

# A Selective Approach for Tone Mapping High Dynamic Range Content



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## Problem

Large resolution HDR textures/images are becoming common in computer graphics applications; but it is still a prohibitive task to perform on them a filtering step such as local tone mapping in real-time.

## Previous Work

- ✓ A. ARTUSI, BITTNER, J., WIMMER, M., AND WILKIE, A. 2003. Delivering interactivity to complex tone mapping operators. In *Proceedings of Eurographics Symposium on Rendering 2003*, 38–44.
- ✓ CHEN, J., PARIS, S., AND DURAND, F. 2007. Real-time edge aware image processing with the bilateral grid. In *Proceedings ACM Siggraph 2007*.
- ✓ ROCH, B., ARTUSI, A., MICHAEL, D., CHRYSANTHOU, Y., AND CHALMERS, A. 2007. Interactive local tone mapping operator with the support of graphics hardware. In *Proceedings of the Spring Conference in Computer Graphics, Proceedings SCCG 2007*.

## Challenges

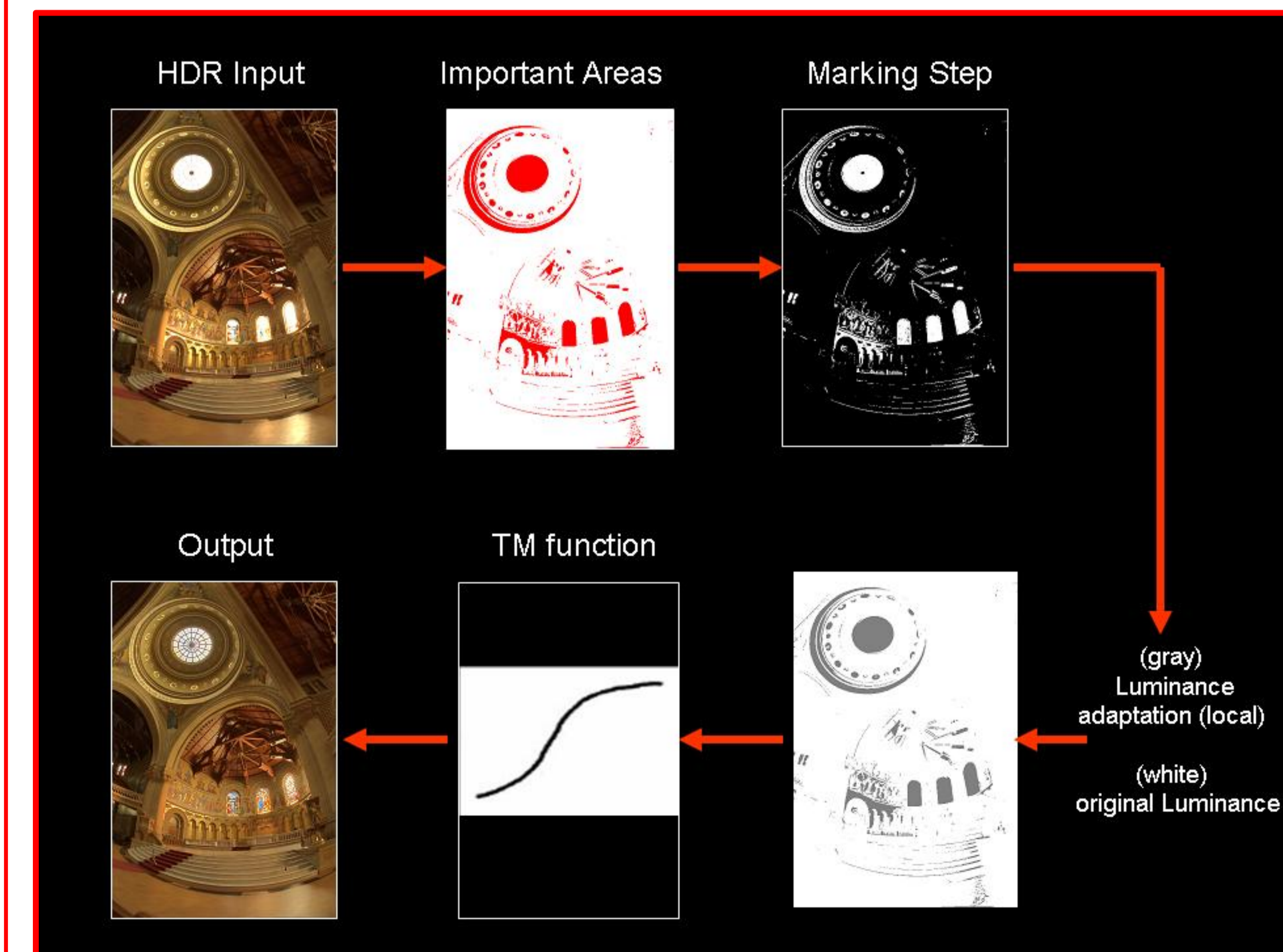
Real-time performances for very large HDR textures/images can be achieved. Furthermore, this framework can be used to identify regions of the input HDR image where different TMOs or different settings of the same TMO can be applied to better preserve contrast and details.

