

LINEARIZED ANALYSIS OF NOISE AND RESOLUTION FOR DL-BASED IMAGE GENERATION

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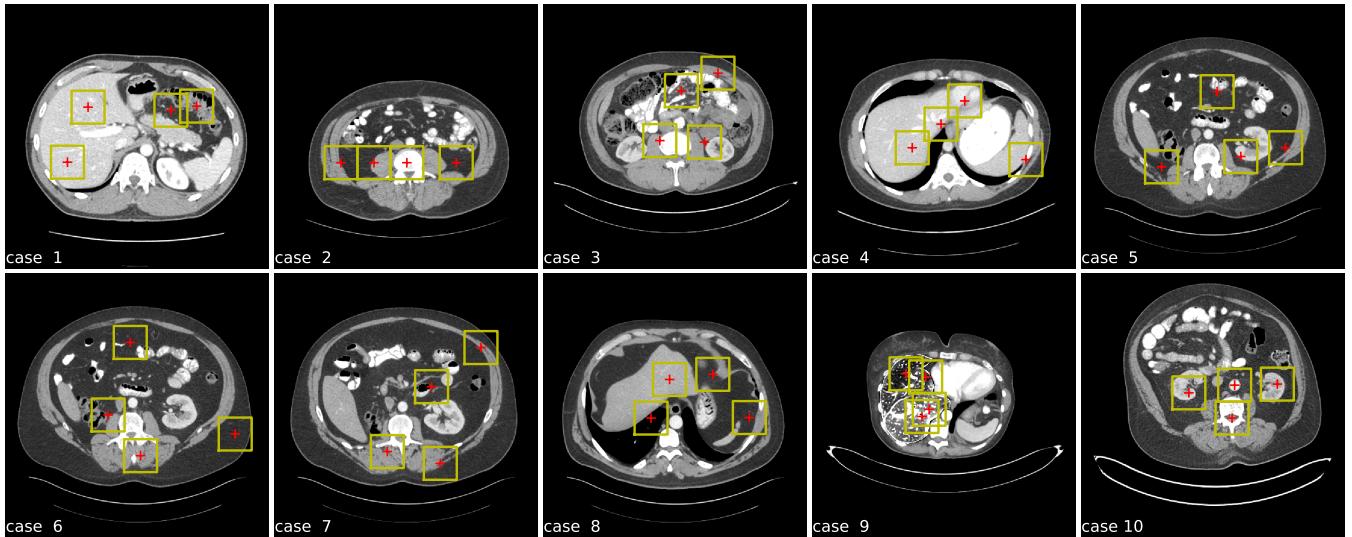


Fig. 1: Signal locations for all 10 cases, including case 2 and 10 that were analyzed in more detail. For each of the remaining 8 cases, four signal locations (red '+') were randomly chosen. Display setting is $(C, W) = (1050, 400)$ HU except for case 9, for which the lung region is shown with $(C, W) = (150, 150)$ HU, and the rest of the image with $(C, W) = (1050, 400)$ HU.

