

Proposal for a Master Thesis

Topic: Disparity Estimation of Multi-faceted Objects using Specular Reflections

Description: Disparity estimation plays a crucial role in computer vision, particularly for depth perception and 3D reconstruction. While neural networks have achieved remarkable performance in this domain^{1,2}, they struggle with smooth and textureless surfaces like plastics. To address this issue, the non-neural disparity estimation algorithm SRDE (Specular Reflection Disparity Estimation) was developed. It exploits the specular reflection that smooth surfaces often exhibit. Results are shown in Figure 1.

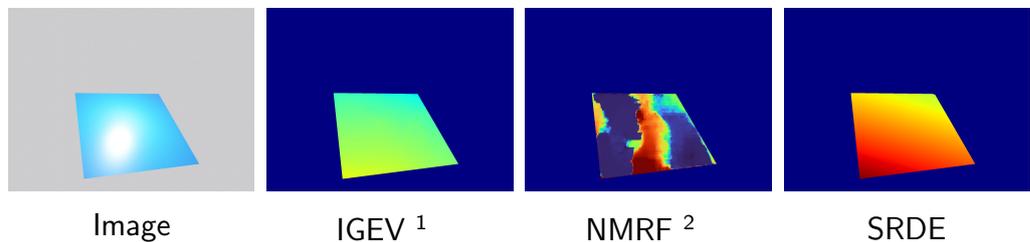


Figure 1

The goal of this work is to extend SRDE to multi-faceted objects. In particular, the approach shall be generalized to handle objects with multiple planar surfaces, such as cubes or similar geometries. Therefore, the setup shall be extended by an additional light source, enabling the estimation of multiple surface planes from distinct specular reflections. By jointly estimating these planes, their intersections can be used to recover edges and more complex object structures.

Tasks:

- Investigation of the underlying SRDE algorithm
- Recording and generation of more test images
- Adaption and extension of SRDE to multi-faceted objects
- Evaluation and comparison of developed algorithm

Prerequisites: Very good performance in the course 'Image, Video, and Multidimensional Signal Processing', excellent Python programming skills, strong mathematical background

Language: English or German

Supervisor: Katja Kossira, M.Sc.
(Cauerstr. 7, room 06.022, email: katja.kossira@fau.de)

Professor: Prof. Dr.-Ing. André Kaup

Available: Immediately (March 2026)

¹G. Xu et al.: "Iterative Geometry Encoding Volume for Stereo Matching", CVPR, 2023.

²T. Guan et al.: "Neural Markov Random Field for Stereo Matching", CVPR, 2024.