

Single Viewpoint Symmetry-Based Model Completion for Efficient 3D Acquisition

Creating complete models of real-world objects from captured images is an important part of computer graphics and geometric modeling. However, a challenge for image-based techniques is obtaining a complete model of the 3D object from a single viewpoint. Our key observation is that it is possible to create a complete model from a single viewpoint if it is possible to infer information about the occluded regions from what is seen from the one viewpoint. Symmetry, which exists in many natural and man-made objects, helps us achieve this goal. With the aid of symmetry, we can quickly and efficiently classify the symmetry into one of a small set of cases and then perform a plausible reconstruction of more than what is visible from the single viewpoint. We first classify the symmetry of the object and then perform model completion. Using optimization-based techniques we discover and transfer symmetric patches of geometry to areas of missing geometry and zip them together to form a single, complete mesh. We additionally can convert the mesh into a solid watertight object by sealing off the model or creating an inset of the model. Unlike previous approaches, our model completion does not require an object database and supports three related families of symmetric objects. We demonstrate our approach by capturing, reconstructing, and completing several real-world objects, ranging up to millions of triangles.