HDR Frame	Glo. TM	Loc. TM	Sel. TM	$\frac{Sel.TM}{Loc.TM}$
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

## Our Approach

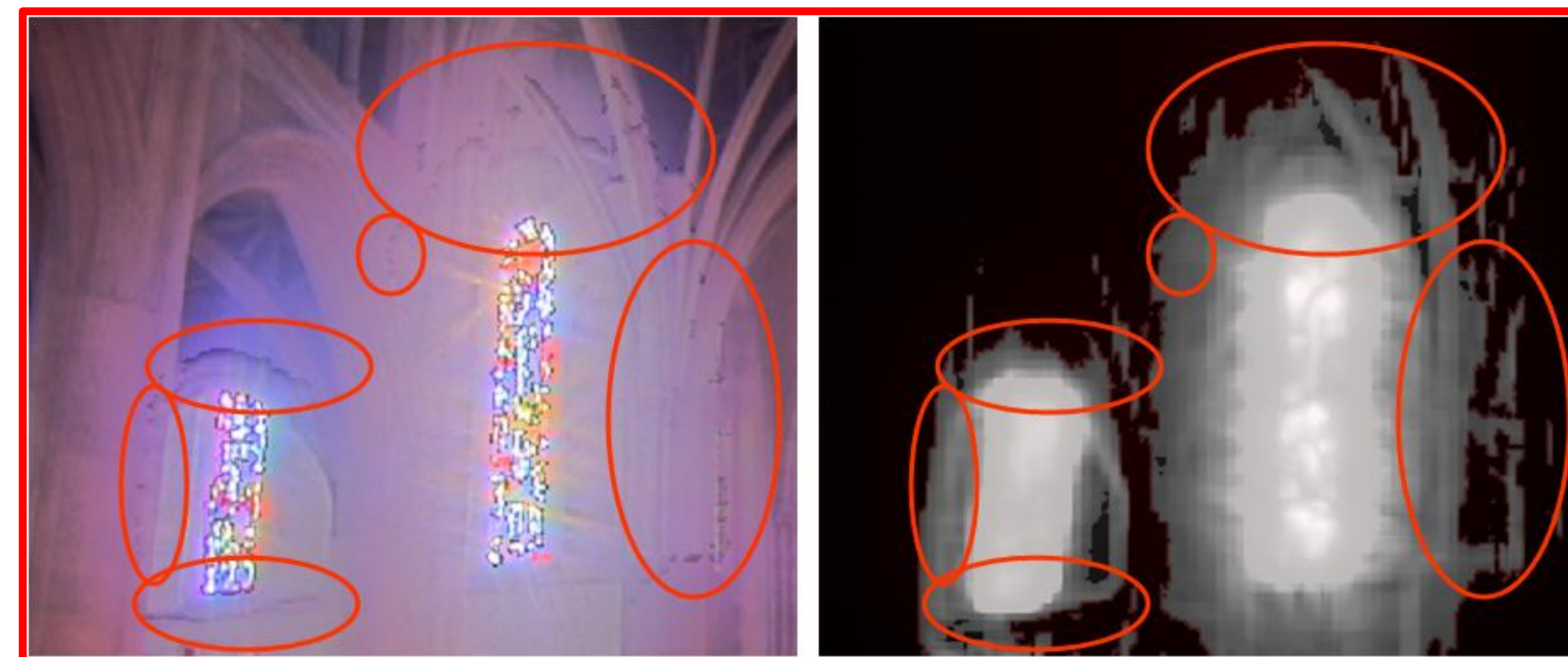
• **Observation:** Knowledge of where the strong contrast is located may be exploited to limit the use of a computational expensive local luminance adaptation computation only on these regions.

• We propose a simple framework, Figure 1, that allows to save high amount of computation time that may be re-addressed to other steps of the rendering pipeline.



