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信息科学

红外与可见光图像融合系统的探测概率

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摘要：提出了一种定量计算红外与可见光图像融合系统目标探测概率的方法，建立了该融合系统的目标探测概率计算模型。首先，研究了影响目标探测概率的主要因素：目标与背景的光谱对比度、红外与可见光探测器的特性、环境照度条件、融合图像质量、目标大小与距离。针对这些影响因素，分别构建了5个影响目标探测概率因素的数学模型。在此基础上，设计了基于红外与可见光图像融合系统的探测概率计算模型。最后，针对两组实际任务进行了实验。以第一组为例，其对于单一探测系统目标为树木的探测概率 p_{vis} 为0.294 8， p_{IR} 为0.136 0，而采用不同算法的融合系统探测概率为0.414 2，远高于单一探测器的探测概率。得到的结果验证了融合系统的目标探测概率计算方法的有效性，证明了融合图像质量以及目标自身的光谱特性对融合系统目标探测概率起着重要作用。该模型实验结果符合人眼视觉特征。

关键词：红外图像 可见光图像 图像融合 探测概率 目标探测

Detection probability of infrared and visible image fusion system

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Abstract: A method to calculate the target detection probability quantitatively for a infrared and visible image fusion system was proposed and a corresponding calculation model was established. First, the main factors affecting on the target detection probability were analyzed, and they were the spectral contrast of target and background, the characteristics of infrared and visible light detector, environmental illumination conditions, the integration of image quality, and the target size and distance. Then, five mathematical models on the effect factors mentioned above was constructed. On this basis, a calculation model for the detection probability based on infrared and visible image fusion system was completed. Finally, the experiments for two practical missions were performed. The first experiment show its results as follows: target detection probability of trees for a single detection system p_{vis} is 0.294 8, p_{IR} is 0.136 0, but the detection probability for the fusion detection system is 0.414 2, much higher than that of single detector, which verifies the validity of the calculation method of fusion system for target detection probability. It proves that the fusion image quality and the spectral characteristics of goal itself play important roles for target detection probability. Moreover, the experiment results of the model is accord with the human visual characteristics as well.

Keywords: infrared image Visible image Image fusion detection probability Target Detection

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