Spherical-to-ERP Epipolar Rectification for Single-Axis Disparity in 360° Stereo

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Abstract

Omnidirectional stereo images provide full-surround perception but violate the geometric assumptions of classical disparity estimation: in spherical or fisheye views, epipolar correspondences follow curved great-circle paths, producing two-dimensional displacements that cannot be treated as single-axis disparity before geometric rectification. In this work, we adopt a standard spherical-to-equirectangular (ERP) projection as a preprocessing step, which straightens epipolar curves and restores a one-dimensional disparity structure—horizontal for left–right rigs and vertical for top–bottom rigs. Building on our previously introduced RAFT + Epipolar-Aligned Channel Selection (EACS) framework, originally developed for rectilinear and ERP stereo, we examine whether the same modular pipeline remains accurate when the input originates from spherical stereo imagery. After ERP projection, dense optical flow from RAFT is reduced to disparity by retaining only the baseline-aligned flow component. Experiments on synthetic fisheye stereo datasets show that this spherical→ERP→RAFT+EACS pipeline produces accurate, smooth, and structurally consistent disparity maps at real-time speed. These findings confirm that established ERP preprocessing can be effectively combined with our earlier RAFT+EACS method to enable practical, interpretable, and efficient disparity estimation from spherical stereo, providing a straightforward pathway for extending conventional stereo pipelines to 360° imaging.

Keywords

Spherical Stereo, Omnidirectional Vision, Equirectangular Projection (ERP), Optical Flow–Based Disparity, Epipolar-Aligned Channel Selection (EACS), Stereo Correspondence.