

Introducing EVI: the dynamic HDR converter

German engineer **Lucien Lenzen** has developed innovative software that allows downconverting high dynamic range images to standard dynamic range live – a process that has up to now been fraught with problems for a variety of reasons.

Introduction

One of the main difficulties involved in progressing from standard dynamic range (SDR) to high dynamic range (HDR) television is the need to provide good downward compatibility with the huge number of SDR television receivers already installed and in current use. The new generation of broadcast cameras can provide a much wider scene contrast range than conventional displays and it is obvious that converters are needed to handle the different formats. Such a converter was demonstrated on the Ikegami booth at IBC 2018 by the University of Applied Science in Wiesbaden, Germany.

This raises two questions: “Aren’t there enough HDR downconverters already on the market?” and “Why do we need another one?”



Figure 1: Exaggerated local tone mapping with halo artefacts and surreal look

What is static mapping?

To understand the difference between a classic HDR downconverter and our proposed Enhanced Video Imaging (EVI) system we have to take a look at how contrast compression is performed.

Many camera operators use a knee function to incorporate luminance information which would normally be outside the SDR range. Traditional HDR downconverters work in more or less the same way. But the capabilities of such systems are very limited compared to the wide range of luminance information. Normally they use a fixed curve that doesn’t take much image content into account. Even if it does though, using a flat gradation to cope with a high contrast range will lead to a flat-looking image at some point. This is why the results of some more sophisticated approaches which use metadata to tweak the curve based on the image content are still not necessarily convincing. Moreover, metadata are hard to handle in a live broadcasting environment.

Learning from film-makers and computer graphics artists

The problem of dealing with a higher contrast range at acquisition than at distribution may be a new one for the broadcast industry but it is an old one for film-makers and computer graphics artists. Film has always captured more information, so manual grading always has been and still is performed by a colourist. If he or she can not deal with the high dynamic range of the incoming material with just one gradation curve, windows are built to treat different image regions separately. Shadows can be lifted and overly bright sections simultaneously darkened. The problems with grading though are that it doesn’t work for live broadcasting and it can be expensive.

Meanwhile, computer graphics artists use various procedures based on local tone mapping. These also have some drawbacks for live broadcasting:

- They can be computationally intensive for video applications.
- Because they are basically designed for still images, they can give problems arising from the temporal domain, leading to flicker artefacts.
- They can result in halo artefacts causing a glow around objects and a very unrealistic look (see Figure 1).



Figure 2: The intermediate steps of EVI