## Observations

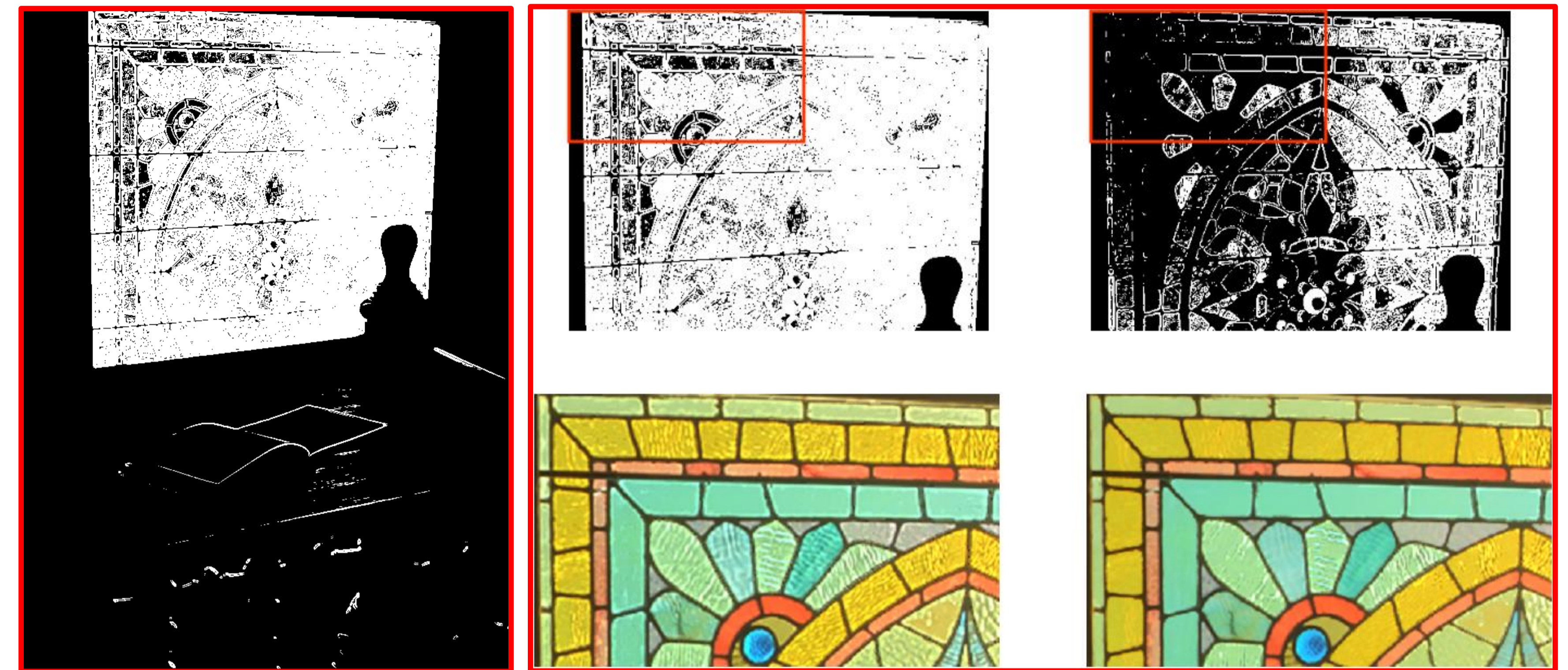
- **1<sup>st</sup> Observation:** Gradient Magnitude is a good feature of contrast.
- We would like to identify the areas that contribute to the luminance adaptation computation.



- **2<sup>nd</sup> Observation:** Saliency map applied on HDR images reveals that the high level of luminance areas are the one most salient.
- On the other hand the saliency map is failing in identify the transition areas between bright and dark regions.

## Solution

- Edge detector (Sobel Filter) applied on the logarithmic domain.
- Thresholding allows to identify the lowest gradient transition to keep details in low and high contrast regions



