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**Vision Through Semi-Reflecting Media: Polarization Analysis**

**Yoav Y. Schechner, Joseph Shamir and Nahum Kiryati**

**Department of Electrical Engineering  
Technion - Israel Institute of Technology  
Haifa 32000, Israel**

**Abstract**

Consider scenes deteriorated by reflections off a semi-reflecting medium (e.g. a glass window) that lies between the observer and an object. We present an approach to recover the scenes (layers) and to classify which is the reflected one, based on imaging through a polarizer at two or more different orientations. We analyze the image formation process taking into account changes in the reflection and polarization properties due to internal reflections within the medium. Reconstruction by inversion of this process requires the estimation of the orientation (inclination and tilt angles) of the transparent (invisible) surface. The inclination angle is estimated by seeking the value which leads to decorrelation of the estimated layers, or to their minimal mutual information. Fundamental ambiguities in the estimation of the angles are discussed. The layers are automatically labeled as reflected/transmitted. Experimental results demonstrate the success of angle estimation and consequent layer separation and labeling.