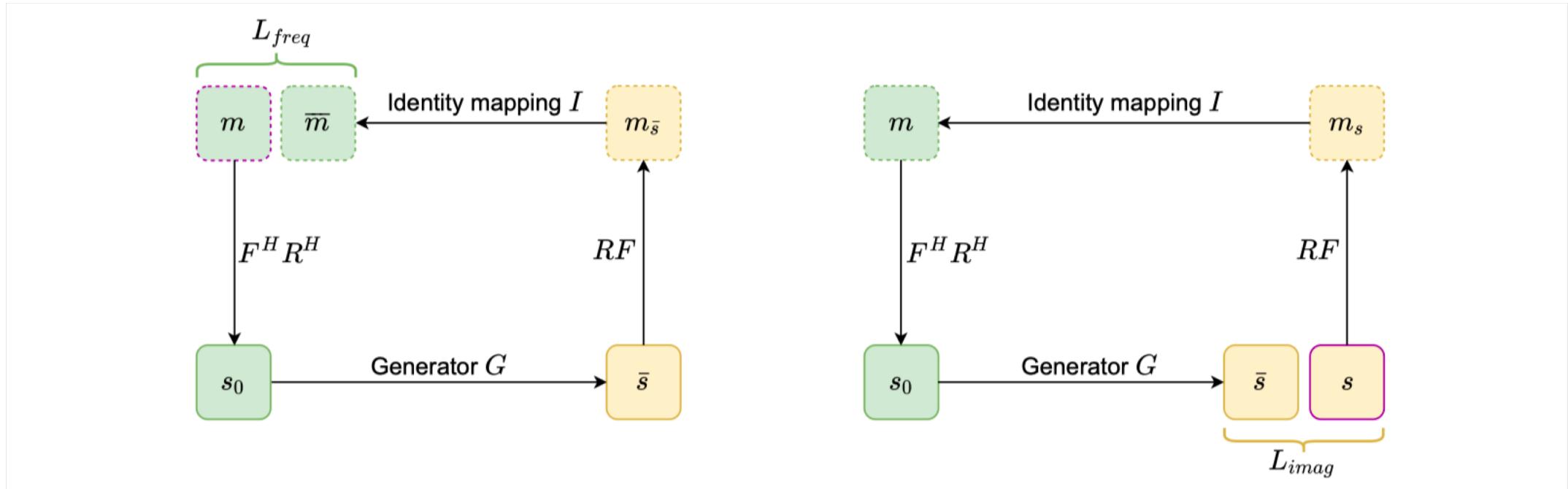
Loss functions

$$L_{total} = L_{adv}(G, D) + \alpha L_{freq}(G) + \gamma L_{imag}(G)$$

$$L_{adv} = E[1 - \log D(G(s_0))] + E[\log D(s)]$$

$$L_{adv} = -E[D(s)] + E[D(s_0)]$$

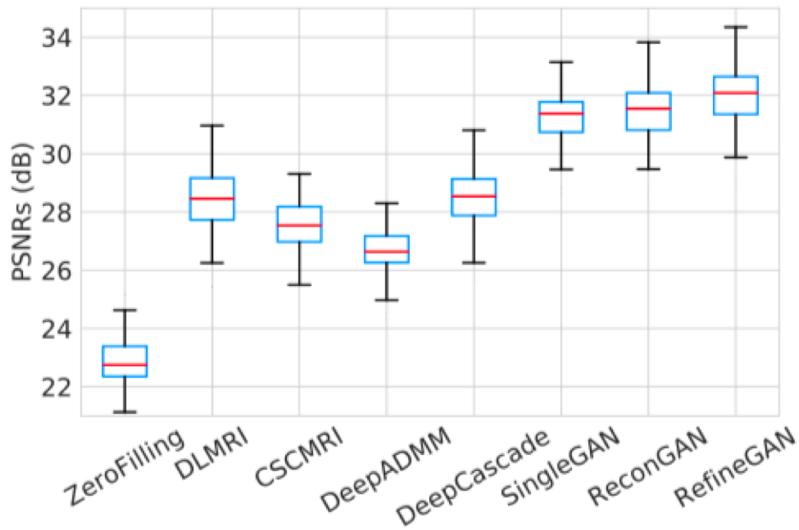
Cyclic loss



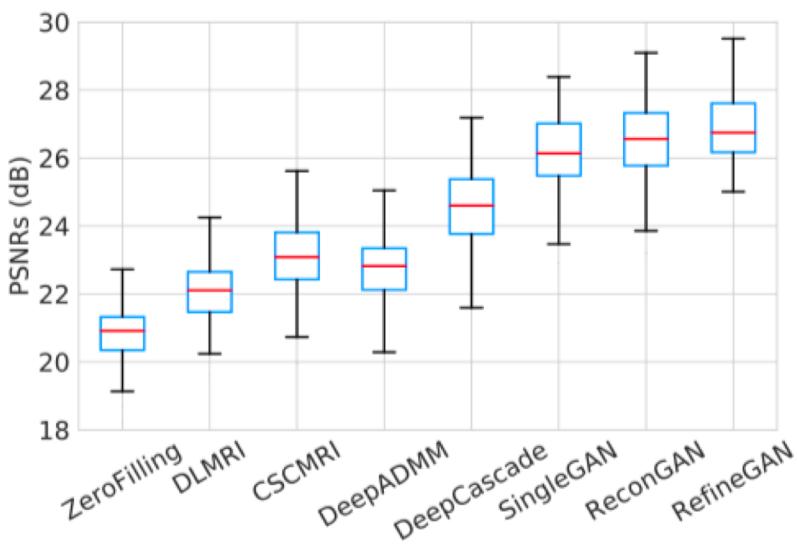
Running time measurements

Methods	Brain	Chest
CSCMRI	8.56808	9.37082
DLMRI	604.24623	613.84531
DeepADMM	0.31725	0.28677
DeepCascade	0.22182	0.25627
SingleGAN	0.064599	0.075529
<u>ReconGAN</u>	0.060753	0.068871
<u>RefineGAN</u>	0.106157	0.111607

