Texture reconstruction algorithm driven by prior knowledge of ground object types

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SUMMARY

The texture reconstruction method uses multi-view images and 3D geometric surface models as data sources to establish the mapping relationship and texture consistency constraints between 2D images and 3D geometric surfaces to produce a three-dimensional model with color reality. Accurate and reliable texture mapping is essential to achieve visual realism of 3D models. The existing methods suffer from at least texture fragmentation and temporal inconsistency issues. A texture reconstruction method guided by multi-view semantic segmentation information is proposed. The core content includes four parts: (1) Occlusion-aware sparse critical scene construction. A multiscale and multifactor joint screening strategy is constructed using recovered camera parameters, image parameters, trajectories, connection points and neighboring candidate image sets. (2) Consistent semantic information extraction from the 3D model. First, the UAVid dataset is selected and enriched as a training sample library, and the semantic segmentation of 2D images is performed using the UNetFormer framework. Then, a global consistent 3D semantic mapping rule is proposed to refine and fuse the segmentation results of multiview 2D images into the semantic information of 3D models. (3) Energy function construction considering prior knowledge. The optimal view is selected for ground objects of different geometric complexities by introducing prior knowledge of ground objects into the energy function; thus, the optimal view of adjacent similar ground objects becomes more cohesive. (4) Color adjustment includes global and local adjustments, which are used to reduce the color discontinuity between texture blocks. Experimental verification and analysis are conducted using public and actual datasets. Compared with famous algorithms such as Allene, Waechter, and OpenMVS, the proposed algorithm performs best in terms of quantitative indicators of texture quality and clarity and contrast in the details; moving objects are culled more cleanly, and redundant calculations are significantly reduced.