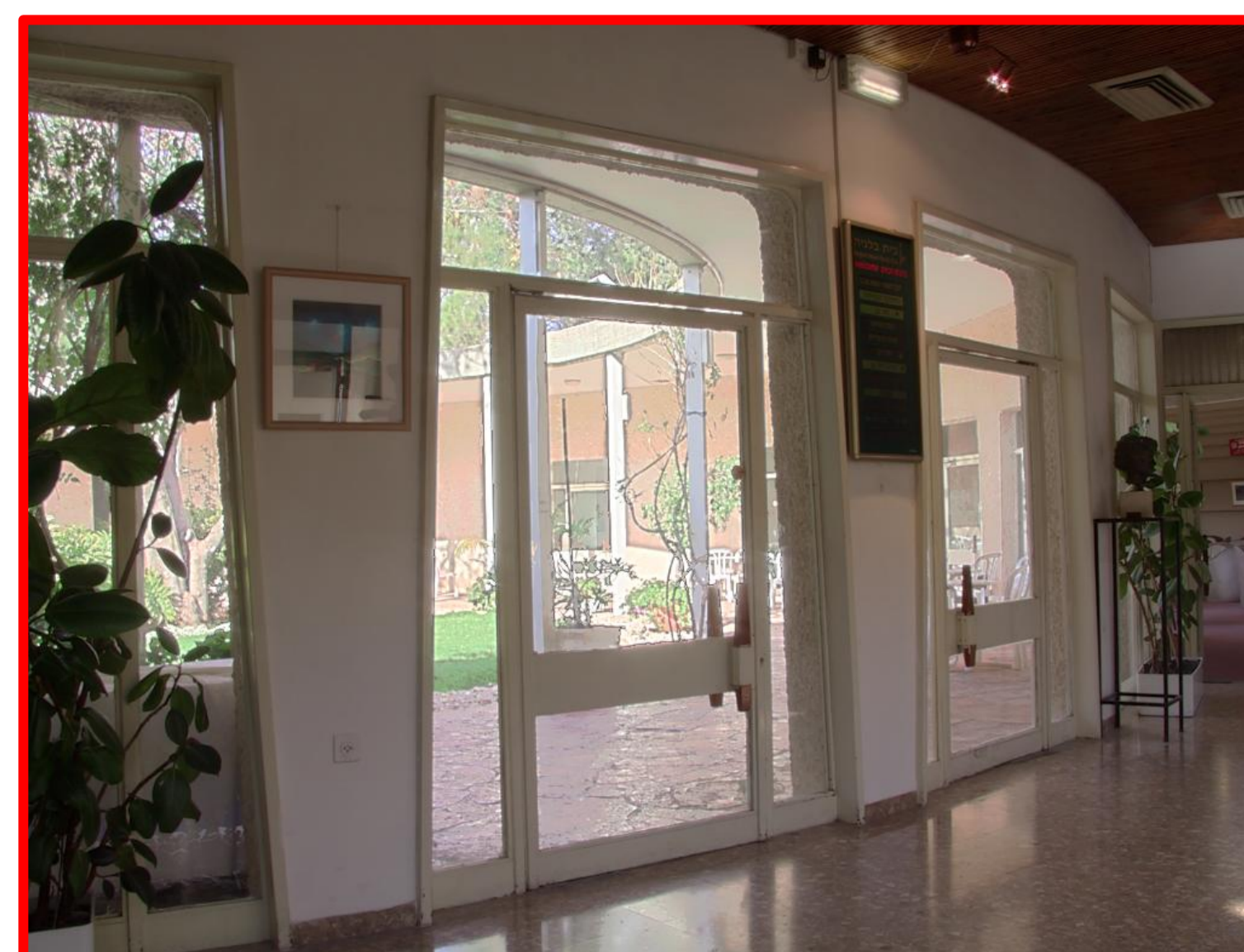
## Experimental Results



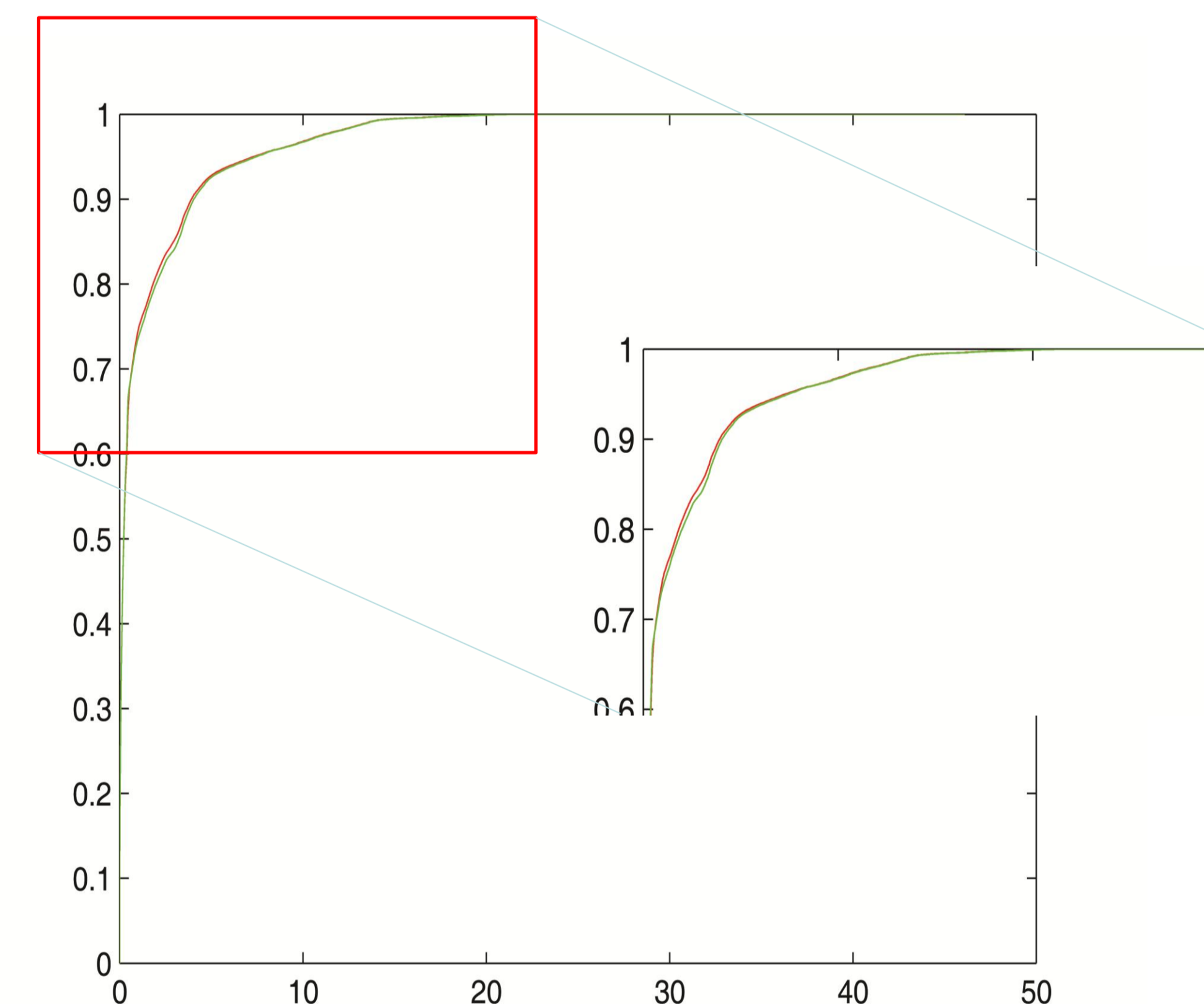