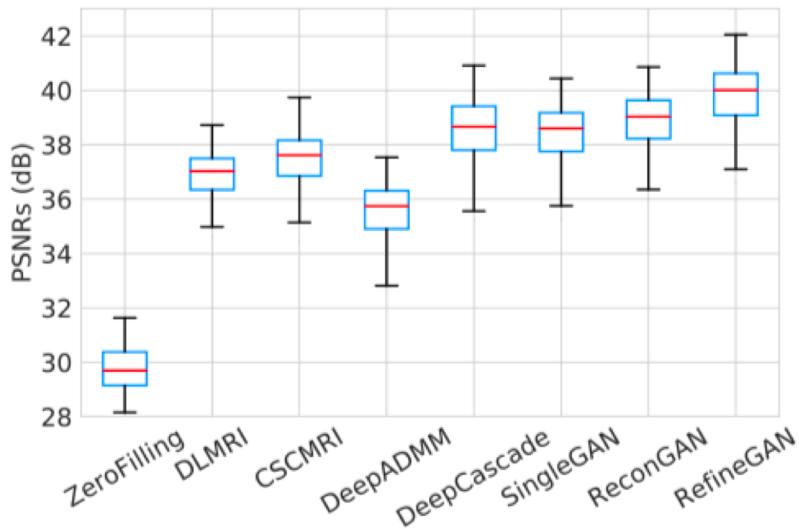
RESULTS



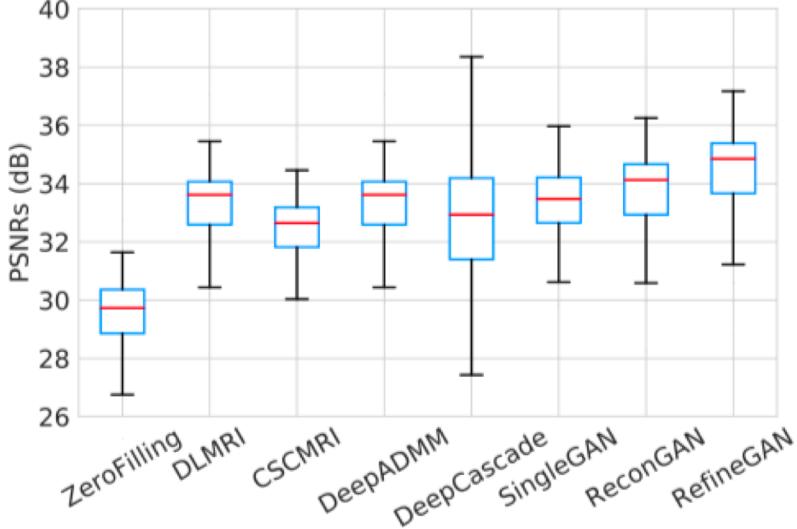
(a) Brain 10%



(b) Chest 10%

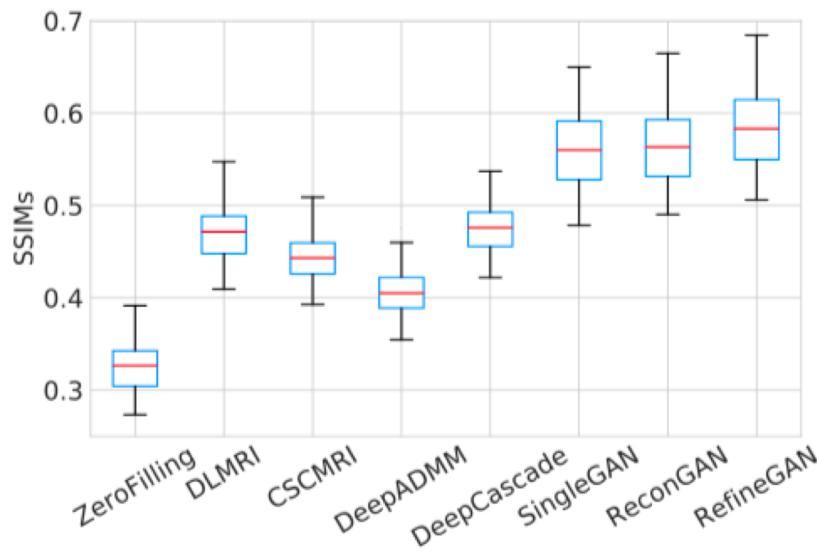


