Lehrstuhl für Fahrzeugtechnik
Fakultät für Maschinenwesen
Technische Universität München

MA

Multi-View Neural Video Compression for Autonomous Vehicles

Autonomous vehicles utilize multiple synchronized cameras to achieve comprehensive environmental perception. Current neural video compression approaches process each camera stream independently, failing to exploit the substantial redundancy present when multiple cameras observe the same 3D scene structure. The fixed geometric relationships between cameras in autonomous vehicle configurations provide exploitable priors that remain unused in existing neural compression architectures. Modern range-conditional compression models have demonstrated superior rate-distortion performance for single camera systems by leveraging depth information, but no work has extended this approach to multi-camera systems where geometric correspondence across views provides additional compression opportunities.

The goal of this work is to develop a multi-view neural video compression system that jointly encodes multiple camera streams by exploiting shared scene structure through range conditioning and cross-view feature dependencies, demonstrating superior compression efficiency compared to independent per-stream encoding.

Work Packages:

- Literature survey of multi-view video compression and range-conditional neural codecs
- Extension of existing single-camera range-conditional codec to multi-camera architecture with joint latent space
- Development of computationally efficient temporal module handling multiple synchronized video streams
- Implementation of per-camera depth conditioning with structural encoding of camera extrinsic and geometric relationships
- Design of cross-camera conditional entropy coding where side cameras condition on center camera transmitted information
- Comparative evaluation measuring compression gains versus independent encoding baseline on autonomous driving datasets

Requirements:

- Programming experience with Python and well versed with Pytorch
- Understanding of multi-view geometry and camera calibration
- High personal motivation and independent working style.
- Very good language proficiency in German, English

Kontakt:

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Recommended Literature:

1. Nonlinear Transform Coding
2. End-to-End Neural Video Compression: A Review
3. DCVC-RT
4. Low-Latency Neural Stereo Streaming
5. Neural Stereo Video Compression with Hybrid Disparity Compensation
6. LMVC: An End-To-End Learned Multiview Video Coding Framework

This work can also be completed in German.

If you are interested or have any questions, please send me an e-mail with your CV and a current transcript of your records, thank you!

The paper should document the individual steps in a clear and concise manner. The candidate undertakes to complete the term paper independently and to indicate the academic resources used.

The submitted paper remains the property of the chair as an examination document.

Prof. Dr.-Ing. M. Lienkamp

Betreuer: Niklas Krauß, M. Sc.

Ausgabe:_____

Abgabe: _____

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