Ground Truth



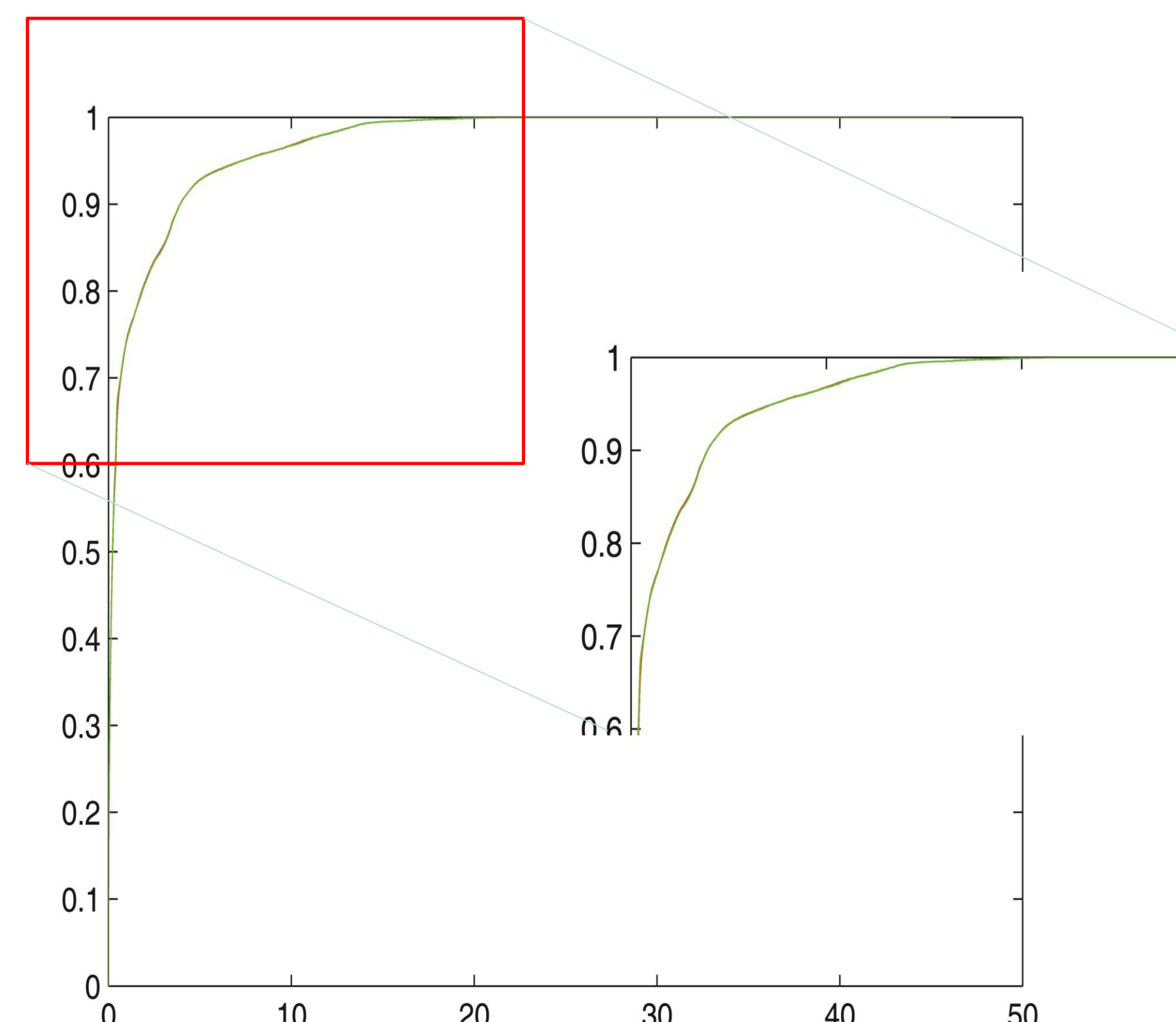
Our Method Threshold 0.1