(c) Brain 30%

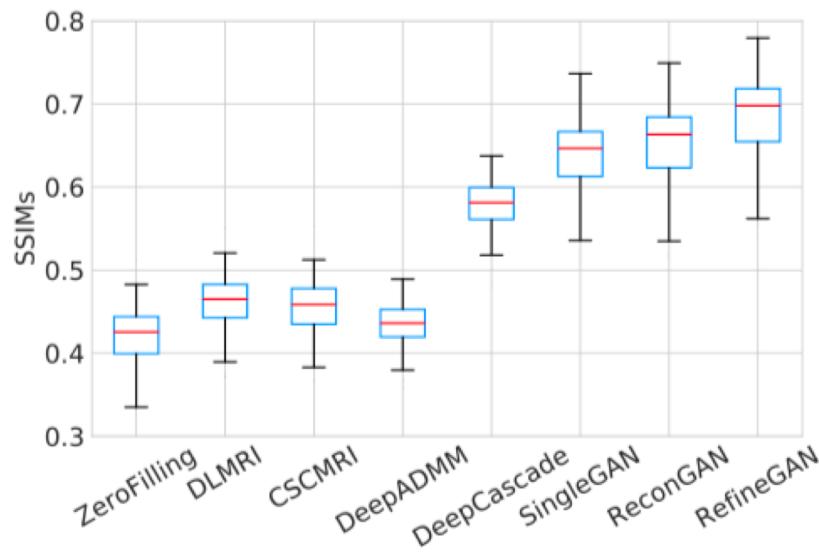


(d) Chest 30%

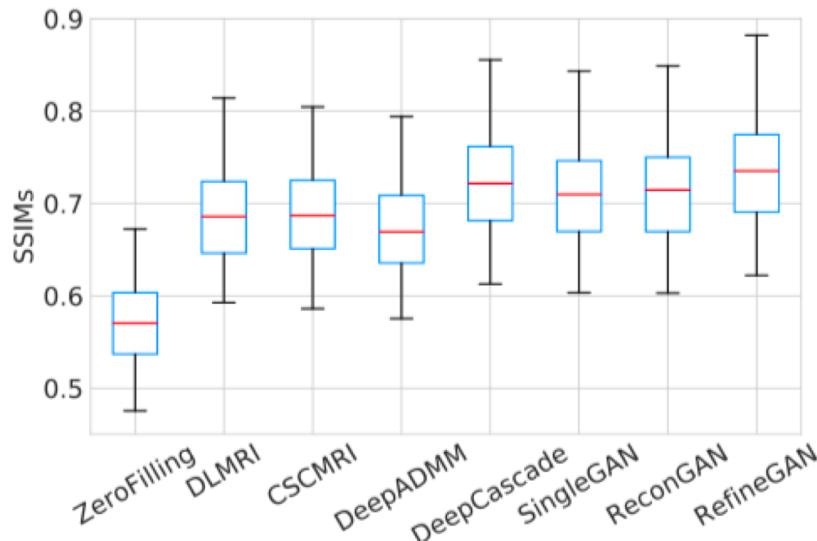
RESULTS



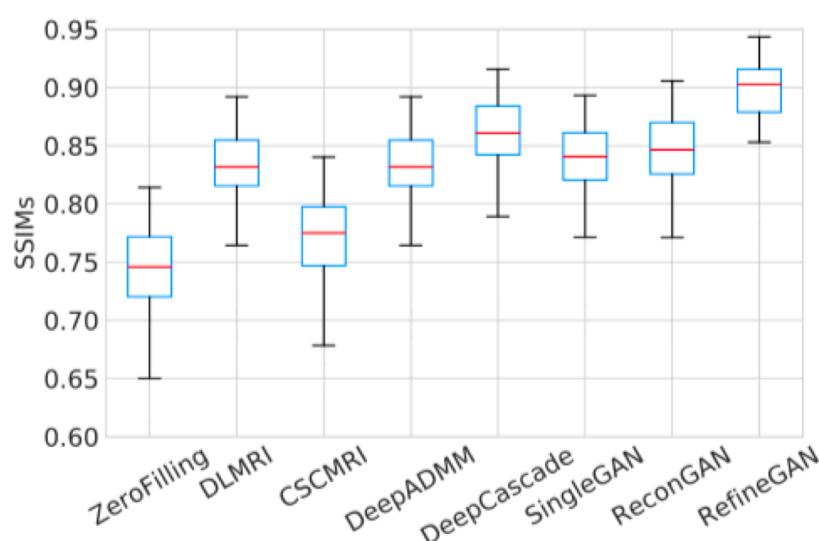
