Optimized Image Compression for Mobile Photography

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The widespread adoption of smartphones with high-resolution cameras has driven a surge in image capture, particularly for selfies, food, and landscapes, which dominate social media. Efficient image compression is essential to reduce storage and transmission requirements while maintaining visual quality. Traditional methods like JPEG and JPEG2000 have reached their limits, making learning-based image compression (LIC) a promising alternative. However, most LIC models, such as Seg-PIC [2], are trained on general-purpose datasets like COCO, limiting their effectiveness for smartphone-specific content.

This work fine-tunes the SegPICC [2] model for selfies, food, and landscapes, with the decoder fixed to ensure compatibility with JPEG AI standards [1]. The encoder was trained separately on 10,000 images from each dataset: Selfie, Food101, and landscapes. During inference, we adopted the 4×4 grid partition approach originally proposed in SegPIC, which avoids additional bitrate overhead while maintaining high reconstruction quality. This method maintains standardized decoder compatibility while optimizing for domain-specific content.

The model was evaluated on the Kodak dataset, the JPEG AI test set, and unseen Flickr30k selfies using PSNR and MS-SSIM metrics. The fine-tuned SegPIC model achieved significant improvements over the pre-trained version: BD-rate savings of -2.69% for the same PSNR and -2.89% for the same MS-SSIM for selfies, -3.87% (PSNR) and -4.02% (MS-SSIM) for food, and -1.13% (PSNR) and -1.40% (MS-SSIM) for landscapes. On Flickr30k selfies, the model generalized well, with BD-rate reductions of -3.40% (PSNR) and -5.80% (MS-SSIM). While slight performance declines were observed on general datasets like JPEG AI, the trade-off highlights the benefits of specialization. Visual inspections showed improved reconstruction of textures and fine details at lower bitrates, particularly for domain-specific categories.

This study demonstrates the advantages of fine-tuning LIC models for specific use cases while preserving compatibility with standardized decoding frameworks. Future work will expand to broader categories, such as pets and portraits, and explore preclassification mechanisms for dynamic encoder selection.

References

- [1] Joint Photographic Experts Group (JPEG). JPEG AI—learning-based image coding standardization. https://jpeg.org/jpegai/.
- [2] Yuxi Liu, Wenhan Yang, Huihui Bai, Yunchao Wei, and Yao Zhao. Region-adaptive transform with segmentation prior for image compression. In *CVPR*, Vancouver, BC, Canada, June 2024.