General Dynamic Scene Reconstruction from Multiple View Video
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Motivation and Contributions
Limitations of existing multiple wide-baseline dynamic scene reconstruction technique:
1. They work in controlled environments;
2. Assumption of known background appearance and structure;
3. Fixed and calibrated cameras.
Contributions:
1. An automatic method for initial coarse dynamic scene reconstruction without prior knowledge of background appearance or structure;
2. A robust approach for joint segmentation refinement and dense reconstruction of dynamic scenes from wide-baseline moving cameras.

Framework for proposed general scene reconstruction
Joint segmentation and reconstruction refinement
1. Depth at each pixel \( p \) is assigned from a set of depth values \( D = \{ d_1, ..., d_{|D|}, U \} \). Each \( d_i \) is obtained by sampling the optical ray from the camera and \( U \) is an unknown depth value to handle occlusions and to refine object segmentation.
2. Energy minimization of the cost function is performed:
   \[
   E(d) = \lambda_{data} E_{data}(d) + \lambda_{contrast} E_{contrast}(d) + \lambda_{smooth} E_{smooth}(d)
   \]
3. Each dynamic object with the region \( R_I \) and \( R_O \) is processed separately.
4. We divide our depth labels in two sets, one for the region \( R_I (D_I) \) and other for \( R_O (D_O) \) such that \( |D_I| < |D_O| \)
5. The equation consist of three terms: the data term is for the photo-consistency scores, the smoothness term is to avoid sudden peaks in depth and maintain the consistency and the contrast term is to identify the object boundaries.

Results and Evaluation
Summary:
1. The proposed approach allows unsupervised reconstruction without prior information on scene appearance or structure.
2. The segmentation and reconstruction accuracy are significantly improved over previous methods allows application to more general dynamic scenes.
3. Tests on challenging datasets demonstrate improvements in quality of reconstruction and segmentation compared to state-of-the-art methods.

References

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