Supplementary Materials

Robust Low-dose CT Sinogram Prepocessing via Exploiting Noise-generating Mechanism

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1. Parameter setting details of the competing method

In the main text, the proposed algorithm is compared with several existing methods. Each of the methods used for comparison has its own trade-off parameter in the regularization term. To make a possibly fair experiment comparison, for each of our experiments, we have implemented each competing method with multiple different settings of parameters, and then attempted to pick up the best one from them (based on PSNR). In this section, we will list the finally tuned parameters of the utilized methods in experiments.

Digital phantom study. In this study, the trade-off parameter of PL, PWLS, POCS-TV and PWLS-TV^2 are respectively setting as 0.05, 300, 0.5 and 150. The parameter b of IMAP-TV and IMAP-TV^2 is both initialized as 1.

Physical phantom study. In this study, The parameter b of IMAP-TV and IMAP-TV^2 is respectively initialized as 0.005 and 1.5 for all cases.

At 17 mAs, the trade-off parameter of PL, PWLS, POCS-TV and PWLS-TV^2 are respectively setting as 0.005, 180, 0.5 and 1000.

At 40 mAs, the trade-off parameter of PL, PWLS, POCS-TV and PWLS-TV^2 are respectively setting as 0.008, 200, 0.5 and 2000.

At 60 mAs, the trade-off parameter of PL, PWLS, POCS-TV and PWLS-TV^2 are respectively setting as 0.012, 220, 0.5 and 2500.

Preclinical porcine data study. In this study, the trade-off parameter of PL, PWLS, POCS-TV and PWLS-TV^2 are respectively setting as 0.002, 300, 0.25 and 600. The parameter b of IMAP-TV and IMAP-TV^2 is both initialized as 1.

2. More experimental result on digital phantom study

In this section, we show the anthropomorphic torso phantom results reconstructed by different algorithms from low-dose projection data at 40 mAs and 60 mAs in Fig. 1 and Fig.2, respectively. It can be seen that the proposed method evidently performs better than all the completing sinogram recovery methods, in the recovery of both finergrained textures and coarser-grained structures. Moreover, the constructing result of proposed method is also visually comparable to the POCS-TV method. This is consistent with the results for the Physical phantom study at 17 mAs.

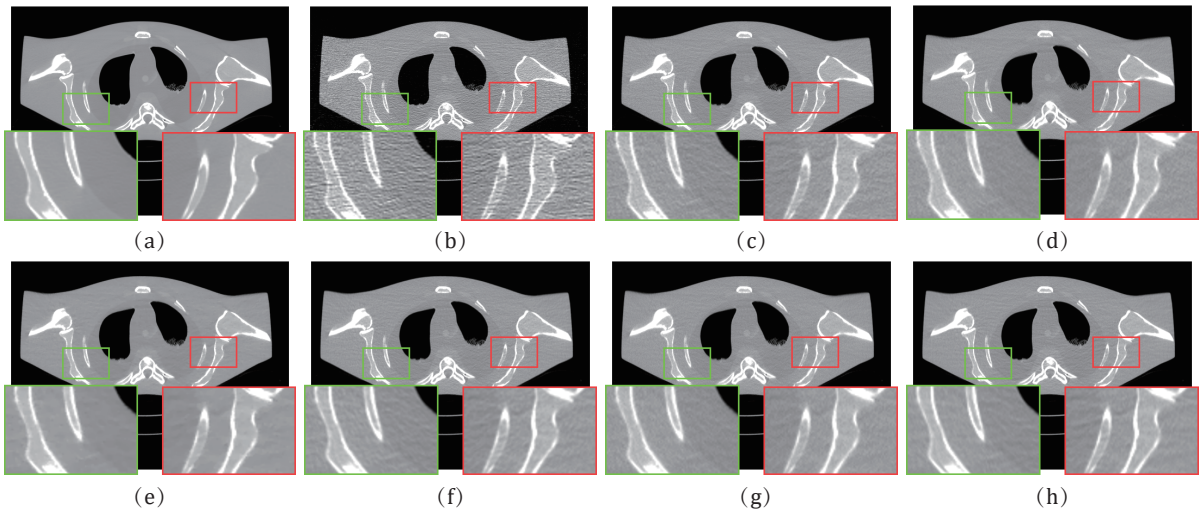

Figure 1: (a) The noise-free image of the anthropomorphic torso phantom study; (b)-(h) The images reconstructed by FBP, PL, PWLS, POCS-TV, PWLS-TV^2, IMAP-TV and IMAP-TV^2 at 40 mAs respectively. The demarcated areas in each image are amplified at a 3 time larger scale for easy observation of details.

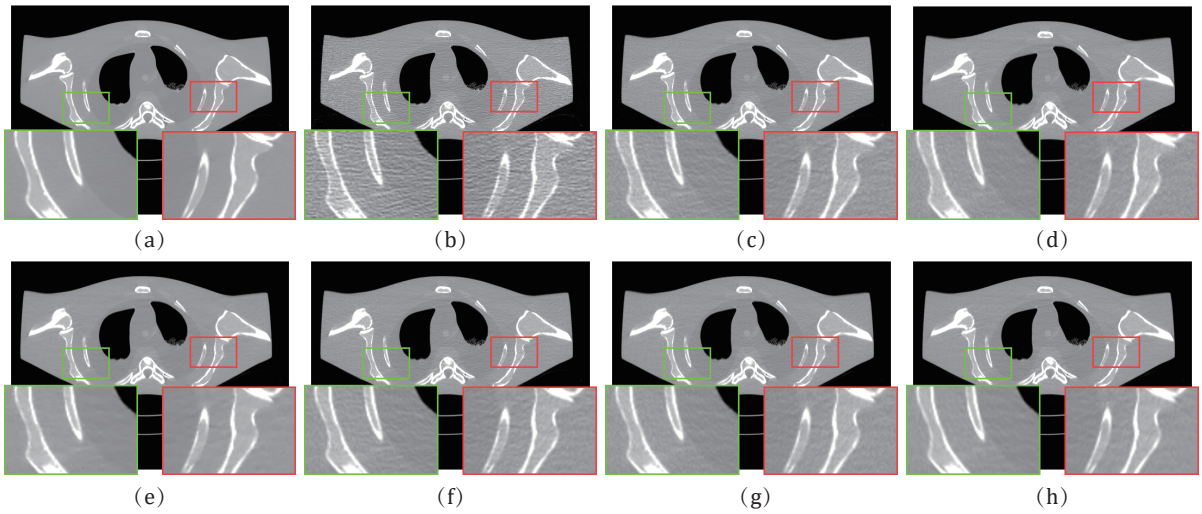

Figure 2: (a) The noise-free image of the anthropomorphic torso phantom study; (b)-(h) The images reconstructed by FBP, PL, PWLS, POCS-TV, PWLS-TV^2, IMAP-TV and IMAP-TV^2 at 60 mAs respectively. The demarcated areas in each image are amplified at a 3 time larger scale for easy observation of details.