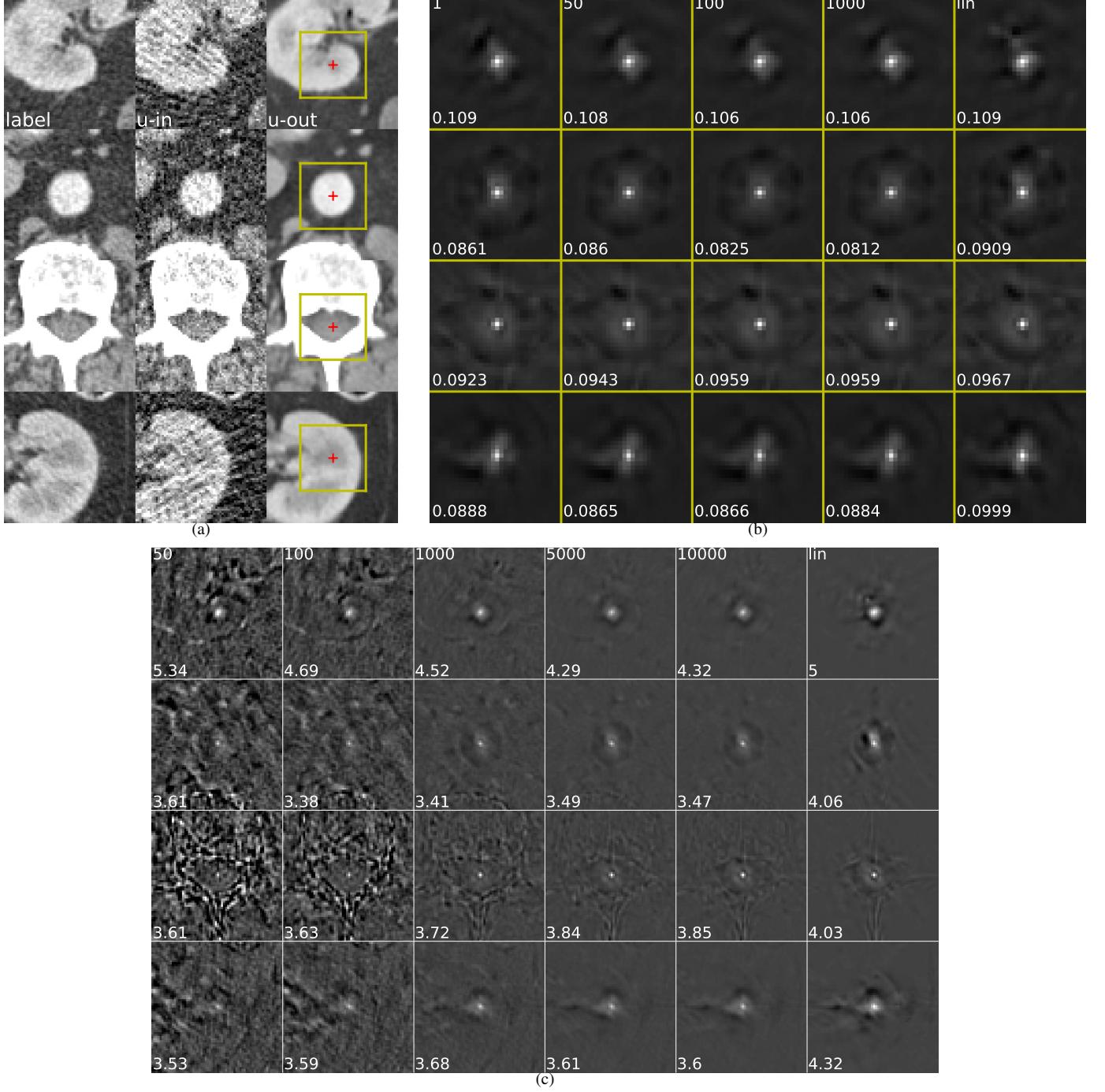


Fig. 2: Approximation of noise covariance image and LIR using network linearization at exposure level I_0 for test case # 10. Similar arrangement as in Fig. 3 of the main text. The different rows are the different ROIs. (a) The different columns are (1) the ground truth label; (2) FBP reconstruction using sparse view (145 views) noisy data (U-Net input); (3) U-Net output (145 views) using (2) as input. The red '+' marks the locations where the LIR and the covariance images are calculated. (b) The LIR calculated using MC simulations of 1, 50, 100, and 1000, noise realizations, and LLIR. (c) The covariance image calculated using MC simulations of 50, 100, 1000, 5000, 10000, noise realizations, and the network linearization. The text annotations are the CRC (unit-less) and standard deviation (HU) at the center pixel for (b) and (c), respectively.

