ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Distributed Computing

Prof. R. Wattenhofer

Optimizing Encoding Speed for Coordinate-Based Low Complexity Hierarchical Image Codec

Learned image compression outperforms traditional codecs in image quality at the same rate, but they are not deployed widely due to their slow decoding speeds. COOL-CHIC [1] addresses this issue by achieving fast decoding times through the use of a low-complexity coordinate-based neural representation. This method reduces the decoding process to just 680 multiplications per pixel, significantly lowering the computational cost compared to more complex autoencoder-based methods. By leveraging a learned function that maps pixel coordinates to RGB values and sending these parameters using entropy coding, COOL-CHIC achieves high-quality compression that is competitive with traditional codecs like HEVC, all while making decoding feasible for real-time applications without requiring specialized hardware. However, the encoding process is still time-consuming, taking minutes per image, as it involves overfitting a multi-layer perceptron (MLP) to reconstruct the image, making the encoding process complex.

This project explores how the encoding time of COOL-CHIC can be decreased while maintaining high compression quality and real-time decoding capabilities. Various approaches will be investigated, including meta-learning techniques to accelerate the learning process, quantization strategies to improve the compression rate without sacrificing image quality, and different initialization techniques to reduce the training time of the MLP. Additionally, other strategies to optimize the encoding process will be explored, aiming to improve both speed and efficiency in various aspects of the encoding pipeline.

Requirements: Strong programming skills in Python and an interest in learned compression techniques.

Weekly meetings will address questions, discuss progress, and brainstorm new ideas.

Contact

In a few sentences, please describe your interest in this project and any relevant coding experience or background (e.g., projects or coursework).
Till Aczel: taczel@ethz.ch, ETZ G60.1

References

[1] Théo Ladune et al. "Cool-chic: Coordinate-based low complexity hierarchical image codec". In: *Proceedings of the IEEE/CVF International Conference on Computer Vision*. 2023, pp. 13515–13522.