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Titel des Beitrags: Multi-sensor super-resolution for hybrid range imaging with application to 3-D endoscopy and open surgery.

Abstract: In this paper, we propose a multi-sensor super-resolution framework for hybrid imaging to super-resolve data from one modality by taking advantage of additional guidance images of a complementary modality. This concept is applied to hybrid 3-D range imaging in image-guided surgery, where high-quality photometric data is exploited to enhance range images of low spatial resolution. We formulate super-resolution based on the maximum a-posteriori (MAP) principle and reconstruct high-resolution range data from multiple low-resolution frames and complementary photometric information. Robust motion estimation as required for super-resolution is performed on photometric data to derive displacement fields of subpixel accuracy for the associated range images. For improved reconstruction of depth discontinuities, a novel adaptive regularizer exploiting correlations between both modalities is embedded to MAP estimation. We evaluated our method on synthetic data as well as ex-vivo images in open surgery and endoscopy. The proposed multi-sensor framework improves the peak signal-to-noise ratio by 2 dB and structural similarity by 0.03 on average compared to conventional single-sensor approaches. In ex-vivo experiments on porcine organs, our method achieves substantial...
improvements in terms of depth discontinuity reconstruction.