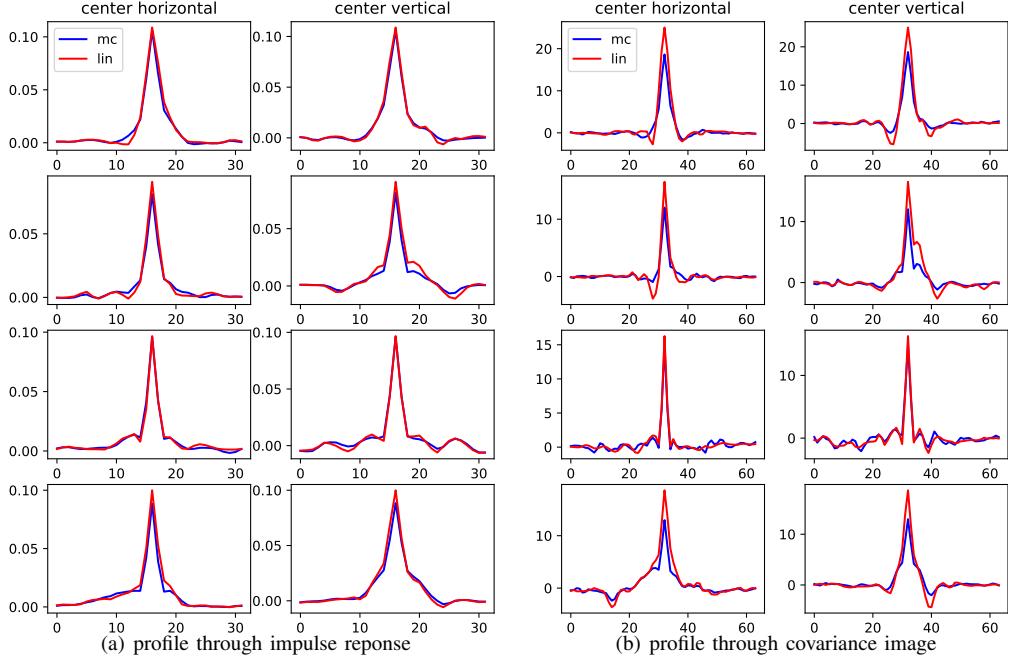


Fig. 3: Test case # 10, exposure level I_0 . (a) Center horizontal and vertical profiles through the LIR using MC (1000 noise realizations) and network linearization. The peak values are the CRCs annotated in Fig. 2(b). (b) Center horizontal and vertical profiles through the covariance images using MC (10000 noise realizations) and network linearization. The peak values are the variance of the center pixels, *i.e.*, the square of the standard deviations annotated in Fig. 2(c).

