Color Gamut Mapping

81-90

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Closed-loop color management

- Closed-loop color management by Crossfield et al.
  - Method to get from a source to destination device color space
    - LUT
      - A list of source dRGB and corresponding dCMYK
        - Direct method
        - Neighboring Method
        - Interpolation method

Fig 4.3. (a) example of 3D LUT from dRGB to dCMYK
– Tetrahedral and trilinear interpolation as example
  • Use of four points near by target point
    – Calculation of weighted sum of destination device color values for each interpolating tetrahedron’s vertices

Fig 4.3. (b) tetrahedron
– Limitation

• Known Source and destination
  – Impossible to apply if we know only source of one system

• The same color reproduction system
  – Influenced by the number of color channel
  – Application to small number of system
Intermediate color space

- Color reproduction modularity
  - defined by colorimetrical basis
  - Act as color information for communication
  - System A transformed to sRGB, then sRGB transformed to B system

- Benefits
  - Many mapping to or from the intermediate space for many systems
  - Easy to add new system
– sRGB as example
  • Defined in colorimetric terms
  • Having viewing conditions
  • Chosen in the colorimetric definition by typical CRT display
  • Easy transformation to CIEXYZ values by 3x3 matrix
    – Correct color reproduction
  • Suitable color communication based on exact colorimetric interpretation
  • Do not provide user choice for color reproduction
– Disadvantage for gamut mapping
  • Single mapping would need to provide good results for applying different types of content

– sRGB color communication
  • Communicate color information between devices
  • Provide unique colorimetric interpretation
    – The same color for human eyes

Fig 4.4. sRGB
ICC color management

- ICC
  - Alternative to sRGB
  - Standard for explicit color management
  - Two step of color reproduction
    - Forward transformation; device value to colorimetric descriptor in PCS
    - Inverse transformation; colorimetric descriptor to device value
– **Color space for PCS**
  - CIEXYZ and CIELAB for a reference viewing environment
    - ISO3664, D50, 500lx, 20% surround reflectance
    - LAB as \([0 -128 -128]\) to \([100 127 127]\)
      » Other values are clipped

– **Rendering intents**
  - Media-relative colorimetric
    - Full adaptation to media white point
  - ICC-absolute colorimetric intent
    - Only use tristimulus values for such as art
  - Perceptual
    - Preferred or pleasing reproduction of images
  - Saturation
    - Trade off preservation of hue to preserve the vividness of pure colors
- The similarity between ICC and sRGB approach
Windows color system (WCS) from Vista system
Importance of gamut mapping in color reproduction

◆ Case 1
  – Gamut mapping is redundant and an identity mapping provides the best result
    • Destination gamut encloses the entire source gamut

◆ Case 2
  – Source gamut exceed those of the chosen destination but they do so only to a limited extent
    • Invisible difference or very small difference

◆ Case 3
  – Source and destination gamuts are significantly different from each other