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Purpose: Information and Discussion

Title: HDR video test sequences

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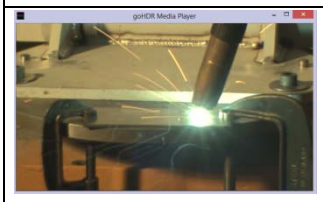
Abstract
Until sensors are developed that are singularly capable of directly capturing all the light in a scene, individual HDR video frames will need to be created by merging a number of SDR frames captured at different exposures or through the use of filters, such as Neutral Density filters. If more than one sensor is used then the SDR frames need to be first aligned. The need to merge and align SDR data to create a complete HDR frame can result in significant artefacts. This document describes the circumstances, and suggests scenarios, that can potentially cause problems when capturing HDR video. These must be adequately addressed to ensure a high quality HDR video result.

Introduction
An HDR image can be created by [DB08]:

a) Capturing a sequence of different exposures using the same sensor and then merging the results
b) Simultaneously capturing different exposures, or the same exposures using, for example a different Neutral Density filters, on a number of sensors. These different SDR images then need to be first aligned and then merged.

The time taken to take the different exposures, and the possible need to align can result in significant artefacts [SS12]. These artefacts need to be minimised, for example through deghosting algorithms [KHM14], if high quality HDR video is to be achieved. This document describes challenging situations for HDR video capture, and suggests test sequences that could be used to determine if the HDR video capturing approach has adequately coped with the challenge.

Thumbnail	Type	Proposed scenarios
	Complex/ small/ large motion (camera and object motion)	Flames, crowds of different densities and distances (eg. popular public places and sports)
	Fast and abrupt object motion	Time lapse, fast vehicle traffic, close range surveillance (in-vehicle cam), ball sports – fast balls

	Non rigid motion	Water surfaces (varying reflection of sun light due to moving waves), smoke rings, sunset colours,
	Independently moving objects	Crowd scene
	Small object/motion displacement	Welding, metal grinder
	Large motion displacement	Large motion between frames in which object may disappear
	Large region of the scene changes	Train coming out of tunnel (panning following its trajectory), moving highlight/disco ball (white shirts under UV, metallic paint), change of overall illumination due to cloud movement, city scene with a fountain in the middle of the shot (specular highlight)
	Occlusion	Crowd scene, reflection off waves and boats - boats suddenly occluding the sun
	Night scenes – with bright lights	Bonfire with dancers at night, fireworks, car or traffic driving at night, city at night (footage shot from the hill)
	High texture motion	Fountain, fireworks & dancers, tree on a sunny and windy day with shadow below (it is important to have unlikely number of pixels per texture element), high frequency textures (i.e. blinds) moving open and closed, windmill so there is slow movement of the arms, skiing downhill with high frequency specular highlights in the snow
	Resolution effects	Rolling shutter/propeller
	Highly saturated colours	Macro view of flower under wind movements (close up, preferably a bee in the shot who is collecting pollen)
	Scene cut and fade to black/white	

It is recommended that these test sequences could provide a robust test suite for the subsequent evaluation of HDR compression techniques. It is proposed to use goHDR's low cost HDR video system to capture these scenarios (a number exist already) and to share these with others for evaluation purposes.

References

[KHM14] Karaduzovic-Hadziabdic K., Hasic Telalovic J., Mantiuk R. "Expert evaluation of deghosting algorithms for multi-exposure high dynamic range imaging", HDRi2014: Second International Conference and SME Workshop on HDR imaging, EU COST Action IC1005, March 2014.

[SS12] SRIKANTHA A., SIDIBE D. “Ghost detection and removal for high dynamic range images: Recent advances”. Signal Processing: Image Communication 27, 6, 650 – 662, 2012.