

# Viarte SDR-to-HDR Up-conversion & Digital Remastering of SD/HD to HD/UHD Services

## 1. Introduction

As trends move rapidly towards online content distribution and bigger and brighter progressive UHD/HDR displays, the need for high quality remastering of SD/HD and SDR to HDR up-conversion of valuable SD/HD/UHD assets becomes more relevant than ever. Various technical issues inherited in legacy content hinder the immersive viewing experience one might expect from these new HDR display technologies. In particular, interlaced content need to be properly deinterlaced, and frame rate converted in order to accommodate OTT or Blu-ray re-distribution. Equally important, film grain or various noise conditions need to be addressed, so as to avoid noise being further magnified during edge-enhanced upscaling, and to avoid further perturbing any future SDR to HDR up-conversion. Film grain should no longer be regarded as an aesthetic enhancement, but rather as a costly nuisance, as it not only degrades the viewing experience, especially on brighter HDR displays, but also significantly increases HEVC/H.264 compressed bit-rates, thereby increases online distribution and storage costs.

## 2. Digital Remastering and SDR to HDR Up-Conversion Process

There are several steps required for a high quality SD/HD to HD/UHD remastering project. The very first step may be tape scan. The digital master forms the baseline for all further quality assessment.

isovideo's SD/HD to HD/UHD digital remastering services use our proprietary, state-of-the-art award-winning Viarte technology. Viarte's proprietary motion processing technology is the best available. It is unique in that it is not perturbed by fast luminance variations, and has almost no occlusion artifacts when given clean sources.

In general there are five to six steps required in our digital remastering process (prior to re-encoding), and they are:

- i. Deinterlacing and/or inverse-telecine,
- ii. Frame rate conversion,
- iii. Noise reduction,
- iv. Up-scaling,
- v. Contrast enhancement,
- vi. SDR to HDR up-conversion (**New!**).

All six steps can effect the final remastering quality, as well as HEVC/AVC compression efficiency for distribution.

### 3. Advantages of Viarte Digital Remastering

- GPU motion-compensated (MC) deinterlacing is the only technology that offers 100% vertical resolution with imperceptible flicker, while also achieving a substantial HEVC/H.264 bit-rate reduction when compared with compressing interlaced directly. Together these two attributes are a true objective measure of deinterlacing quality. This deinterlacing quality has enabled filmmakers to shoot in ntsc60i and show their film on the big screen, and also on Blu-ray.
  
- Sophisticated inverse telecine, including automatic and correct handling of mixed/broken cadences, including PSF. It also
  - handles extreme noise variation,
  - does not introduce any unnecessary duplicated frames,
  - does not output unprocessed interlaced frames, even under extreme non-candence/mixed/broken-candence situations,
  - handles cross-fades,
  - uses true motion calculations (not motion adaptive) for extremely reliable (near 100%) scene-change detection, even under severely varying noise conditions.

Viarte was used in over 40 episodes of an original TV sitcom after being compared with other competing solutions.

Either or both of above two steps is usually the **first required** processing step in nearly all SD material remastering operations. They are also key to obtaining the best results - choosing the best technology here is vital to ensure the highest possible conversion. Errors from poor deinterlacing / inverse telecine will be further accumulated and magnified in subsequent processing, such as frame rate conversion, noise reduction, up-scaling, re-interlacing, etc, leading to unavoidable visual artifacts.

Viarte MC deinterlacing and inverse telecine, when used in conjunction with Viarte MC noise reduction offers unmatched image quality with significant HEVC/AVC bit-rate reductions.

- Viarte MC Frame Rate Conversion (FRC) is the highest quality, pixel-accurate any-to-any (including fractional rates) MC FRC technology available. The latest Viarte FRC processing can readily handle HDR material to the high precision required. Viarte FRC offers particularly accurate conversion for HFR, giving stunning quality for HDR with HFR. It provides an additional sophisticated, accurate simulated motion-blur capability to reduce judder on playback, when down-converting from 50i/p, NTSC-30i/60p, to NTSC-24p or true 24p.

Viarte can also perform up to +/- 10% tempo adjustment, so material can be fit to a specified time slot.

- Viarte HDR/SDR MC noise reduction achieves up to 80% bit-rate savings beyond AVC/HEVC, while keeping subtle detail and sharpness. When combined with edge-sharpening up-scaling and contrast enhancement, viewers can enjoy a near immersive viewing experience not normally achieved with SD sources. It also best prepares legacy content for conversion to HDR if desired. Many films have already used Viarte noise reduction.
- Superbly sharp video up/down any-to-any (SD to 8K) scaling with natural-looking edge enhancement, and absolutely no ringing. Conversions between different aspect ratios, and cropping or pillar-box/letter-boxing are also supported. A leading Hollywood studio compared Viarte scaling results with their in-house developed “BEST” scaler in their view, and found that our scaling quality is as good as theirs after magnifying our results by 400%. However, Viarte scaling performs at least **40x** faster than theirs!
- Re-interlacing is required for domestic/international broadcasting redistribution. Viarte offers precise solutions for these also.
- Accurate color-space conversion between Rec 601, Rec 709, ITU, DCI-P3 (film), BT 2020.
- Viarte SDR-to-HDR inverse tone mapping provides a solution for content creators and service distributors to up-convert legacy 8/10-bit Rec709 SDR content to HDR. For example, this includes conversion to ST2084 at 1000 nits, or HLG at 1200 nits, with BT2020 color. It allows legacy SDR material to be converted to stunning HDR. The results are fully compliant with the latest Rec. ITU-R BT.2100-0. Viarte correctly sets SEI metadata for HEVC, HEVC master-display chromaticity, white-point settings, etc.

#### 4. Awards and Film Applications

- Viarte was a one of five (out of 1500 exhibitors) prestigious Game-Changer Awards winners presented by the IABM/NAB in 2013. isovideo is honored to be a part of [IABM's](#) 40<sup>th</sup> Anniversary Publication (see section: “*Award Winners through the years*”).
- Viarte was credited for “footage conversion” in Academy-Award winning director Ron Howard's "*Made in America*"; "*Finding the Gold Within*" by Karina Epperlein; "*Love & Mercy*" by Bill Pohlad, etc.

#### 5. Free Trial

We offer no obligation free-trial, and fast turn-around services with the competitive pricing. If you have a remastering project in mind, please don't hesitate to contact us.