The JPEG Still Picture Compression Standard
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This paper introduces the first international standard for continuous-tone still image compression. It presents a DCT-based compression method that achieves compression ratios between 10:1 and 50:1 while maintaining visually acceptable image quality. The algorithm first divides images into 8x8 blocks, applies the DCT transformation, quantizes the coefficients, and finally performs entropy coding. The standard defines multiple modes of operation including sequential, progressive, lossless, and hierarchical encoding, making it adaptable to various applications. A key strength is the introduction of the Baseline sequential codec, which ensures interoperability while still allowing for more complex implementations. The standard is flexible, handling various image formats, color spaces, and quality requirements through parameterizable quantization tables. While the paper does a great job of documenting implementation details and providing practical guidance, it has some limitations. For example, the approach can produce blocking artifacts at high compression ratios. Additionally, the design of appropriate hash functions isn't discussed in a lot of detail which could be improved. Despite this however, JPEG has had tremendous impact, even laying the foundation for future video compression standards like MPEG. The standard also provides extensive guidance on quantization strategies, including example tables that have been optimized for typical viewing conditions. The JPEG committee made the important decision to not mandate specific quantization or Huffman tables, allowing applications to optimize for their specific needs. The standard also introduces innovative features like progressive encoding, which allows images to be reconstructed gradually as data arrives - particularly useful for network applications. While primarily focused on lossy compression, JPEG also includes a separate lossless mode of operation, though it typically achieves much lower compression ratios. The paper goes beyond just technical specifications by providing implementation guidelines and discussing practical considerations for both hardware and software implementations. This attention to real-world application has contributed significantly to JPEG's longevity and widespread adoption across diverse fields from digital photography to medical imaging.

MPEG: A Video Compression Standard for Multimedia Applications
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This paper describes the MPEG standard for video compression, targeting bit rates around 1.5M bits per second while maintaining acceptable quality. The standard's key innovation is the introduction of bidirectional prediction, called B-frames, alongside conventional intra and predicted frames (I and P frames), which work together to significantly improve compression efficiency. The paper details a layered syntax structure that supports various applications and formats while ensuring error resilience. MPEG combines motion compensation with DCT-based compression, similar to JPEG, achieving exceptional quality at manageable bit rates. The standard carefully considers practical implementation aspects, including buffer management and decoder requirements. The approach isn't perfect, however, as it increases the complexity of encoding due to motion estimation, creating a quality vs. bitrate tradeoff that didn't exist before. Despite this however, MPEG has been very impactful, lending hand to digital video integration into computer systems and spawning development of dedicated video compression hardware. The standard's flexibility and practicality have led to widespread adoption in multimedia applications. The paper introduces sophisticated buffer management through the video buffer verifier model, which ensures decoders can operate with reasonable memory constraints. It defines a 'constrained parameters' subset that guarantees interoperability while still allowing more advanced implementations to support higher resolutions and bit rates. The standard's layered approach to syntax provides remarkable flexibility, allowing applications to optimize for their specific needs while maintaining compatibility. Audio synchronization was also carefully considered, with mechanisms provided to maintain proper timing relationships between audio and video streams. Looking beyond its immediate applications, the paper discusses potential extensions to higher resolutions and bitrates, demonstrating remarkable foresight about future needs in digital video. The MPEG committee's collaborative development process, involving extensive testing and evaluation of competing approaches, helped ensure the standard's robustness and practicality.