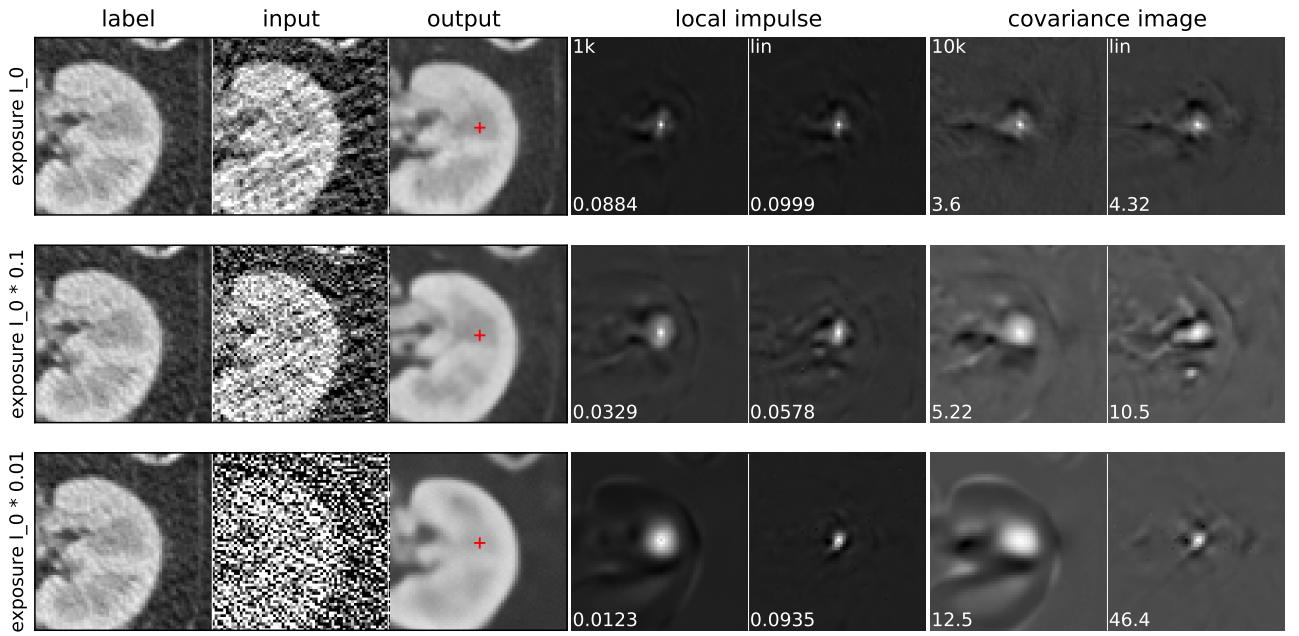


Fig. 4: U-NET test results at the three exposure levels for test case 10, ROI 4. Similar observations as in Fig. 6 of the main text can be made. As the exposure level is drastically reduced, network linearization is unable to fully capture (a) the larger spatial extent of the LIR, and (b) the larger correlation range of the covariance image. Network linearization overestimates the CRC and the noise standard deviation. Display setting: (C, W) = (1050, 400) HU.

