论文与报告

基于非采样Contourlet变换多传感器图像融合算法

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摘要
针对同一场景多聚焦图像的融合问题, 提出了一种基于非采样 Contourlet 变换 (Nonsubsampled Contourlet transform, NSCT) 图像融合算法. 并对经 NSCT 分解得到的不同频域子带系数, 分别讨论了低频子带系数和各带通方向子带系数的选择方案. 在选择低频子带系数时, 提出了一种基于图像局部区域梯度能量和``加权平均''相结合的系数选择方案, 从而不仅能够恰当地选择融合后图像的 NSCT 系数, 还能够有效地抑制噪声对融合图像质量的影响; 在选择带通方向子带系数时, 充分利用了 NSCT 的方向特性以及各尺度子带图像与源图像尺寸大小相同的特性, 给出了非采样 Contourlet 域方向对比度的概念, 并提出了一种基于方向对比度的系数选择方案. 采用了多聚焦图像进行仿真实验, 并对融合结果进行了主客观评价. 实验结果表明, 相比于传统的基于小波变换的图像融合算法, 该算法能够有效避免``人为''效应或高频噪声的引入, 得到具有更好视觉效果和更优量化指标的融合图像.

关键词　图像处理　图像融合　非采样Contourlet变换　方向对比度　局部区域梯度能量
分类号　TP391.41

Fusion of Multi-sensor Images Based on the Nonsubsampled Contourlet Transform

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Abstract
For the fusion problem of the multi-focus images of the same scene, a novel algorithm is proposed based on the nonsubsampled contourlet transform (NSCT). The selection principles of the low frequency subband coefficients and bandpass directional subband coefficients are discussed respectively. For choosing the low frequency subband coefficients, we present a scheme based on the local area energy of image gradient combined with the weighted average scheme, which can not only restrain the noise effectively but also select the coefficients properly. When choosing the bandpass directional subband coefficients, we make best use of such NSCT characteristics as directional sensitivity and same size between subband image and the original image, and define the directional contrast in the contourlet domain. Then we present a selection principle based on the directional contrast. The algorithm has been used to merge several sets of multi-focus images. The experimental results indicate that the proposed approach can avoid the introduction of artifacts and can significantly outperform the traditional wavelet-transform-based image fusion method in terms of both visual quality and objective evaluation criteria.

Key words　Image processing　image fusion　nonsubsampled Contourlet transform (NSCT)　directional contrast　local area energy of image gradient

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