Global k-Space Interpolation for Dynamic MRI Reconstruction using Masked Image Modeling

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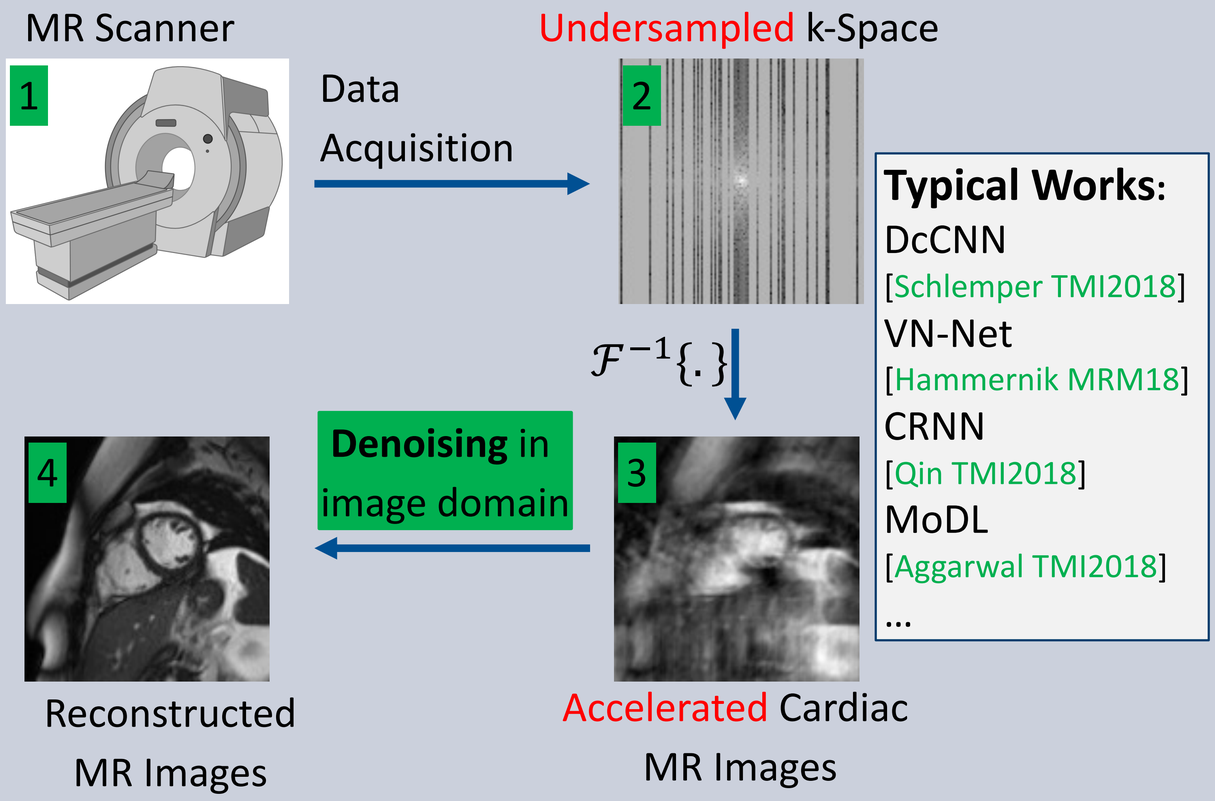
Project Page

