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Stereo Model Selection and Point Cloud Filtering using an Out-of-Core Octree

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Abstract. Dense image matching methods enable the retrieval of dense surface information using any kind of imagery. The best quality can be achieved for highly overlapping datasets, which avoids occlusions and provides highly redundant observations. Thus, images are acquired close to each other. This leads to datasets with increasing size – especially when large scenes are captured. While image acquisition can be performed in relatively short time, more time is required for data processing due to the computational complexity of the involved algorithms. For the dense surface reconstruction task, *Multi-View Stereo* algorithms can be used – which are typically beneficial due to the efficiency of image matching on stereo models. Our dense image matching solution *SURE* uses such an approach, where the result of stereo matching is fused using a multi-stereo triangulation in order to exploit the available redundancy. One key challenge of such *Multi-View Stereo* methods is the selection of suitable stereo models, where object space information should be considered to avoid unnecessary processing. Subsequently, the dense image matching step provides up to one 3D point for each pixel, which leads to massive point clouds. This large amount of 3D data needs to be filtered and integrated efficiently in object space. Within this paper, we present an *out-of-core octree*, which enables neighborhood and overlap analysis between point clouds. It is used on low-resolution point clouds to support the stereo model selection. Also, this tree is designed for the processing of massive point clouds with low memory requirements and thus can be used to perform outlier rejection, redundancy removal and resampling.

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