PH257-SD-THA3

Deep Learning Super-Resolution Imaging for Enhancing Image Resolution in Digital Mammography

Thursday, Nov. 30 12:15PM - 12:45PM Room: PH Community, Learning Center Station #3

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PURPOSE

Image resolution is an important factor for detecting suspicious low-contrast masses under conditions of breast glandular tissue in digital mammography. In addition, 4K or 8K diagnostic displays become to be implemented, in particular, high-resolution displays are often required in mammography. The purpose of this study was to apply and evaluate a novel deep-learning based super-resolution (SR) method for enhancing image resolution in digital mammography.

METHOD AND MATERIALS

A total of 711 cases with breast masses were sampled from the Digital Database for Screening Mammography (DDSM) database. The 711 cases contained 711 MLO images and 607 CC images. Super-resolution convolutional neural network (SR-CNN), which is state-of-the-art deep-learning based SR method, was trained with millions of natural non-medical images. With the trained SR-CNN, the high-resolution image was reconstructed from the low-resolution one. For quantitative evaluation, peak signal-to-noise ratio (PSNR) and structural similarity (SSIM) were measured for assessing the image noise level and the perceived image quality. The image quality of the SR-CNN was evaluated by two metrics compared with those of conventional interpolation methods (nearest neighbor [NN], bilinear [BL]) by means of one-way ANOVA and Tukey's post-hoc test.

RESULTS

[MLO]: In the SR-CNN scheme, the mean ± SDs of PSNR and SSIM were 43.97 ± 3.87 dB, 0.957 ± 0.030, respectively, which were significantly higher than those of NN (41.83 ± 3.06 dB, [p<.001]; 0.938 ± 0.036, [p<.001], respectively), and BL (42.17 ± 3.34 dB, [p<.001]; 0.938 ± 0.040, [p<.001], respectively). [CC]: In the SR-CNN scheme, the mean ± SDs of PSNR and SSIM were 44.20 ± 3.68 dB, 0.960 ± 0.026, respectively, which were significantly higher than those of NN (41.99 ± 2.84 dB, [p<.001]; 0.942 ± 0.032, [p<.001], respectively), and BL (42.36 ± 3.14 dB, [p<.001]; 0.942 ± 0.035, [p<.001], respectively).

CONCLUSION

SR-CNN can significantly outperform conventional interpolation methods for enhancing image resolution in digital mammography.

CLINICAL RELEVANCE/APPLICATION

SR-CNN can provide substantial highly enhancement in magnifying mammographic images, leading to more accurate diagnosis of small or subtle lesions in breast glandular tissue without additional dose exposure or patient nuisance.