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信息科学

基于相频空间稀疏性快速估计发光二极管灯点参数

宋喜佳[1,2]，刘维亚[1]，陈伟[1]，郑喜凤[1]

1.中国科学院 长春光学精密机械与物理研究所 2.中国科学院大学

摘要： 为了得到每个发光二极管(LED)灯点对某些目标位置的贡献量，以便获得、记录或重现特定的LED照明模式，本文对控制LED灯点的脉宽调制波形(PWM)的参数(振幅、频率偏移量、相位延迟)估计问题进行了研究。首先,将频率偏移-相位延迟空间离散化成网状格点空间，根据测量到的数据在格点空间具有稀疏性的特点建立了稀疏模型。然后，基于该稀疏模型，利用正交匹配追踪算法(OMP)用很少的采样点快速地重建出未知参数。最后，采用逐级迭代细分网格技术优化稀疏模型以便有效地抑制估计误差。实验结果表明，本文方法仅使用相当于奈奎斯特采样定理要求的27.5%的采样点即可准确地重建未知参数，从而快速估计LED灯点的参数。在理想情况下，本文算法的均方根误差小于0 68%。另外，不同噪声条件下的对比实验说明该算法在信噪比大于20 db时鲁棒性较好。

关键词： 发光二极管 稀疏模型 正交匹配追踪 网状格点 迭代细化

Fast parameter estimate for LED points based on the sparsity of frequency offset-phase delay space

SONG Xi-jia[1, 2], LIU Wei-ya[1], CHEN Wei[1], ZHENG Xi-feng[1]

1.Changchun Institute of Optics, Fine Mechanics and Physics, Chinese Academy of Sciences 2.University of Chinese Academy of Sciences

Abstract: To obtain every single LED’s contribution when they illuminate the target locations and to acquire, record or reappear some specific light patterns, this paper explores how to estimate the parameters of Pulse Width Modulation (PWM). These parameters are amplitude, frequency offset and phase delay, and they are generally used to control the LED points. Firstly, the frequency offset-phase delay space is dispersed into reticulated grid spaces, and a sparse model is established based on the measured data with sparsity characteristics in the grid space. Then, on the basis of the sparse model, very few samples are utilized to reconstruct the unknown parameters fast by means of Orthogonal Matching Pursuit (OMP) algorithm. Finally, an iterative refinement grid technique is introduced to optimize the sparse model so as to suppress the estimation error effectively. Experimental results indicate that the method presented in this paper can reconstruct the unknown parameters fast by using only 27.5% samples that of the traditional Nyquist sampling theorem. Simultaneously, this algorithm is found robustness when Signal to Noise Ratio(SNR) is higher than 20 db after lots of contrast tests in different noise conditions.

Keywords: Light Emitting Diode(LED) sparse model Orthogonal Matching Pursuit(OMP) reticulated grids iterative refinement

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通讯作者: 宋喜佳

作者简介: 宋喜佳(1985-)，男，黑龙江木兰人，博士研究生，2008年于西安邮电学院获得学士学位,主要从事LED大屏幕光色参数采集，机器视觉，嵌入式系统开发的研究。

作者Email: songxijia2009@gmail.com

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