**A 8-BIT-GREY-LEVEL IMAGE EMBEDDING ITS 512 COLOR PALETTE**

Marc CHAUMONT and William PUECH
marc.chaumont@lirmm.fr and william.puech@lirmm.fr
LIRMM, UMR CNRS 5506, Université de Montpellier II

**HIDING COLORS; PALETTE-BASED SCHEMES:**

**WHY HIDING COLOR INFORMATION?**

- **color palette:**
  - free access to grey-level images,
  - key-manage access to the color information.

**COLOR SECURED of image database.**

**GENERAL PALETTE-BASED PRINCIPLE:**

1. Find an index image and a color palette with:
   - A color quantized image close to the color image,
   - An index image close to the luminance image,
   - A color palette owning consecutive close colors.
2. Embed the color-palette into the index image.

**A 8-BIT-GREY-LEVEL IMAGE EMBEDDING ITS 512 COLOR PALETTE:**

**embedding:**

1. **Quantization on 512 colors (9 bits):**
   - **STEP 1:** Octree, then k-mean quantization,
   - **STEP 2:** Color palette re-ordering.

2. **Reversible embedding:**
   - **MESSAGE:** - a bit-plane arithmetically encoded,
     - the color-palette arithmetically encoded.
   - **HOST IMAGE**: - the remaining 8-bit plane.
   - **ALGORITHM:** - a congruence based approach.
     \[ T : \mathbb{N} \times \mathbb{N} \rightarrow \mathbb{N} \]
     \[ T(x_1,x_2) = (x_1 + 1)x_2 - x_1x_2. \]
     - 4 in experiments

**RESULTS AND CONCLUSIONS:**

- **images**
  - PSNR\(_{\text{color image}}\) (512 colors)
  - PSNR\(_{\text{index color}}\)
  - PSNR\(_{\text{index gray}}\)

<table>
<thead>
<tr>
<th>images</th>
<th>PSNR(_{\text{color image}})</th>
<th>PSNR(_{\text{index color}})</th>
<th>PSNR(_{\text{index gray}})</th>
</tr>
</thead>
<tbody>
<tr>
<td>airplane</td>
<td>39.96 dB</td>
<td>42.96 dB</td>
<td>42.96 dB</td>
</tr>
<tr>
<td>house</td>
<td>39.27 dB</td>
<td>41.67 dB</td>
<td>41.67 dB</td>
</tr>
<tr>
<td>lena</td>
<td>38.63 dB</td>
<td>40.93 dB</td>
<td>40.93 dB</td>
</tr>
<tr>
<td>peppers</td>
<td>36.32 dB</td>
<td>38.95 dB</td>
<td>38.95 dB</td>
</tr>
<tr>
<td>baboon</td>
<td>33.31 dB</td>
<td>35.86 dB</td>
<td>35.86 dB</td>
</tr>
</tbody>
</table>

**Conclusion:**

- A watermarked image still semantically understandable,
- A rebuilt color-image of better quality (512 different colors),
- A more resistant approach to colorization attack.

**Acknowledgments:** TSAR French Project ANR SSIA 2006-2008

(*) Saint-Germain-en-Laye museum; « a young woman holding a ram »,
Jan van Vybert (1603-1671), oil on oak.