(a) Brain 10%



(b) Chest 10%

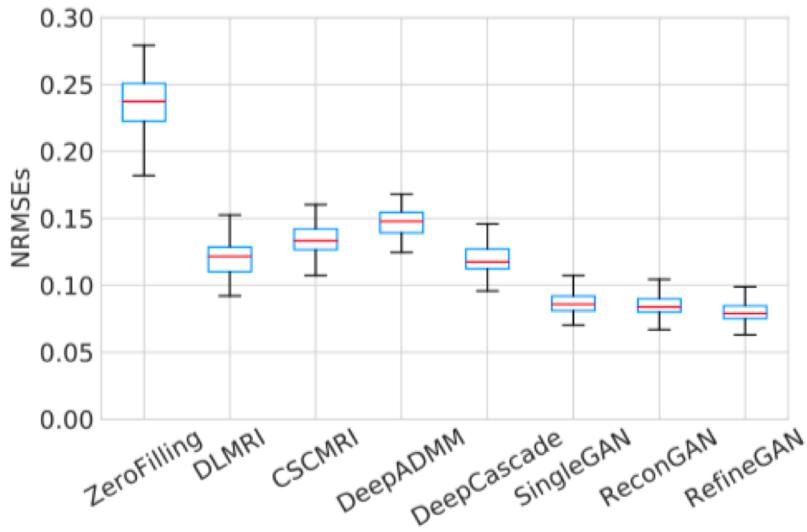


(c) Brain 30%

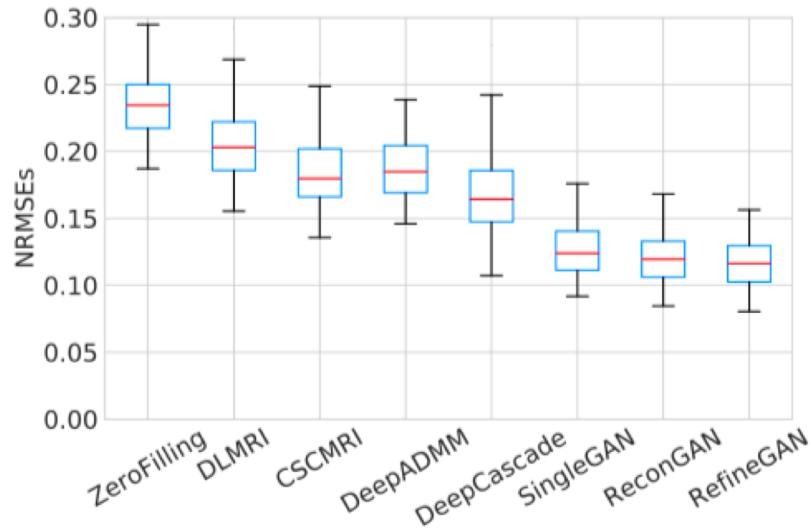


(d) Chest 30%

