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P2.57: Effective noise reduction using a modified image pyramid incorporated with guided filtering for animal X-ray imaging

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Radiography is one of the most commonly used diagnostic tools in veterinary practice and, particularly, denoising is one of the important image processing tasks. Robust noise removal will improve the image quality of diagnosis. There are many state-of-the-art noise reduction methods that have been studied in the image processing literature. Nevertheless, no algorithm that can robustly remove image noise has been universally accepted because the resulting image performance of a denoising algorithm can vary substantially, depending on the imaged subject, X-ray imaging system, and operating conditions. In this study, to overcome this challenge, we proposed an effective denoising method based on a modified image pyramid incorporated with guided filtering for the practice of companion animals. Compared to traditional pyramid-based approaches that use a Gaussian filter and two-stage pyramid, our approach uses a guided filter and three-stage pyramid to robustly separate noise component from the image, keeping image details . Figure 1 shows the schematics of the traditional and proposed pyramids. To demonstrate the feasibility of the proposed denoising algorithm, we performed the noise reduction of a dog's radiograph, which was taken at an animal hospital, using the proposed algorithm, and evaluated the image quality in terms of the structural similarity and peak signal-to-noise ratio. Figure 2 shows the resulting images of a dog using several denoising algorithms: noisy image and denoised images using wavelet, traditional pyramid, proposed pyramid with Gaussian filtering, and proposed pyramid with guided filtering, followed by BayesShrink-based hard thresholding, respectively. According to our preliminary results, the proposed algorithm achieved the highest image performance among the other denoising algorithms, indicating its efficacy for reducing noise in animal radiography. More quantitative evaluation of the image performance will be presented in the paper.

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