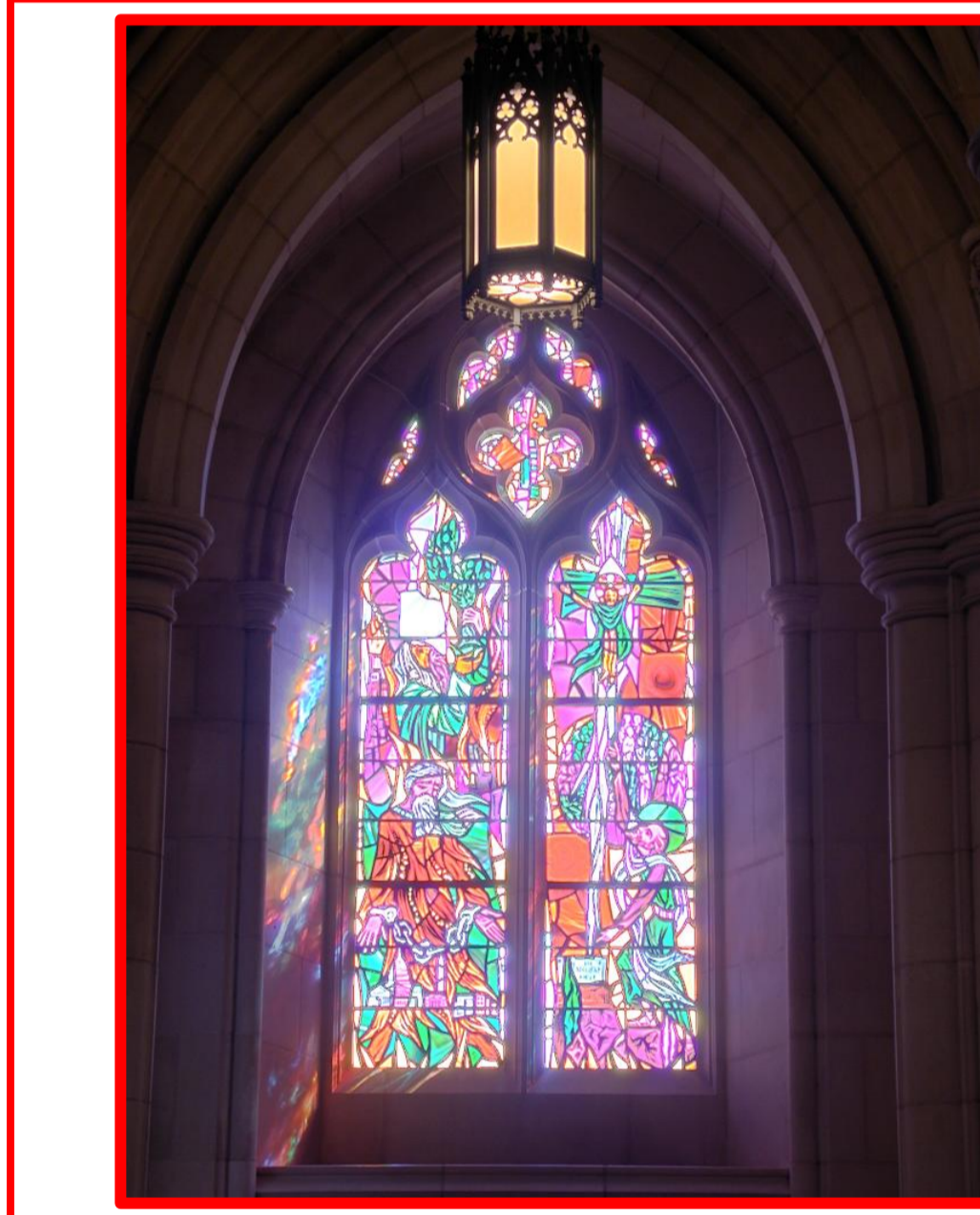
Our Method Threshold 0.05