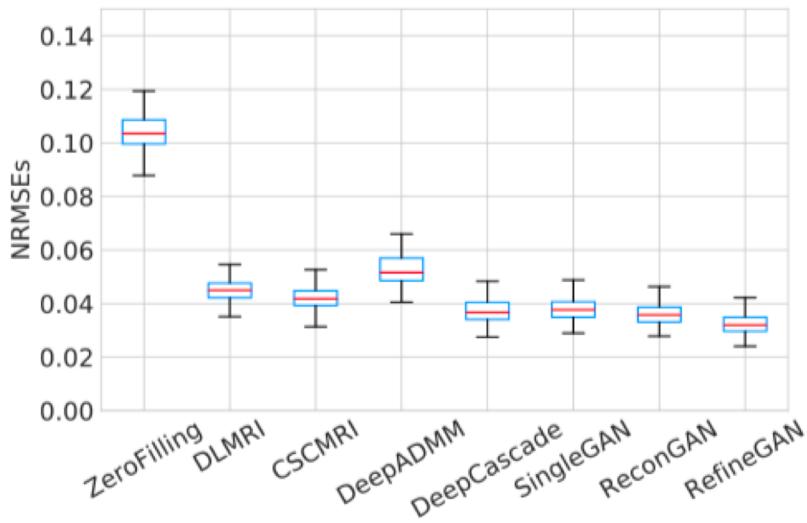
RESULTS



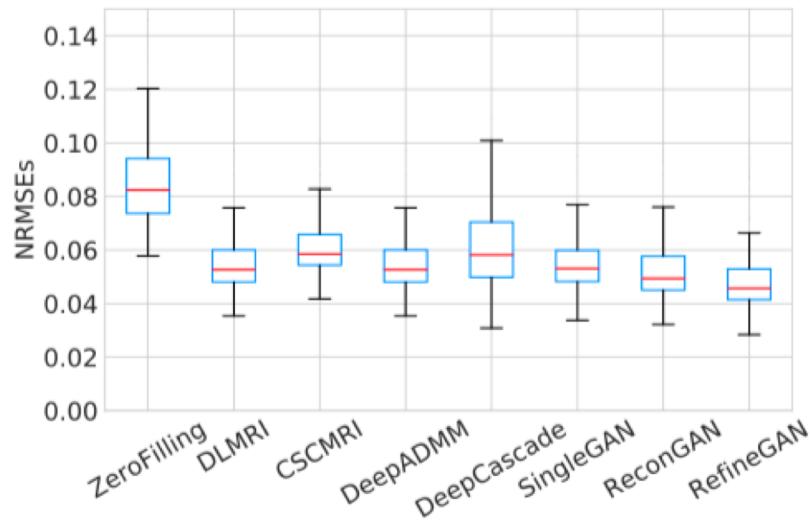
(a) Brain 10%



(b) Chest 10%

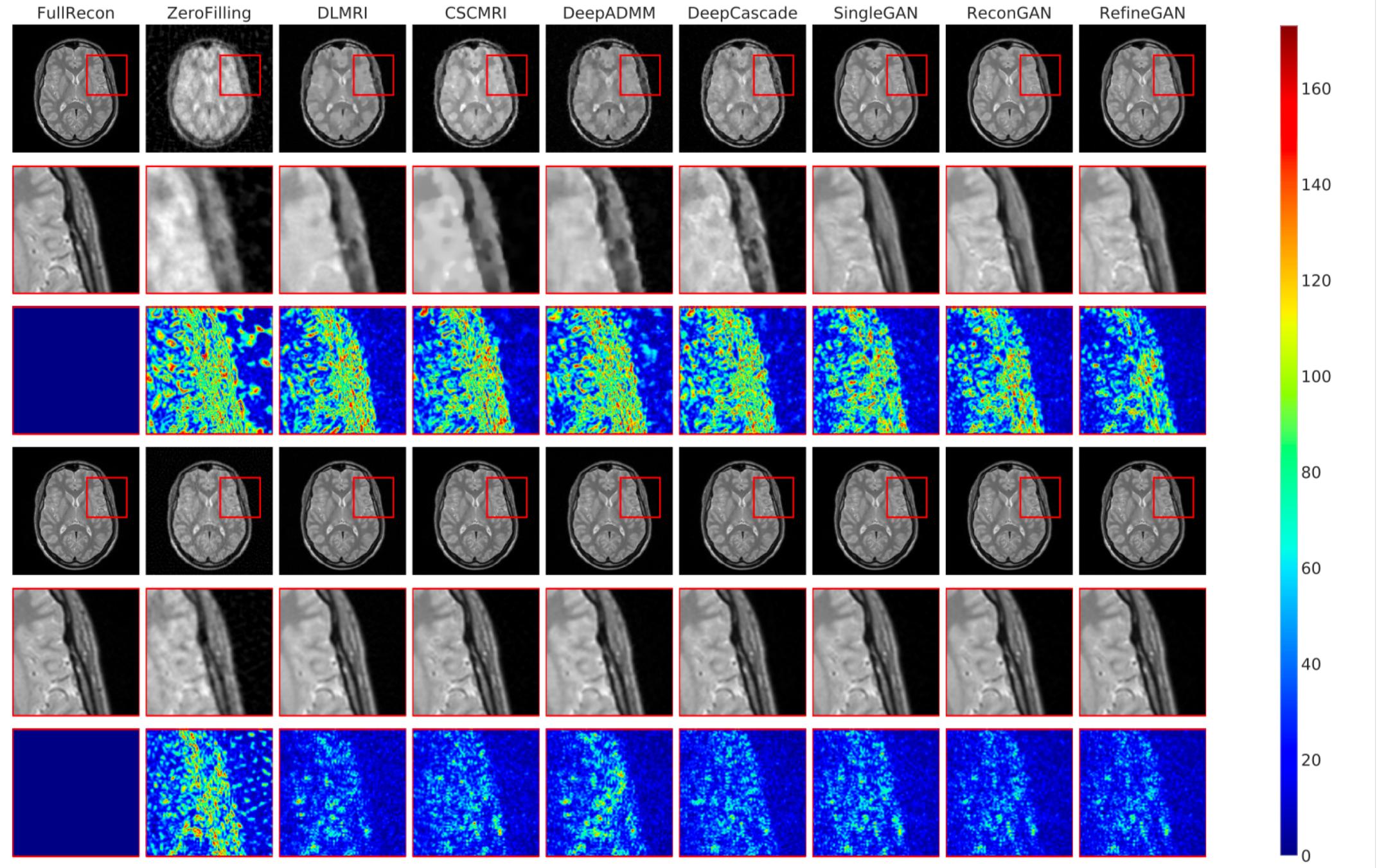


