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Joint Dictionary Learning for Multispectral Change Detection

Abstract:

Change detection is one of the most important applications of remote sensing technology. It is a challenging task due to the obvious variations in the radiometric value of spectral signature and the limited capability of utilizing spectral information. In this paper, an improved sparse coding method for change detection is proposed. The intuition of the proposed method is that unchanged pixels in different images can be well reconstructed by the joint dictionary, which corresponds to knowledge of unchanged pixels, while changed pixels cannot. First, a query image pair is projected onto the joint dictionary to constitute the knowledge of unchanged pixels. Then reconstruction error is obtained to discriminate between the changed and unchanged pixels in the different images. To select the proper thresholds for determining changed regions, an automatic threshold selection strategy is presented by minimizing the reconstruction errors of the changed pixels. Adequate experiments on multispectral data have been tested, and the experimental results compared with the state-of-the-art methods prove the superiority of the proposed method. Contributions of the proposed method can be summarized as follows: 1) joint dictionary learning is proposed to explore the intrinsic information of different images for change detection. In this case, change detection can be transformed as a sparse representation problem. To the authors' knowledge, few publications utilize joint learning dictionary in change detection; 2) an automatic threshold selection strategy is presented, which minimizes the reconstruction errors of the changed pixels without the prior assumption of the spectral signature. As a result, the threshold value provided by the proposed method can adapt to different data due to the characteristic of joint dictionary learning; and 3) the proposed method makes no prior assumption of the modeling and the handling of the spectral signature, which can be adapted to different data.