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Riemannain Geometries Of Visual Space

Authors : Jacek Turski

Abstract : The visual space geometries are constructed in the Riemannian geometry framework from simulated iso-disparity conics in the horizontalvisual plane of the binocular system with the asymmetric eyes (AEs). For the eyes fixating at the abathic distance, which depends on the AE's parameters, the iso-disparity conics are frontal straight lines in physical space. For allother fixations, the iso-disparity conics consist of families of the ellipses or hyperbolas depending on both the AE's parameters and the bifoveal fixation. However, the iso-disparity conic's arcs are perceived in the gaze direction asthe frontal lines and are referred to as visual geodesics. Thus, geometriesof physical and visual spaces are different. A simple postulate that combines simulated iso-disparity conics with basic anatomy od the human visual system gives the relative depth for the fixation at the abathic distance that establishes the Riemann matric tensor. The resulting geodesics are incomplete in the gaze direction and, therefore, give thefinite distances to the horizon that depend on the AE's parameters. Moreover, the curvature vanishes in this eyes posture such that visual space is flat. For all other fixations, only the sign of the curvature canbe inferred from the global behavior of the simulated iso-disparity conics: the curvature is positive for the elliptic iso-disparity curves and negative for the hyperbolic iso-disparity curves.

Keywords : asymmetric eye model, iso-disparity conics, metric tensor, geodesics, curvature
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