(c) Brain 30%

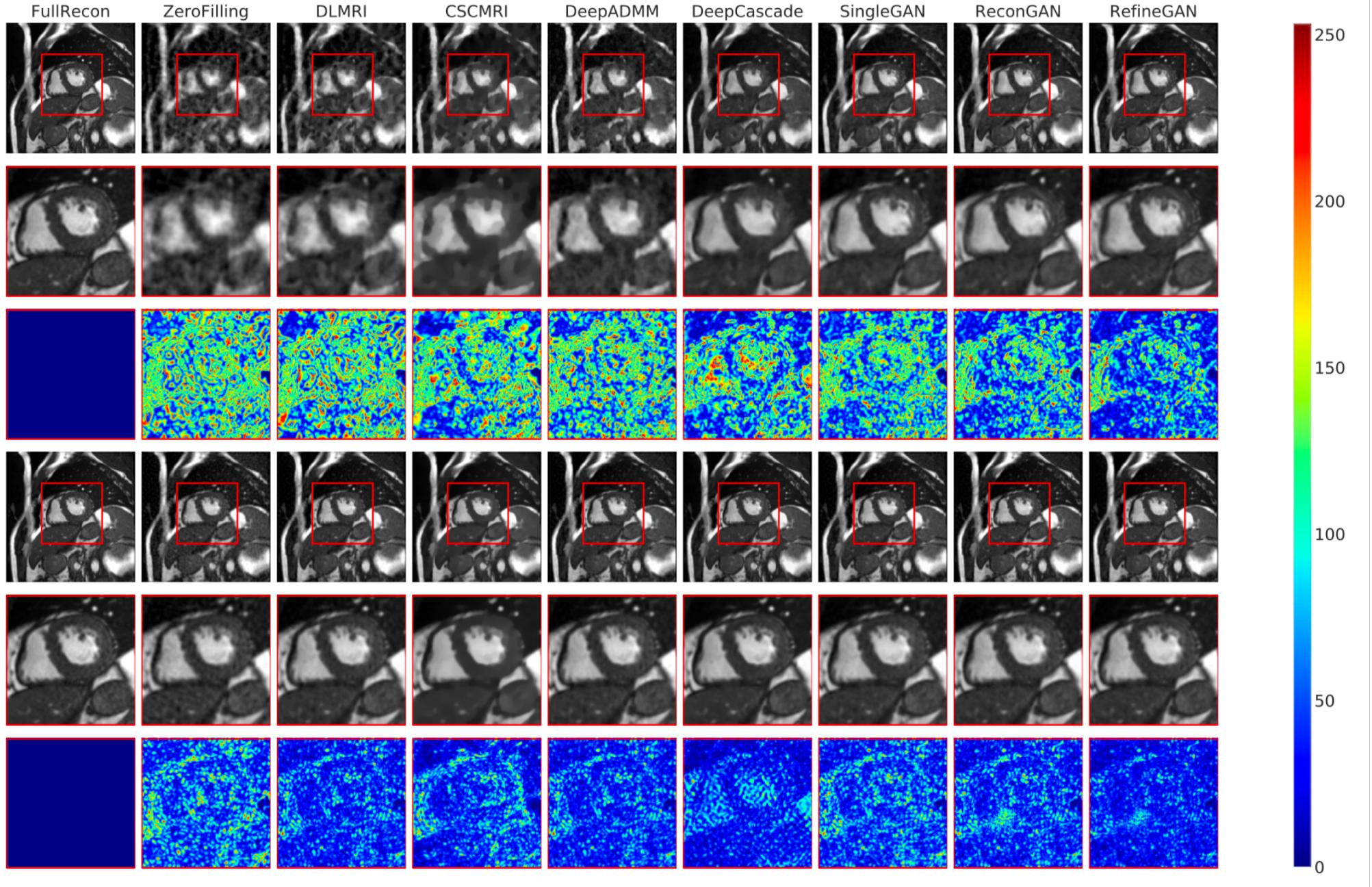


(d) Chest 30%

RESULTS



RESULTS



RESULTS

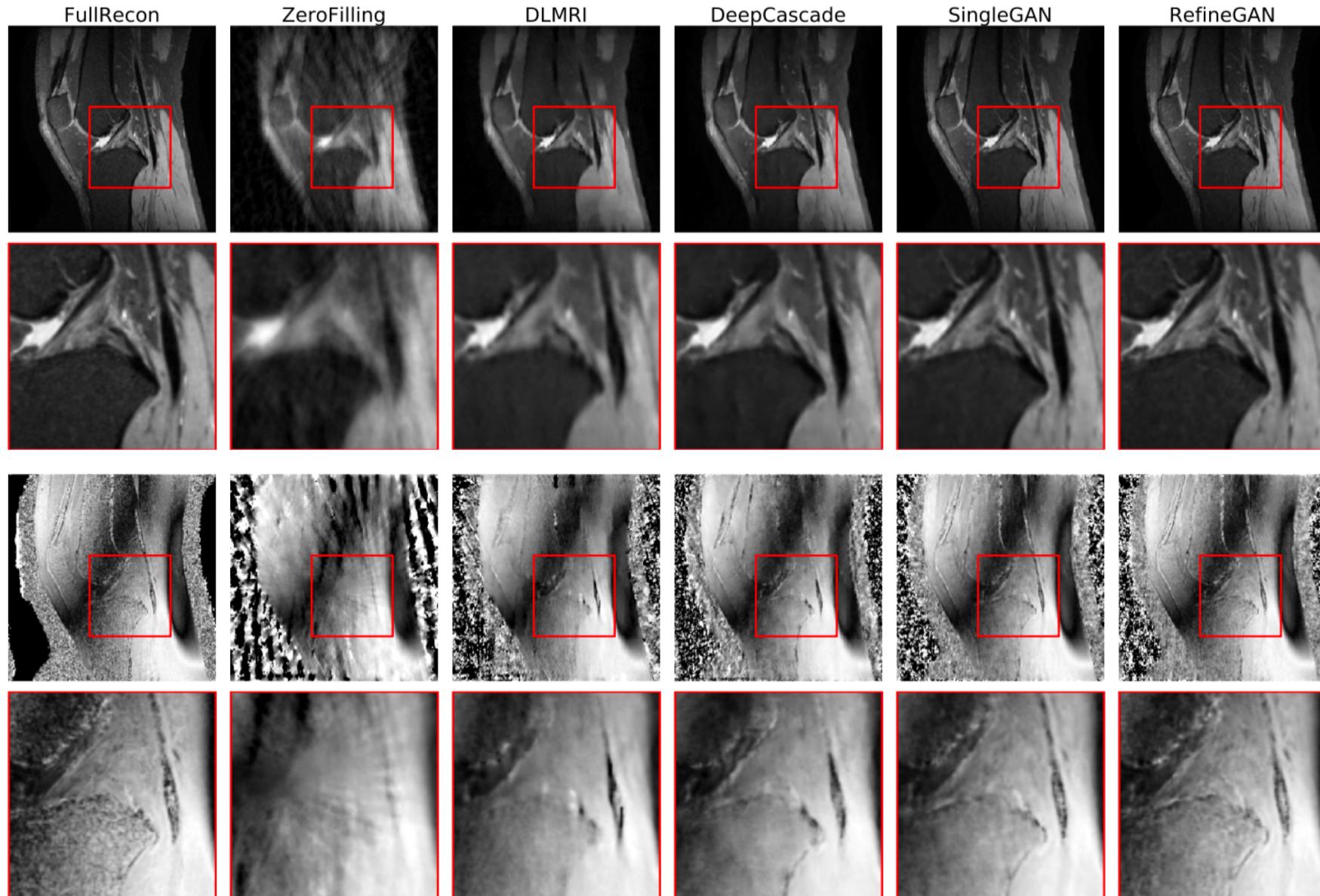


Fig. 12. Image quality comparison on the knees dataset (top 2 rows: magnitude images, and bottom 2 rows: phase images) at a sampling rate 10% : Reconstruction images and zoom-in results