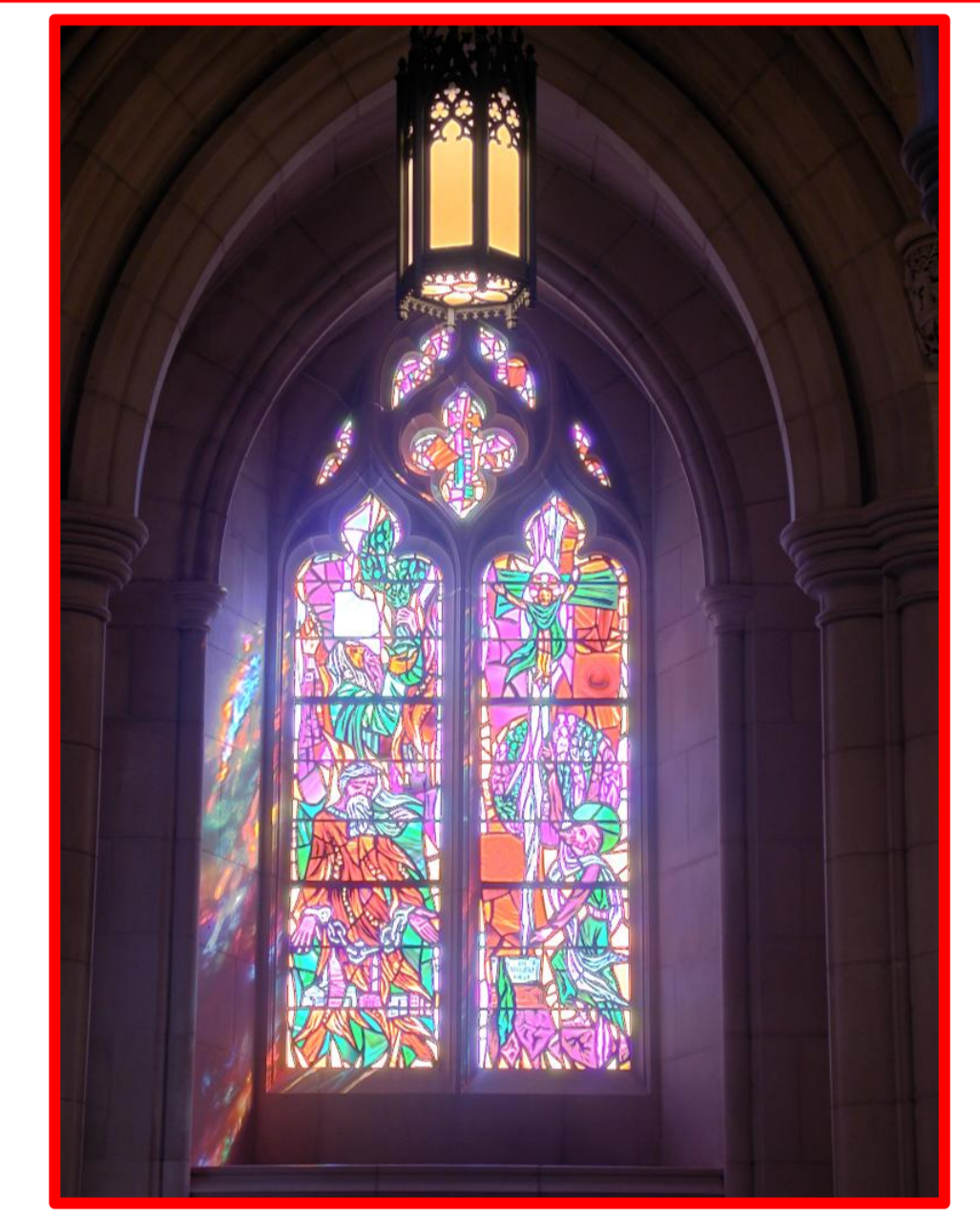
TM Curves: Red Ground Truth, Green Our Method with Threshold 0.1