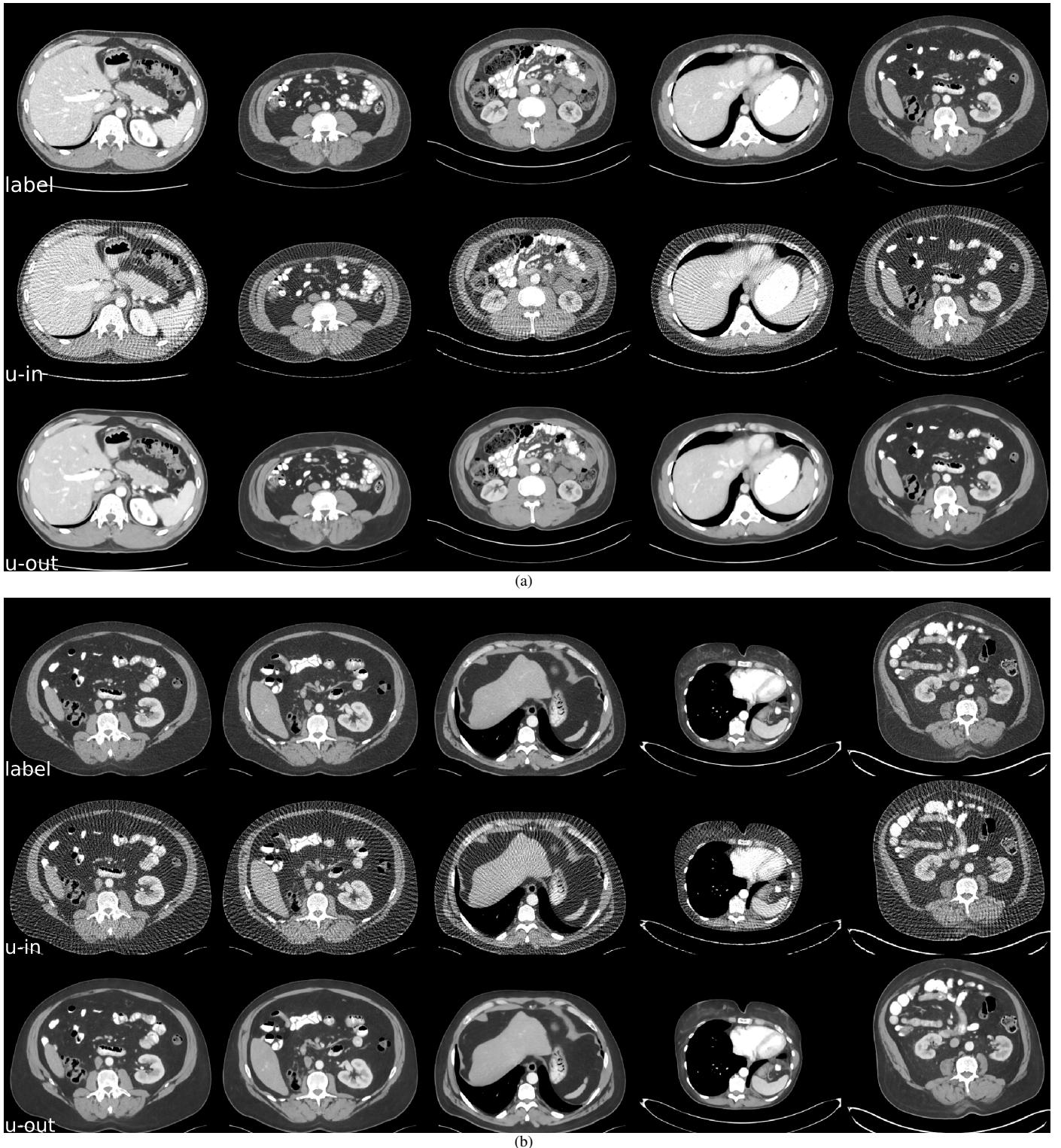


Fig. 5: U-NET test results at exposure level I_0 for 10 test cases. The different rows are (1) the ground truth labels; (2) FBP using noisy sparse-view data (145 views); (3) UNET output using (2) as the input. It can be seen that streak artifacts are to a large extent eliminated. Display setting: (C, W) = (1050, 400) HU.

