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Image Interpolation

I. The Artifact Hunt

1.1. The most *stair-stepping* or *blockiness.*

The Nearest Neighbor is a “stair-stepping” method. This is due to diagonal or curved edges, nearest neighbor simply copies the nearest pixel without blending, causing sharp “steps” instead of smooth transition.

1.2. The Smoothest Areas

Bilinear is the most *Mushy* in smooth areas such as the sky tone. This is due to this method is averaging the colors of nearby pixels, which smooths gradient but also reduces texture and sharpness. Areas that should have slight tonal variation may look overly soft or *“mushy”.*

1.3. The Ringing Artefact

Bicubic appear slightly *sharper* than in the original. However, this extra sharpness can introduce faint *ringing artifacts,* both light or dark halos can appear caused by overshooting around high contrast edges

II. Performance Profiling

2.1. Image Interpolation Execution Time Comparisons.

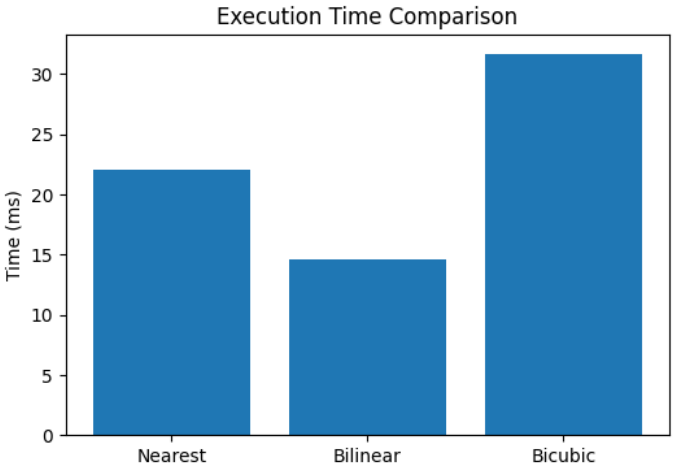

Figure 1. Execution Time Comparison between Nearest, Bilinear, and Bicubic

2.2. The Smoothest Areas

Bicubic percentage differentiation is calculate with equation below, in Equation (1):

$$\frac{T_{B\text{icubic}} - T_{\text{bilinear}}}{T_{B\text{ilinear}}} \times 100\% \quad (1)$$

By using the equation, the percentage difference is 117.37% slower than Bilinear. Explained in Equation (2):

$$\frac{65.43 \quad - 30.11}{30.11} \times 100\% \; = \; 117.37\% \tag{2}$$

2.3. Relationship Between Number Pixels Each Algorithm Samples

The more pixels each interpolation method samples, the higher its computational cost. This results in smoother and sharper results but at the expense of processing time. In real-time applications, Bilinear often offers the best balance between speed and quality.

Table 1. Relationship Between Sampled Pixels and Processing Time

Interpolation Method	**Pixels Samples**	**Computation Complexity**	**Processing Time**	**Visual Quality**
Nearest Neighbor	1	Very Low	Fastest	Lowest
Bilinear	4	Moderate	Medium	Moderate
Bicubic	16	High	Slowest	Highest