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BLOCK-BASED COLOR CORRECTION ALGORITHM FOR MULTI-VIEW VIDEO CODING

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Outline

1. Problem
   - MVC
   - Color Correction
   - Existed works

2. Algorithm
   - Workflow
   - Colorization
   - Local-to-global

3. Result
   - Picture
   - Histogram
   - Table
Outline

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1. Problem
Multi-view Video Coding (MVC)

- New experience in video
- Challenge: huge data
- Similarity in different views
- Temporal VS. spatial motion compensation

1. Problem

Color variation among different views

- Unavoidable cause
  - scene illumination
  - camera calibration
  - jitter speed
- Bad effects to
  - visual quality
  - coding efficiency

1. Problem

Existed color correction methods


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Overall workflow

- Multiview video frames input
- Extract the luminance picture
- Macro-block search for correct color
- Colorize other areas
- Mix with global correction for details
- Corrected frames output
2. Algorithm

Colorization scheme

- **Scribble-based**
  - ✓ color blocks as scribbles
- **Y guides U/V**
  - ✓ similar intensity ~ similar color
- **Optimization** [6]

\[
\text{cost}(U) = \sum_{x=1}^{m} \sum_{y=1}^{n} \left( U(x, y) - \sum_{(x+\Delta x, y+\Delta y) \in N} w_N U(x + \Delta x, y + \Delta y) \right)^2
\]

\[
w_N = \exp \left( \frac{-(Y(x, y) - Y(x + \Delta x, y + \Delta y))^2}{2\sigma_N^2} \right)
\]

2. Algorithm

Global mixture

- Block scribble shortcomings
  - square is not enough
  - color bleeding
- Global refinement
  - detect wrongly colored pixels
  - color transfer [7]
  - \( l\alpha\beta \) color space

\[
l^*_T(x, y) = \frac{\sigma_R^l}{\sigma_T^l} (l_T(x, y) - \mu_T^l) + \mu_R^l
\]

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Picture (Visual quality comparison)

- Unavoidable cause:
  - scene illumination
  - camera calibration
  - jitter speed

- Bad effects to:
  - visual quality
  - coding efficiency
3. Result

Histogram (YUV space)
3. Result

Table (ratio of best matching blocks in spatial prediction)

- Spatial motion compensation
- Ratio = No. of best matching blocks / total No.
- Partially reflect the correction effectiveness
- PSNR can be influence by various factors

| Sequence/Frame | Uncorrected | | | | | Proposed method |
|----------------|-------------|-------------|-------------|-------------|-------------|
|                | ratio | gain | ratio | gain | ratio | gain | ratio | gain |
| flamenco2/32   | 9.16% | 0%     | 16.32% | 78.17% | 14.40% | 57.21% | 17.07% | 86.35% |
| flamenco2/256  | 22.15% | 0%     | 21.98% | -0.77% | 25.56% | 15.40% | 26.81% | 21.04% |
| race1/0        | 53.88% | 0%     | 55.49% | 2.99%  | 50.30% | -6.64% | 55.82% | 3.60%  |
| race1/48       | 24.79% | 0%     | 34.01% | 37.19% | 33.85% | 36.55% | 35.62% | 43.69% |