Deep Video Compression

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Limitations of Current Generation Coding

- Witnessing a saturation point in compression ratio while introducing significant encoding and decoding latencies.
- Lack the ability to adapt well with varying network conditions resulting in poor user experience
- High egress and ingest costs while transcoding onto/from CDNs and cloud providers

Why Deep Video Compression?

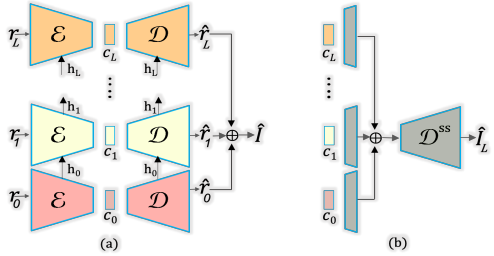
- Resurrects the benefits of scalable video compression (SVC) while eliminating the compression overheads.
- Flexible data-driven approach, eliminating the need for hundreds of algorithms and options that need to be tuned to get the best performance.
- Enables software-defined video coding (on-demand codec upgrades, agile code development, royalty-free).

KEY FINDINGS

- **Deep learning based SVC with zero compression overheads**
- **Orders of magnitude decrease in coding latencies**
- **Fundamentally changing the Internet video delivery path**
- **Broader applications in rate adaptation based approaches (Coding at physical layer, Erasure codes etc)**

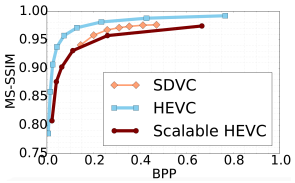
Scalable Compression using Code Fusion

- **SVC Primer**: an adaptive coding method to allow clients to stream videos with adaptive bitrates. Traditional SVC has extreme compression overheads and computational issues.
- **Goal**: Design a light-weight SVC technique using DNNs (SDVC) with no compression overheads.
- We use the iterative residual coding technique [1] to compress the video into different layered codes.
- **Challenges**: High 1) Decoding latency, 2) Memory demand
- Our key insight is that the DNNs can learn to ***fuse*** different codes efficiently compared to an algorithmic approach.
- We use `***code fusion***` to learn a decoder that can decode multiple codes together in a single shot.

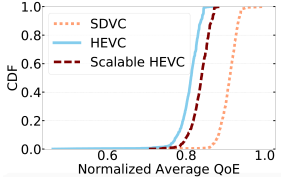


Deep learning based scalable compression: a) iterative coding, b) single-shot decoder.

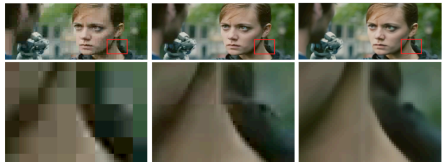
Results



Video Quality vs Bitrate



Video Quality of Experience



HEVC Scalable HEVC SDVC

Qualitative Results

Discussion

- Several research challenges remain before we can embrace the learned compression in the Internet video context--- Mobile devices have low computation and energy sensitive.
- Several opportunities for--- Application specific codecs, software defined codecs, Rate adaption algorithms, Adapting transport and Application protocols.

References

- C.-Y. Wu, N. Singhal, and P. Krahenbuhl. Video compression through image interpolation. In ECCV, pages 416–431, 2018.