RESULTS

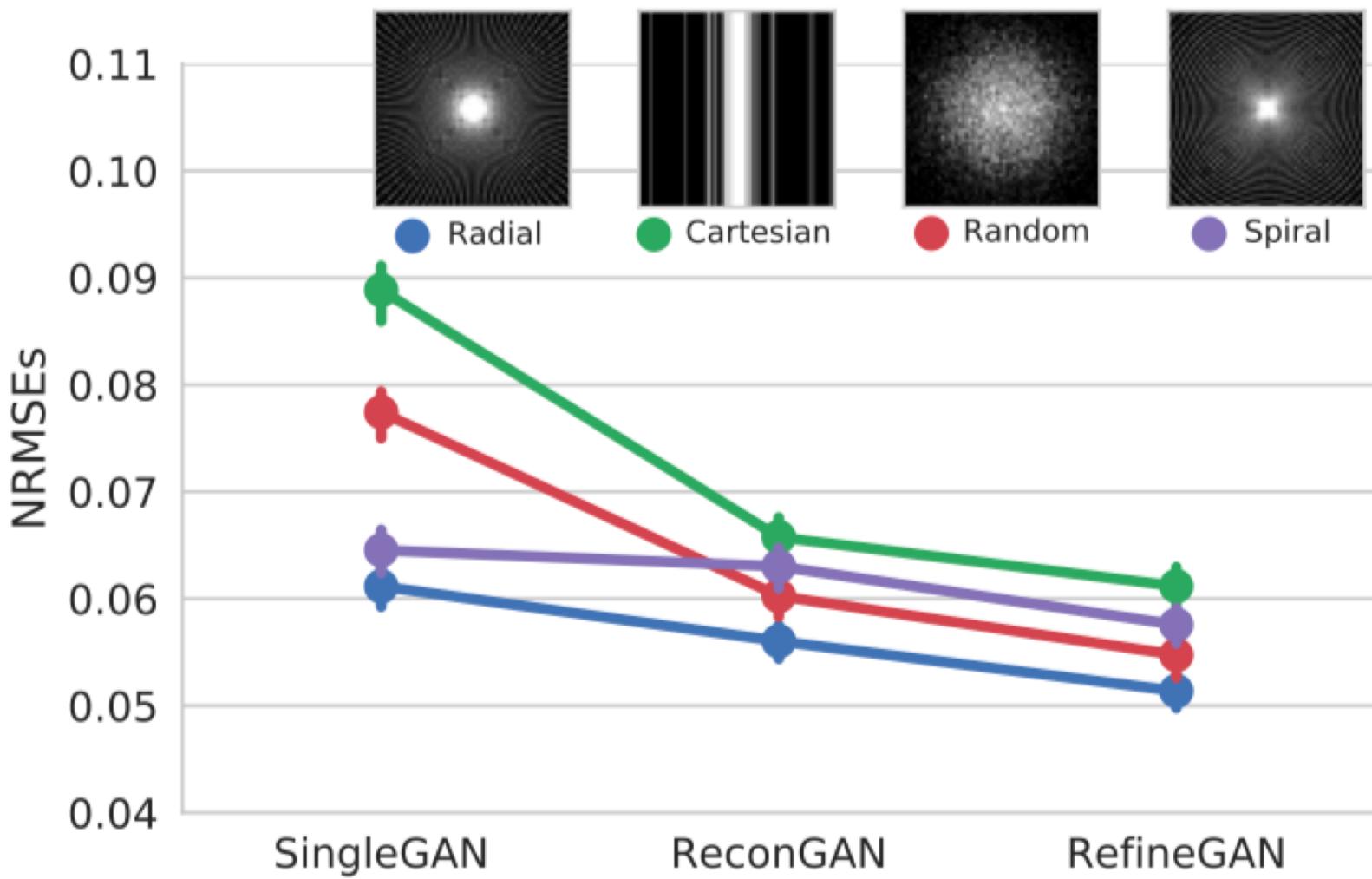


Fig. 13. NRMSEs evaluation on the knees test set at sampling rate 20% with various sampling masks