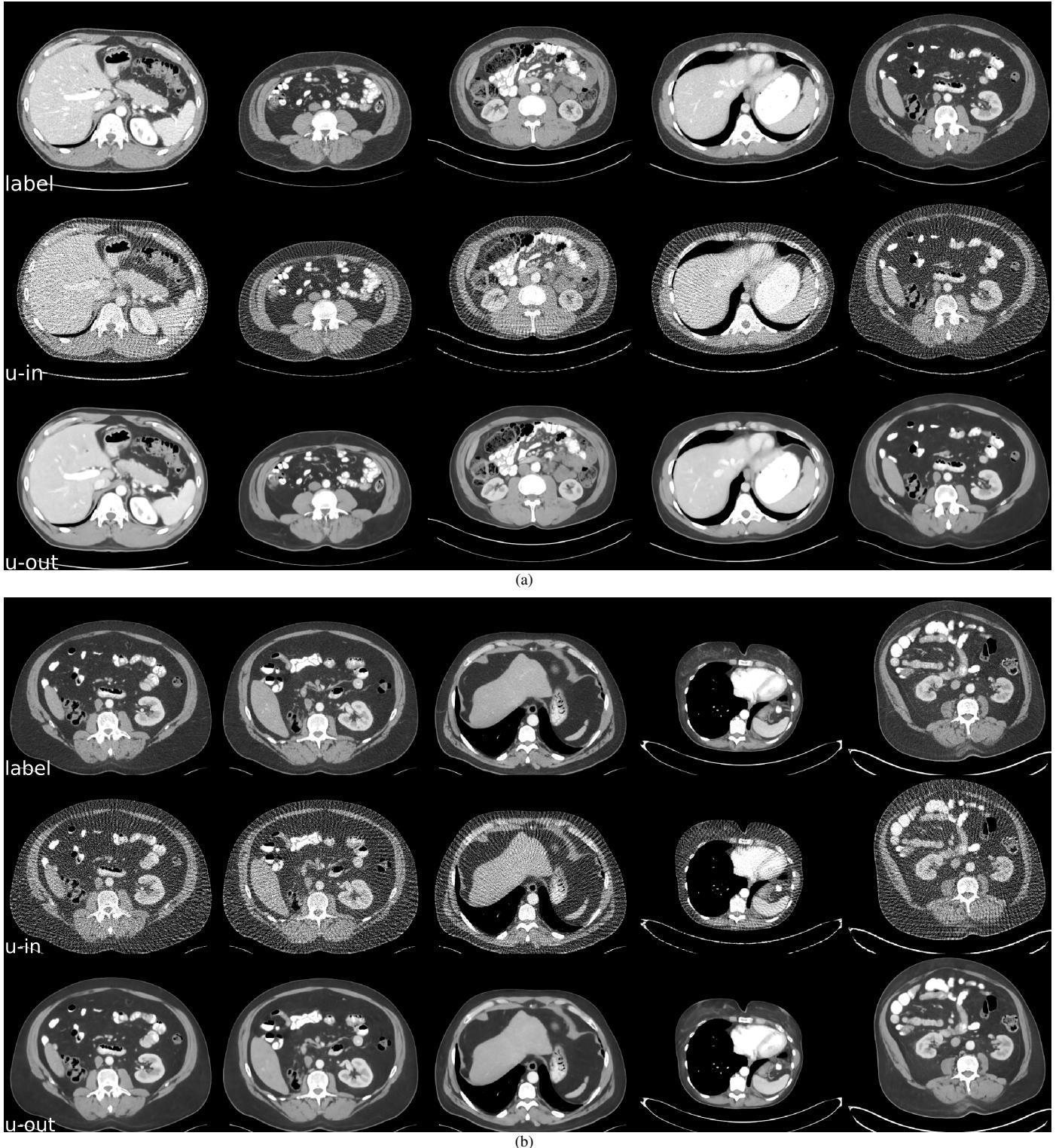


Fig. 6: U-NET test results at exposure level $I_0 \times 0.1$ for 10 test cases. The different rows are (1) ground truth labels; (2) FBP using noisy sparse-view data (145 views); (3) UNET output using (2) as the input. Display setting: (C, W) = (1050, 400) HU.

