

論文の内容の要旨

論文題目 Robust Non-rigid Tracking and Reconstruction Based on Spatial-Temporal Learning
(時空間学習に基づくロバストな非剛体追跡および再構成)

氏 名 李 楊

4D reconstruction of non-rigidly deforming scenes has numerous applications in computer vision, virtual/augmented reality, and robotics, etc. With the latest advancements of consumer-level depth sensors, such as Microsoft Kinect, Intel RealSense, and even smartphone mounted cameras, non-rigid reconstruction using a single RGB-D camera has gained momentum. However, due to the high complexity and non-convexity of the problem and the limitation of range sensors, a robust reconstruction system for generic non-rigidly deforming scene remains a challenge. This thesis aims to develop a single movable RGB-D camera based non-rigid reconstruction system that can 1) handle large non-rigid motion, 2) simultaneously reconstruct both the static background and the dynamic foreground objects of a given scene, 3) handle scene occlusion, and 4) yield global consistent camera pose tracking. We achieve this system by combining the classic tracking and reconstruction method with spatial-temporal priors that are learned from data. Specifically, to satisfy 1), we redefine the non-rigid tracking energy using the distance function that is defined in learned feature space. The feature is trained in the way that it can alleviate the non-convexity of this problem. To satisfy 2), we propose SplitFusion which first split the scene into rigid or non-rigid surfaces and then simultaneously performs tracking and dense reconstruction for both rigid and non-rigid components of the scene. To satisfy 3), we propose a completion approach to jointly recover the occluded structure and motion from partial RGB-D camera observation. To satisfy 4), we propose a self-supervised monocular VO that uses a pose graph optimization back-end to guarantee global camera pose consistency. Thorough experiments demonstrate the advantage of the proposed system in terms of tracking robustness and reconstruction quality in non-rigid scenes.