Multi-Body Depth-Map Fusion with Non-Intersection Constraints: Supplemental Material

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Abstract. The supplemental material reports additional results computed with the proposed multi-body depth-map fusion algorithm with non-intersection constraints.

1 Laptop

Here, we report some additional results based on the Laptop dataset. This dataset contains 18 images of a laptop, taken from a moving camera while the screen of the laptop was moving with respect to the keyboard. The data has been captured such that a fixed configuration between the keyboard and screen has only been observed from at most 3 different camera poses. This means for example that for the keyboard grid, the accumulated consistent evidence over all 3 camera poses for a ghost screen is weaker than the evidence for the keyboard which accumulates data from 18 camera poses. In such a situation, an alternative idea to decrease the ghosting artifacts is to put more emphasis on the spatial regularization term, hoping that regions with low evidence won't get reconstructed due to the otherwise implied high regularization cost. As Fig. 1 shows, such a strategy can indeed decrease the ghosting artifacts to some extent. However, some artifacts remain and the screen still intersects with the keyboard. With our non-intersection constraints, those artifacts and intersections vanish. It is important to note that putting more emphasis on the regularization term can lead to other artifacts, like the elimination of correct regions which are not part of a ghosting artifact or a smooth interpolation between a ghost part and the correct reconstruction (as seen in Fig. 1). Hence, the success of this strategy strongly depends on the motion of the camera and the frequency of changing configurations between the parts.

2 Box

This dataset consists of 13 images taken from a moving camera and a moving wooden box in front of a rigid background. The wooden box translates and rotates which can lead to severe artifacts if not handled properly. We refer to Fig. 2 for some sample input images, depth-maps corresponding to these images for the

Sample Input images	Sample Depth maps	Without Non-Intersection Constraints	With Non-Intersection Constraints

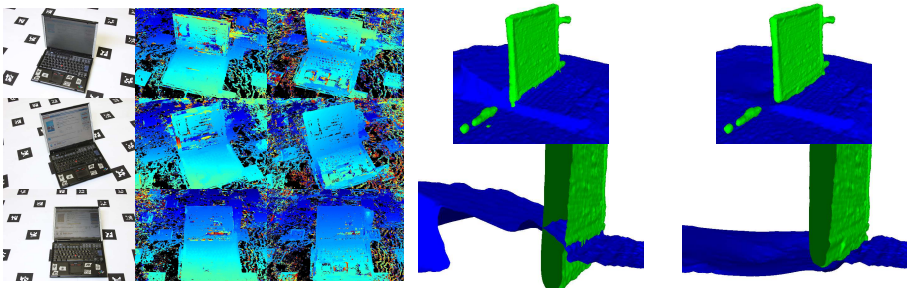

Fig. 1: In comparison to the results reported in the paper, here we increased the spatial regularization term considerably. This eliminates artifacts to some extend even without non-intersection constraints. However, as the close-up views with a slicing plane show, intersections are still present without non-intersection constraints. Moreover, the background plane has wrongly been interpolated smoothly with the most widely-opened position of the screen. Two artifacts remain in both reconstruction. These are due to inaccuracies in the depthmaps, as can be seen in some of the visualized sample depthmaps.

background and the wooden box, and the resulting multi-view reconstruction with disabled and enabled non-intersection constraints. Without non-intersection constraints, the wooden box gets reconstructed multiple times in the background grid (visualized in blue) whereas the background is reconstructed multiple times in the wooden box grid (visualized in green). Due to the rotation of the box, those ghosting artifacts of the background are clearly visible in the box grid. When superimposing the reconstructions from both grids in a common coordinate frame associated with one configuration, intersections are clearly noticeable. Other intersections would become apparent when mapping to a coordinate frame associated to a different configuration. In contrast, with enabled non-intersection constraints, the ghosting artifacts disappear, resulting in a clear segmentation between the wooden box and the background.

Sample Input images	Sample Depth maps	Without Non-Intersection Constraints	With Non-Intersection Constraints

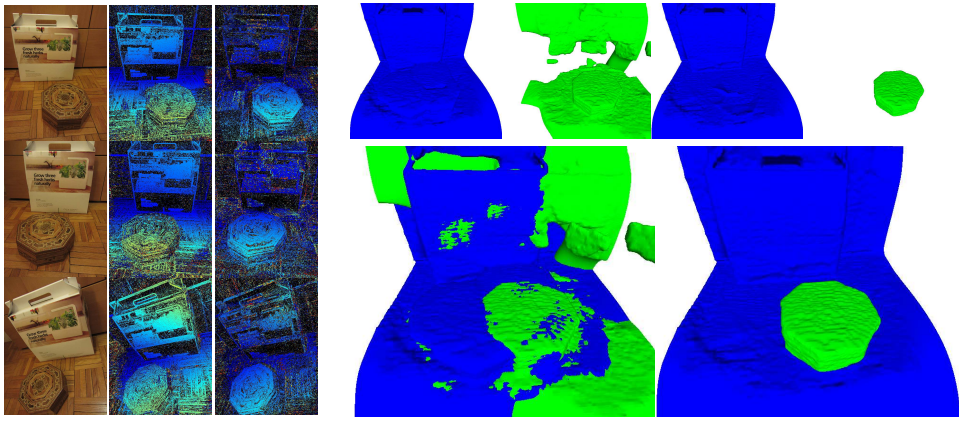

Fig. 2: A wooden box translates on a plane and rotates around the plane normal. Our reconstruction algorithm based on non-intersection constraints not only avoids ghosting artifacts, it also provides a segmentation of the box from the background.