AbstractID: 12884 Title: 20-fold dose reduction using a gradient adaptive bilateral filter: demonstration using in vivo animal perfusion CT

Purpose: To demonstrate the dose saving potential of a fast and practical algorithm based on a novel Gradient Adaptive Bilateral fIltration (GABI) algorithm, applied to *in vivo* extremely low dose animal perfusion CT scans. **Methods:** the GABI algorithm is mainly applied in the time dimension to avoid losing spatial resolution and noise power spectra characteristics (texture of CT images). It expands the bilateral filter algorithm by non-locally adapting its strength based on a temporal gradient applied to the image dataset, and hence preserving contrast fidelity over time. We tested the GABI on two renal perfusion animal experiments which used a reference dose of 160 mAs (full dose FD), and 16 mAs and 8 mAs ($1/10^{th}$ and $1/20^{th}$ of the radiation dose). **Results:** we demonstrated that the GABI algorithm preserves the temporal fidelity, as measured by the time attenuation curves (TACs), while dramatically reducing image noise from very low dose acquisitions, keeping comparable spatial resolution, and preserving CT noise texture. The background SNR for the FD pig A, FD pig B, $1/10^{th}$ dose pig A, $1/20^{th}$ dose pig B, $1/10^{th}$ pig A + GABI, $1/20^{th}$ pig B + GABI were 4.5, 4.4, 1.4, 0.85, 3.8 and 2.9 respectively. Higher background SNR improvements are possible, however we were constrained to keep very high fidelity to the TACs and hence perfusion parameters. **Conclusions:** the GABI algorithm provides a practical framework to highly reduce the dose in CT time series studies. The method is fast since it is image-space based and non-iterative. We demonstrated in real animal data, that in high SNR tasks as renal perfusion the gain in dose reduction can be as high as 20-fold with no practical detriment of perfusion information and image quality comparable to a full dose image acquisition. Further investigation for parameter optimization is guaranteed.