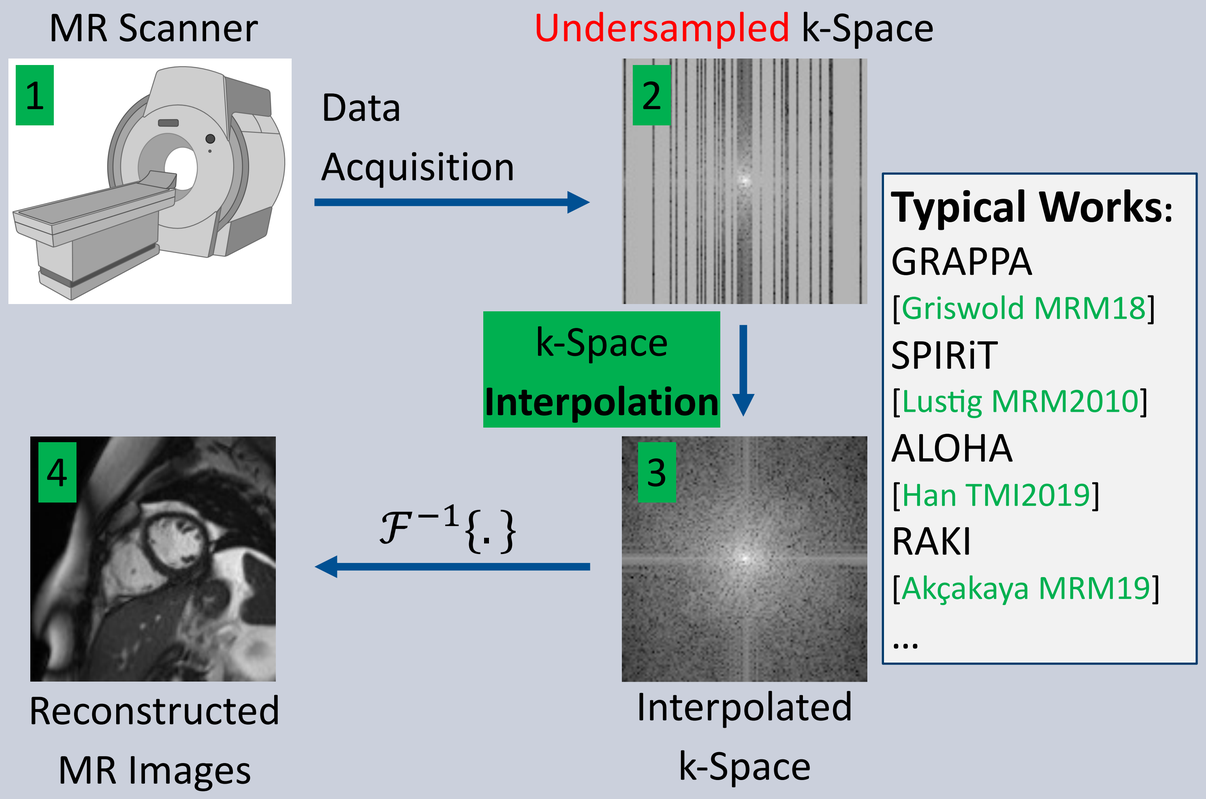
Conventional MR Reconstruction with Image-domain Denoising



Major Limitations:

1. Lack of generalizability due to artifacts-specific priors/regularizers
2. Artifacts distort and/or obscure tissues of interest before denoising kick-in
3. Work on the corrupted data

MR Reconstruction via k-Space Interpolation (work on reliable data without any corruption)

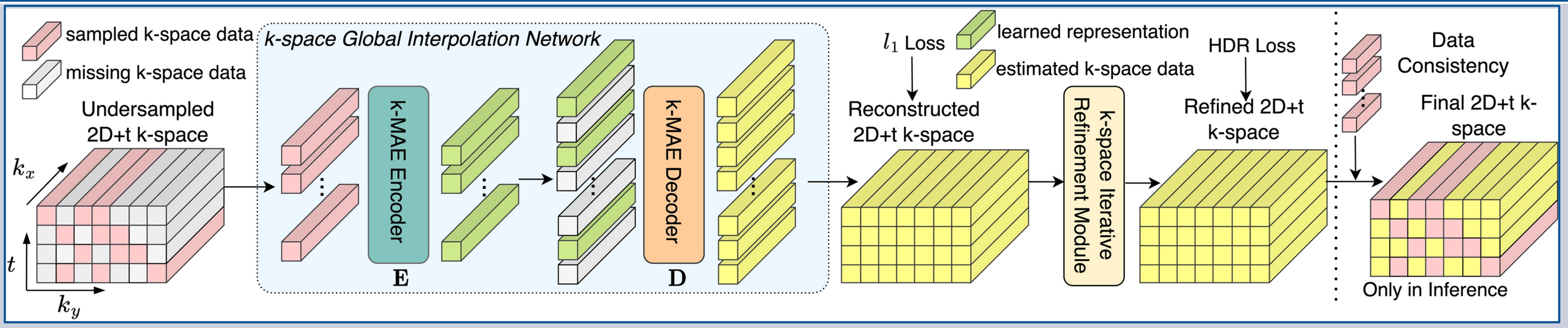


Limitations of current k-Space Interpolation methods:

