Whole-heart CMRA is useful for predicting the future risk for cardiac events in patients with suspected coronary artery disease.

Luminal Stenosis: Stenosis is defined as a localized narrowing of the intestinal lumen without disruption in the intestinal wall or a defect in the mesentery.

Previous studies using whole-heart CMRA at 1.5-T have demonstrated promising clinical results, particularly for high negative predictive value. However, long scan time and relatively low spatial resolution have prevented its wide clinical acceptance as a routine test for coronary artery stenosis detection

Recurrence of patches within the same image scale (at subpixel misalignments) gives rise to the classical super-resolution, whereas recurrence of patches across different scales of the same image gives rise to example-based super-resolution.

Additional proble: Heart motion, breathing motion… Artifacts that lower the resolution

Non-Breath-Hold Technique (Diaphragmatic navigated CMRA) scan time 25-50 min

1D self navigation or image based navigators: scan time 13-25 min

With parallel imaging, compressed sensing, low rank techniques -> 5-10 min scan time with high resolution

Now <1 min!!!

Non rigid motion -> shape and size changing

What is residual learning?

Dyadic kernel?

Network:

Is fed motion compensated data. Consists of   
2 cascaded EDSR networks-> each of them two-fold upsampling in phase encoding direction

8 consecutive residual blocks with 3x3 conv, stride 1, 64 kernels followed by ReLU + residual connections for strengthen residual learning capability of generator.

Discriminator:  
patch-based CNN to capture to capture local discrepansies between SR and HR Image, dyadic kernel increase and alternating stride of 1 and 2 is chosen to extract and focus local features.

VGG-16

Capture perceptual differences

Discriminator and VGG-16 are pretrained, fine tuned by cohort of CTCA patients to train domain aware knowledge

Generator has 1,1 mio params and discriminator 5,2 mio

Input: fully sampled LR-image, either patch of 10-90% of full image size or 100% size

For training equal split between patch and image was chosen (random size and location selection)

Output: isotropic SR image

Loss function: Mean absolute error and Strutural similarity index SSIM between Output of each EDSR stage to corresponding HR image, adversarial loss and perceptual loss with different weightings of 1, 0.3, 0.1, 0.01

Training:….

Testing

Retrospective and prospective cohort

15 patients not seen in training (five-fold crossvalidation with 3 unique left out patients per run from retrospective cohort of 50 patients???) with retrospectively downsampled

Prospective: fully sampled LR images and separate HR image

Scanners:…

Evaluation:

Bicubic interpolation?

Soap-Bubble?

Normalized mean absolute error

Normalized mean squared error

Welch test