

Fast global stereo matching via energy pyramid minimization

Abstract:

Precise Digital Surface Models (DSM) are widely employed in urban monitoring, geological surveys, architecture, or archeology. DSM are now mostly generated using remote sensing surveys based on optical stereo-imaging, interferometric Synthetic Aperture Radar (SAR), or Light Detection And Ranging (LiDAR) acquisitions. In this paper, we work focus on optical stereo-imaging.

We define a global matching framework based on energy pyramid, the Global Matching via Energy Pyramid (GM-EP) algorithm, which estimates the disparity map from a single stereo-pair by solving an energy minimization problem. We efficiently address this minimization by globally optimizing a coarse to fine sequence of sparse Conditional Random Fields (CRF) directly defined on the energy. This global discrete optimization approach guarantee that at each scale we obtain a near optimal solution, and we demonstrate its superiority over state of the art image pyramid approaches through application to real stereo-pairs. We conclude that multiscale approaches should be build on energy pyramids rather than on image pyramids.