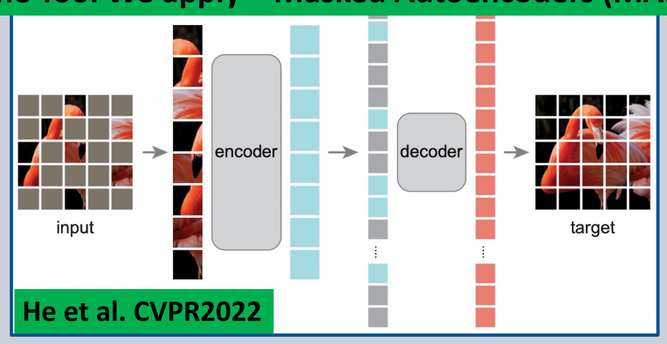
1. Limited Flexibility due to Calibration Signals
2. Only Local Operators
3. No Representation of the Sampled Data

In this work, we proposed k-Space interpolation method -- k-GIN

(Btw. after GRAPPA, RAKI, Caipirinha, SAKE etc., We have one more alcoholic beverage in MR Reconstruction)



The Tool We apply – Masked Autoencoders (MAE)



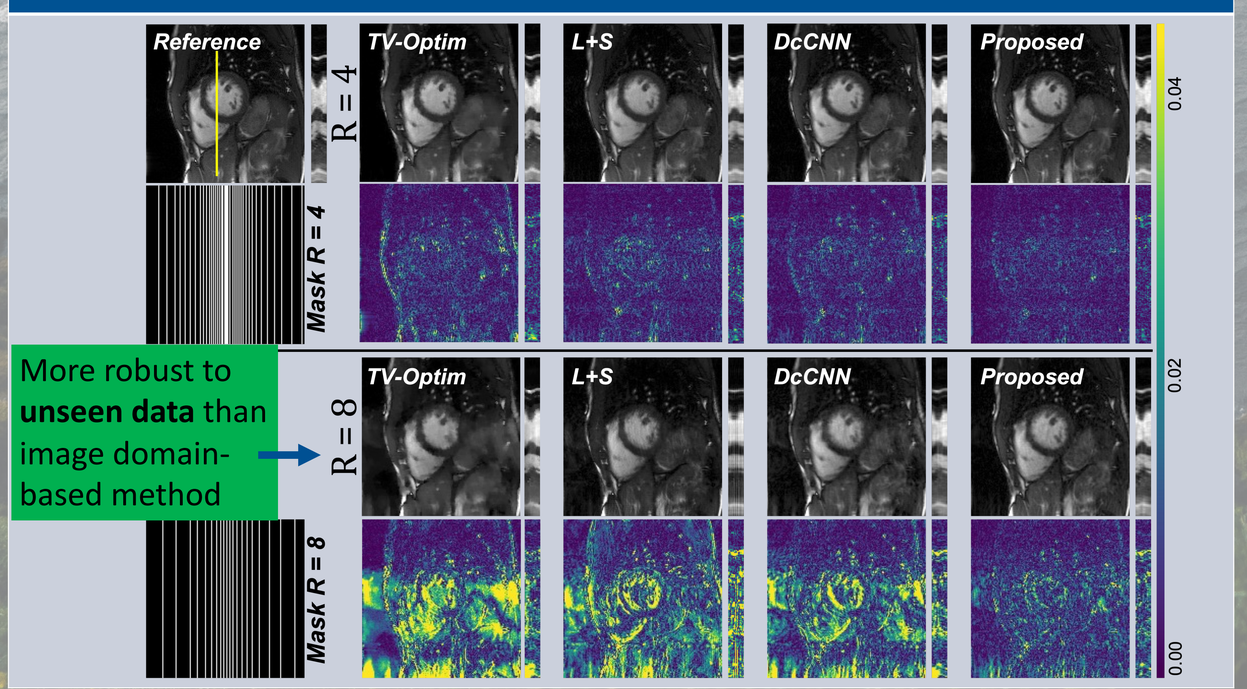
Gist of the work:

- **First usage of MAE** in MR reconstruction and in k-space
- **Global** Interpolation based on **learned representation** from the sampled data
- **More robust** than image domain-based methods at different acceleration rates

Some details

- k_x is used as channel dimension
- Iterative refinement applied on every plane (x-y, y-t, x-t)
- High-Dynamic Range (HDR) loss handle the large magnitude difference in k-space

Reconstruction Results (training at R4, infer at R4 and R8 (unseen))



Outlook

1. Enable Multi-coils setting
2. Flexible input
3. Computational efficient model
4. Downstream task e.g. disease classification, cardiac volume regression and segmentation

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MICCAI2023 Vancouver CANADA