A Selective Approach for Tone Mapping High Dynamic Range Content

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(a) Our Framework (b) STM threshold 0.1 (c) STM threshold 0.05 (d) Ground Truth

Figure 1: *(a) The Selective Tone Mapper (STM) Framework. Full resolution output of the Belgium image:(b) STM using a threshold value of* 0.1*, (c) and threshold value of* 0.05*, (d) ground truth TMO GPU local operator.*

Abstract

Large resolution High Dynamic Range (HDR) textures/images are becoming common in computer graphics applications. However, it is still a prohibitive task to perform on them a filtering step such as tone mapping in real-time. We introduce a novel technique called Selective Tone Mapper (STM) for accelerating the tone mapping step on large resolution HDR images. This technique presents an efficient memory usage, when compared with traditional methods, due to the reduced information required to localize the strong contrast areas.

CR Categories: I.4.1 [Image Processing and Computer Vision]: Enhancement—Filtering; I.3.3 [Computer Graphics]: Picture/Image Generation—Framebuffer operations;

Keywords: High Dynamic Range (HDR), HDR video, real-time, Selective Tone Mapper

1 Selective Tone Mapper (STM)

One of the main tasks of a tone mapping operator (TMO) is to preserve or indeed enhance local contrast and details that are available in the HDR input image. Knowledge of where the strong contrast is located may be exploited to limit the use of a computational expensive local luminance adaptation computation only on these regions. Our goal is to exploit this idea by providing a simple framework, Figure 1 (a), that allows to save high amount of computation time that may be re-addressed to other steps of the rendering pipeline. Using this framework real-time performances for very large HDR textures/images can be achieved. Furthermore this framework can be used to identify regions of the HDR image where different TMOs or different settings of the same TMO can be applied to better preserve contrast and details.

2 Experimental Results

We benchmark the STM on an NVIDIA GeForce 8800 GTX, using IntelDuo Pro 2.33GHz CPU with 2.0 GB RAM. The ground truth TMO used, is the GPU version of the Ashikmin TMO [Roch et al. 2007]. Table 1 highlight how the framework is able to accelerate the GPU implementation of the ground truth local TMO achieving better computational performances. In particular, the last column shows the degree of acceleration of the GPU local TMO when the STM is applied.

HDR Frame	Glo. TM	Loc. TM	STM	$\frac{STM}{Loc.TM}$
512×512	1719	360	503	1.40
1024×1024	584	115	190	1.65
2048×2048	195	33	64	2.00
4096×4096	56	9	20	2.22

Table 1: *Results (in fps) of the GPU implementation varying the resolution of the HDR input frame using the GeForce 8800.*

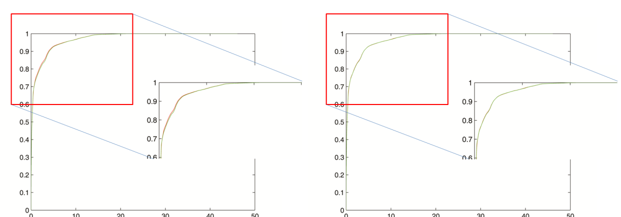

Figure 2: *TMO Curves: (red line) Ground truth local GPU TMO and (green line) the STM using a threshold of* 0.1 *(left) and of* 0.05 *(right), on Belgium image.*

Figure 2, shows the TMO curves of the ground truth TMO GPU local operator and of the STM. If a slight difference, between the two TMO curves, can be seen when the threshold used is 0.1; this is not evident in case the threshold value of 0.05 is used. This results in contrast improvement in the image when the threshold value is decreased (see Figure 1 (b) and (c)).

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References

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