Lehrstuhl für Multimediakommunikation und Signalverarbeitung
Universität Erlangen-Nürnberg

Proposal for a Master Thesis

Topic: **Extension of Neural Disparity Estimation Networks for Reflective Regions through Specular Reflection Exploitation**

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 (see Figure 1).

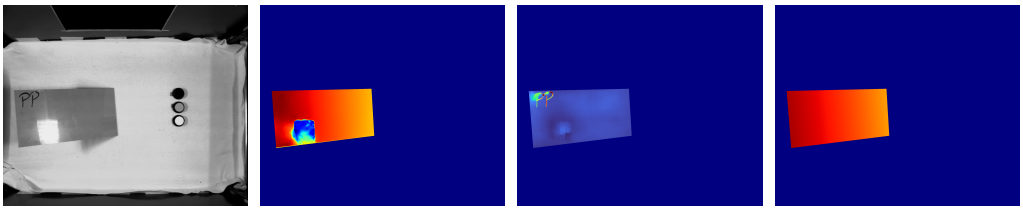

Image | IGEV [1] | NMRF [2] | non-neural [3]

Figure 1

To solve this issue, the specular reflections that smooth surfaces often exhibit are exploited. A non-neural disparity estimation algorithm [3] was developed, that effectively handles reflective surfaces and produces highly accurate results.

The goal of this work is to integrate this new algorithm into state-of-the-art neural networks for disparity estimation and to evaluate whether it enhances their functionality and overall performance. By combining the strengths of both approaches, we aim to improve disparity estimation in difficult environments and explore the potential benefits of hybrid methods for neural network based approaches.

Tasks:

- Investigation of state-of-the-art neural networks for disparity estimation
- Investigation of non-neural disparity estimation for reflective surfaces
- Combination of neural network and non-neural approach
- Evaluation of the extended neural network considering common metrics, synthetic data and real-world data

Prerequisites: Excellent knowledge of Python programming, good knowledge in ML/DL

Supervisor: Katja Kossira, M.Sc., room 06.022, e-mail: katja.kossira@fau.de

Professor: Prof. Dr.-Ing. André Kaup

Available: Immediately (February 2025)

[1] G. Xu et al.: "Iterative Geometry Encoding Volume for Stereo Matching", CVPR 2023.
[2] T. Guan et al.: "Neural Markov Random Field for Stereo Matching", CVPR 2024.
[3] K.Kossira et al.: "Exploiting Specular Reflections for Disparity Estimation of Reflective Surfaces", ICCV 2025.