

An Ellipsoid Object Model of the Refraction Surface

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Abstract

Geometric image distortions appear when cameras register the image from behind a refractive object – e.g. a car windshield. To ensure the reliability of 3D perception algorithms, a distortion model is necessary. The model has to be general enough to capture the variety of possible refractive object geometries. We propose a method where we directly model the refractive media as a thick ellipsoid, and compute the resultant distortions by tracing individual light rays as they refract on the *inner and outer surface* of the object. With this new ellipsoid model provides flexibility and via the model parameters we are able to capture all important factors influencing distortions, namely the curvature of the surfaces, position relative to the camera, and thickness of the refractive material. We test the proposed model on a synthetic dataset, analyzing the advantages and possible failure cases of our method.

Keywords: Image distortions, Calibration, Inverse models