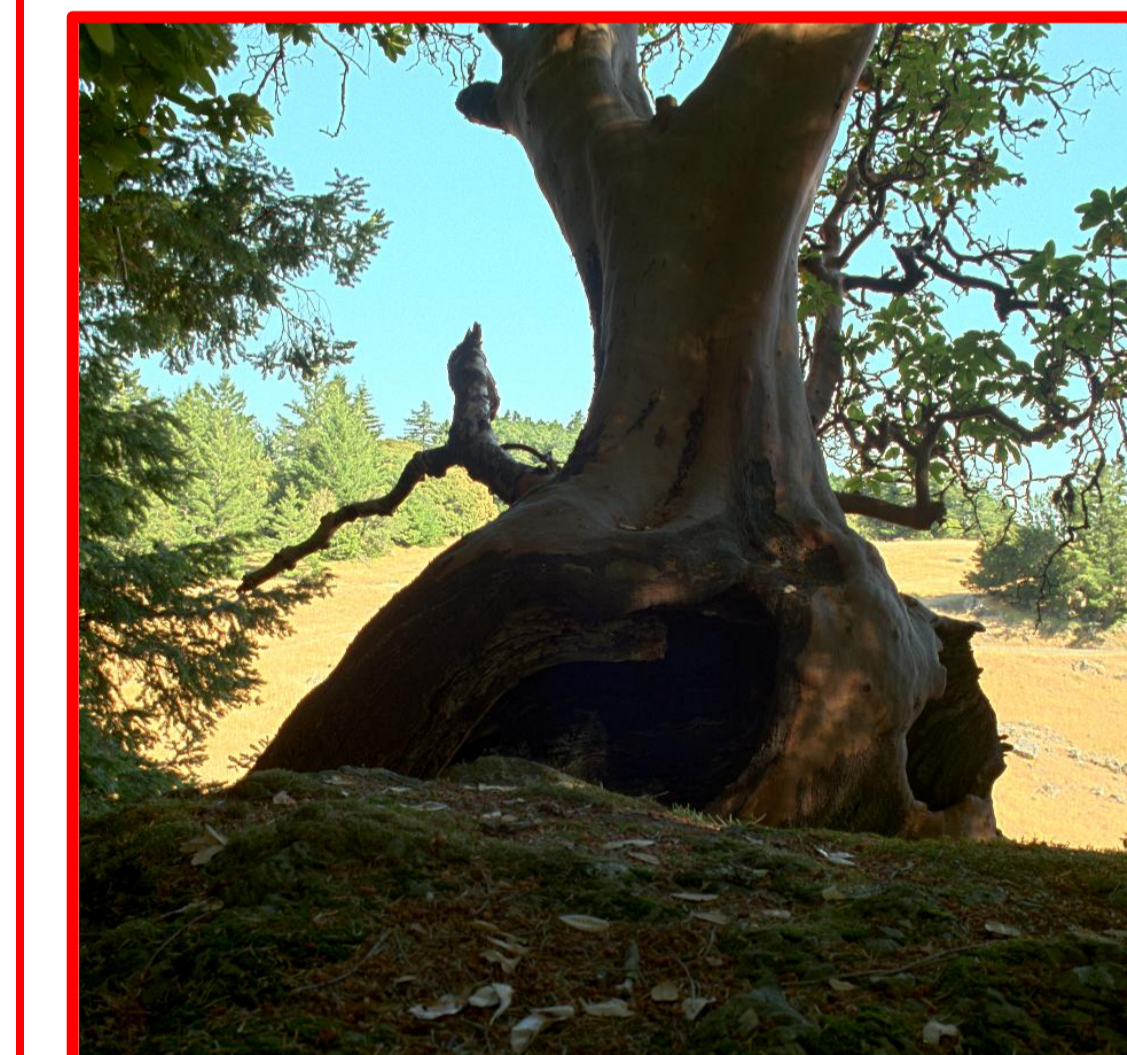
TM Curves: Red Ground Truth, Green Our Method with Threshold 0.05



Ground Truth



Our Method



## Conclusions and Future Work

• Future work needs to investigate how to exploit temporal coherence between multiple frames to enable at least significant parts of the importance areas map to be reused.

• With respects to interactive local adjustment tool future work can exploit the use of the selective approach as a tool where the user interactively can select different areas and apply different local contrast adjustment