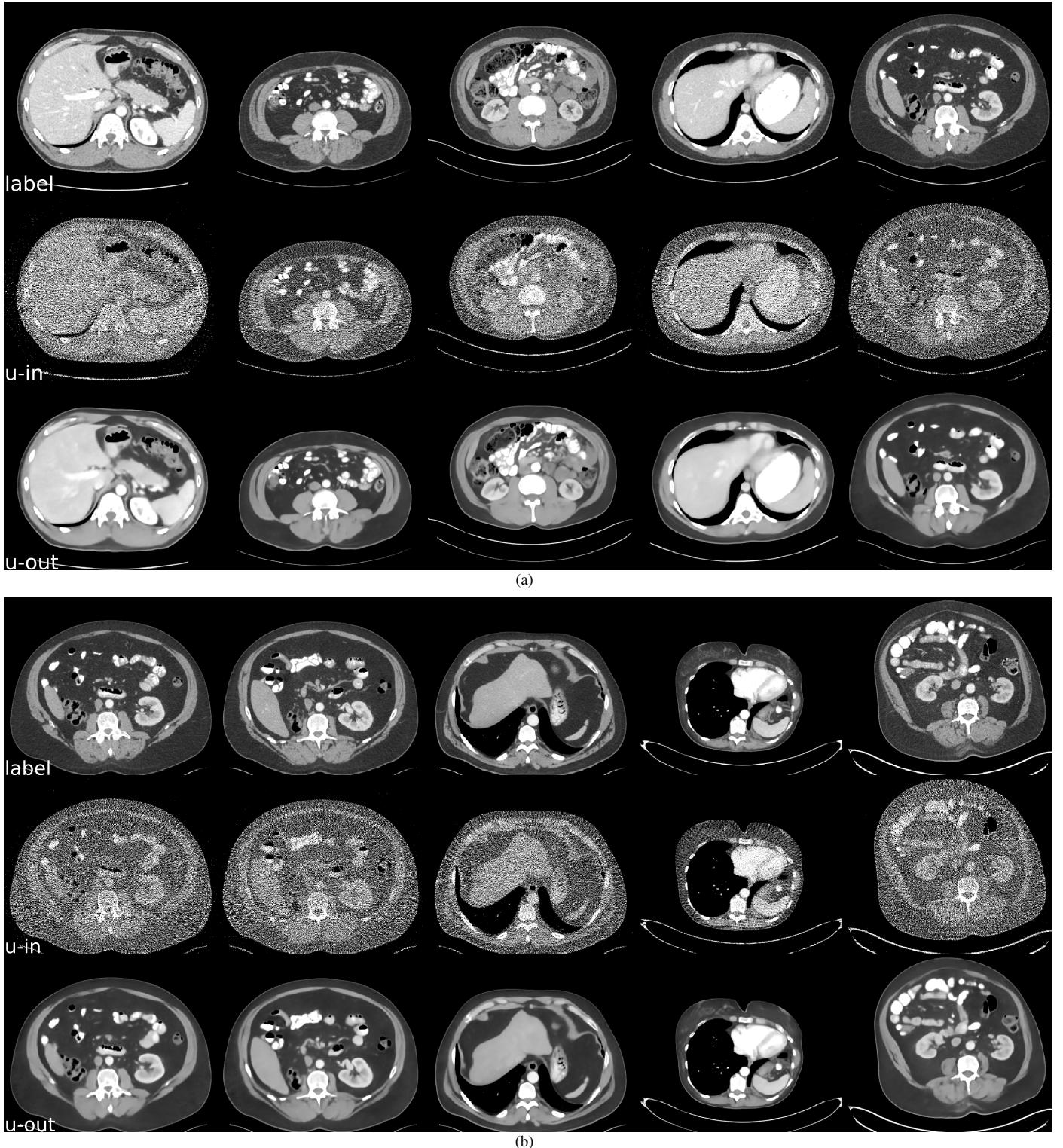


Fig. 7: U-NET test results at the exposure level $I_0 \times 0.01$ for the 10 test cases. The different rows are (1) ground truth labels; (2) FBP using noisy sparse-view data (145 views); (3) UNET output using (2) as the input. Display setting: $(C, W) = (1050, 400)$ HU.

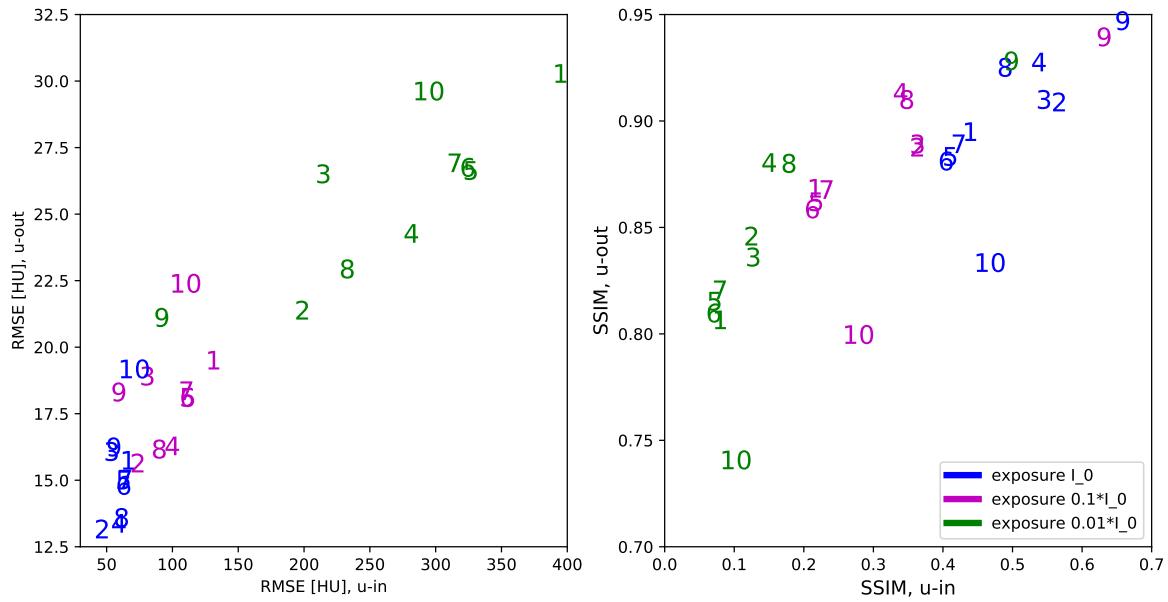


Fig. 8: RMSE (left) and SSIM (right) of FBPCovNet at three exposure levels. The horizontal and vertical axes correspond to input/before and output/after values for each FOM. The test case indices are placed at the corresponding FOM values. Images of the 10 test cases can be found in Figs. 5-7.