

# Exploring Advances in Video Compression Efficiency

BY SEAN MCCARTHY

**C**ompression is a foundational technology in our industry that enables content creators to deliver spectacular experiences to people around the world. It is no wonder, then, that compression is an annual theme of our Journal. This year, video compression experts tell us how existing technologies continue to improve, show us how to use the latest video coding standard, and bring us up to speed on the future of AI-powered video compression.

The overall theme of this issue is compression efficiency, but efficiency is not only about bandwidth. Energy efficiency is also critical and the subject of Natalia Molinero Mingorance's paper describing a study of motion estimation, a power-hungry aspect of video compression, to understand how energy efficiency can be improved for the high-resolution, streaming, and



THE PAPERS IN THIS ISSUE OF THE JOURNAL HIGHLIGHT SOME OF THE **HIGHLY SIGNIFICANT ADVANCES** THAT CONTINUE TO BE MADE IN COMPRESSION AND DELIVERY OF GREAT CONSUMER EXPERIENCES.

interactivity needs of the metaverse. Providing a welcome boost to future research, Mingorance also provides a software tool and methodology that other researchers can use to explore and develop power-friendly video compression techniques. It will be exciting to see the progress that can be made for existing and future video codecs as energy optimization becomes a critical performance metric alongside bandwidth and storage efficiency.

Another theme of this issue is enhancing the functionality and performance of existing video coding and distribution standards.

Markus Weber describes a way to preserve color fidelity during compression, particularly for content that contains graphics. Weber presents an RGB-based compression approach that avoids the color artifacts introduced by YCbCr compression at the same bitrate. The good news is that the approach Weber describes is based on the existing SMPTE ST 2019-1 standard.

Film grain is a hallmark of cinematic content. So much so that a film grain effect is often added in post-production to create a cinematic feel even when the content was captured digitally. The biggest chal-

lenge is that film grain is a statistically random signal that needs much bandwidth. Modern video codecs get around that by enabling film grain to be removed in the encoder and reapplied after decoding. Yet, that brings up another challenge. Most consumer smartphones, TVs, and other playback devices do not support film grain synthesis as a post-decoding process. Grois et al., describe a way to change that by enabling MPEG video codecs such as HEVC to use the film grain synthesis process required to be present on AV1-capable receivers. Their tests with professional video encoders indicate their method can result in more than 80% bitrate savings for content with heavy film grain and about 10%, which is still significant, for content with light grain.

Technologies to deliver compressed audio and video are an intimate part of end-to-end media compression. The challenge is that media is not the same as other kinds of data. That is particularly true for media over IP networks. Kostiukevych et al., identify testing of media IP networks under load as a critical step before operational full-scale deployment. Historically, that has been easier said than done, but the job should be easier using the approaches described by Kostiukevych et al. Their paper provides practical methods to sample and analyze network traffic non-intrusively using low-overhead open-source tools.

Getting ready for the future rounds out the compression theme of this issue. The following papers provide practical guidance that we could start using today to plan for new, even more spectacular products and services.

Practical guidance on using the newest international standard for video compression, Versatile Video Coding, or VVC for short, is the subject of the paper from Litwic et al. VVC is about twice as efficient as HEVC and AV1, so there is growing interest in understanding how VVC can be deployed in broadcast and stream-

ing. Litwic et al., summarize the status of VVC adoption in application standards organizations such as DVB and 3GPP and provides a glimpse into newly published guidelines from the Media Coding Industry Forum on how to use and configure some of the advancements in compression technology that are now available in VVC.

In addition to the papers on compression, two additional insightful papers are presented in this issue.

Eric Rigney guides us on creating clean soundtracks in on-set virtual production that carry efficiently to the final sound mix with minimal post-production. The challenge is that most virtual production facilities focus on creating in-camera visual effects rather than sound production. Rigney identifies improvements to sound production as more economical, efficient, and higher quality than fixing sound in postprocessing

using automated dialog replacement. His paper provides a suite of practical tools and practices to create acoustic-friendly virtual production.

Footen et al., introduce the idea of a curator agent to enhance consumer experiences. A curator agent would be owned by the viewer. Its job would be a trusted personal intermediary to bring together entertainment, news, and advertisement to best match a viewer's interests. Footen, et al., identify the technologies and ecosystem evolutions we should target to enable such efficiently personalized consumer viewing choice.

The papers in this issue of the Journal highlight some of the highly significant advances that continue to be made in compression and delivery of great consumer experiences. From extending the functionality and usefulness of existing compression standards to making energy effi-

ciency a critical performance metric to preparing to use AI and machine learning as the new normal, we can continue to look to compression to provide a versatile, efficient, and reliable foundation for our industry.

### About the Author



Sean McCarthy, PhD, is currently director of video strategy and standards at Dolby, where he explores innovations, new use cases, and core technology standards that assist Dolby transform storytelling, and produce new experiences that unleash the potential of entertainment and communications. McCarthy brings a unique convergence of expertise in signal processing and the neurobiology of human vision to digital video and entertainment technology.

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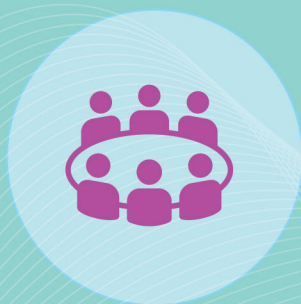
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