Moving Object Detection Using Tensor Based Low-Rank and Saliently Fused-Sparse Decomposition

Abstract

In this paper, we propose a new low-rank and sparse representation model for moving object detection. The model preserves the natural space-time structure of video sequences by representing them as 3-way tensors. Then it operates the low-rank background and sparse foreground decomposition in the tensor framework. On the one hand, we use the tensor nuclear norm (TNN) to exploit the spatio-temporal redundancy of background based on the circulant algebra. On the other, we use the new designed saliently fused-sparse regularizer (SFS) to adaptively constrain the foreground with spatio-temporal smoothness. To refine the existing foreground smooth regularizers, the SFS incorporates the local spatio-temporal geometric structure information into the tensor total variation by using the 3D locally adaptive regression kernel (3D-LARK). What's more, the SFS further uses the 3D-LARK to compute the spacetime motion saliency of foreground, which is combined with the l1 norm and improves the robustness of foreground extraction. Finally, we solve the proposed model with globally optimal guarantee. Extensive experiments on challenging well-known datasets demonstrate that our method significantly outperforms the state-of-the-art approaches and works effectively on a wide range of complex scenarios.

Index Terms—Moving object detection, tensor nuclear norm, tensor total variation, space-time visual saliency.