Perception Motivated Hybrid Approach to Tone Mapping

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Content

- HDR tone mapping
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High Dynamic Range Imaging

- **HDRI**
  - useful in many areas of computer graphics and applications

- **HDR images**
  - several orders of magnitude
  - high precision

- [Reinhard et al. 05]
Tone Mapping Issue

Real world

10^{-6}  \quad 10^{8}

High Dynamic Range

Ordinary picture

10^{-6}  \quad 10^{8}

Low Dynamic Range

10^{-6}  \quad 10^{8}
Tone Mapping Goals

Aesthetical

Cognitive

Perceptual

[Cadik et al. 06]
Global and Local Methods

- Global methods (TRC)
  - fast
  - simple, easy to implement
  - good reproduction of overall image attributes (perceptual)

- Local methods (TMO)
  - spatial processing
  - time-consuming
  - good in reproduction of details (cognitive)
  - artifacts
Global and Local Methods

[Ward94] [LCIS99]
Subjective Perceptual Experiments

- [Cadik et al. 06]
  - superiority of global methods for reproduction of natural scenes
Hybrid Approach to Tone Mapping

- HDR Image
- Global TM
  - Enhancement Map
  - Local TM
- LDR Image
- Locally Enhanced Details
Hybrid Approach to Tone Mapping

HDR Image → Global TM → LDR Image

Global TM

Enhancement Map

Locally Enhanced Details

Local TM
Hybrid Approach to Tone Mapping

- HDR Image
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Hybrid Approach to Tone Mapping

HDR Image → Global TM → Enhancement Map → Local TM → LDR Image

Locally Enhanced Details
Hybrid Approach to Tone Mapping

HDR Image → Global TM → Enhancement Map → Local TM

LDR Image

Locally Enhanced Details
Enhancement Map

- map we use to guide local enhancement
- construction according to the aim of the method
- floating point values (blend of TRC and TMO)
Enhancement Map Benefits

- Reproduction of overall attributes
  - not affected by local method
- Lost details recovered
- Fast computation
  - local method applied to small portion of image
Perceptually Plausible Implementation

[Ward 94]

Bilateral filtering

[Durand & Dorsey 02]
Transformations

Global method

Hybrid method

Local method
Our Results
Our Results
Cognitive Approach

- [Ward et al. 97] + Trilateral filter [Choudhury & Tumblin 03]
- different construction of enhancement map

- details in the paper
Performance Results

- slight slowdown of original global approaches (we ‘pay’ a bit for the wanted details)

- speedup to the original local approaches (average results over 10 HDR images)

<table>
<thead>
<tr>
<th>Perceptually plausible</th>
<th>Cognitive implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enhancement map [% of pixels]</td>
<td>Speedup</td>
</tr>
<tr>
<td>1.4e-3%</td>
<td>118.5</td>
</tr>
</tbody>
</table>
Conclusions

- General hybrid approach
  - utilization of existing methods
  - can be tailored to miscellaneous goals
- Global method (TRC) + local method (TMO)
  - general paradigm of perceptually plausible TMO design
- Enhancement map
- Fast, simple, scalable, perceptually plausible
  - suitable also for time-critical HDR applications
Perception Motivated Hybrid Approach to Tone Mapping

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