Using Fragment Shaders to Manipulate Imagery

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Image Basics

Treat the image as a texture

To get from the current texel to a neighboring texel, add \((1./\text{ResS}, 1./\text{ResT})\) to the current \((S,T)\)
Image Un-Masking

Blend of what have and what want more of

Blend of what don’t want and what have

\[ I_{out} = (1.-t)I_{dontwant} + tI_{in} \]

Negatives

T = 0.

T = 1.
HDTV Luminance Standard

Luminance = 0.2125*Red + 0.7154*Green + 0.0721*Blue

Brightness

Idontwant = vec3( 0., 0., 0. );

T = 0.  T = 1.  T = 2.
**Contrast**

\[ I_{\text{dontwant}} = \text{vec3}(0.5, 0.5, 0.5); \]

\( T = 0. \) \hspace{1cm} \( T = 1. \) \hspace{1cm} \( T = 2. \)

**Saturation**

\[ I_{\text{dontwant}} = \text{vec3}(\text{luminance}, \text{luminance}, \text{luminance}); \]

\( T = 0. \) \hspace{1cm} \( T = 1. \) \hspace{1cm} \( T = 3. \)
Difference

\[ I_{\text{dontwant}} = I_{\text{before}} \]
\[ I_{\text{in}} = I_{\text{after}} \]

ChromaKey

Replace fragment if:
\[ R < T \]
\[ G < T \]
\[ B > 1 - T \]
Edge Detection

**Horizontal and Vertical Sobel Convolutions:**

\[
H = \begin{bmatrix}
-1 & -2 & -1 \\
0 & 0 & 0 \\
1 & 2 & 1 \\
\end{bmatrix} \quad V = \begin{bmatrix}
-1 & 0 & 1 \\
-2 & 0 & 2 \\
-1 & 0 & 1 \\
\end{bmatrix}
\]

\[
S = \sqrt{H^2 + V^2} \quad \Theta = \text{atan2}(V, H)
\]

**Edge Detection**

- \( T = 0 \).
- \( T = 0.5 \).
- \( T = 1 \).
Blur Convolution:

\[ B = \frac{1}{16} \begin{bmatrix} 1 & 2 & 1 \\ 2 & 4 & 2 \\ 1 & 2 & 1 \end{bmatrix} \]

Sharpening Convolution:

\[ B = \frac{1}{16} \begin{bmatrix} 1 & 2 & 1 \\ 2 & 4 & 2 \\ 1 & 2 & 1 \end{bmatrix} \]

Idontwant = Iblur
Sharpening

$T = 0.$

$T = 1.$

$T = 2.$

Mandelbrot Set

$z_{i+1} = z_i^2 + z_0$

How fast does it converge, if ever?
Julia Set

\[ Z_{i+1} = Z_i^2 + C \]

How fast does it converge, if ever?