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1/12/2025

Pattern Recognition & Computer Vision

- What is the difference between an interleaved image representation and a planar image representation in memory?

In a planar image representation, the colors are stored individually. For example, in a 24-bit image, it would be 8 red, then 8 green, then 8 blue. You would have to go to 3 different places in memory that are largely separated to get the RGB value.

In an interleaved image representation, the colors are stored together. Going back to the 24-bit example, it would be like, RGBRGBRGB… where 1 'RGB' is one pixel. When the RGB values are stored together in each pixel, this is more efficient because you can access the 3 values at once.

- Give a couple of subjective explanations of what a filter can do.

A filter can do blurring (such as a background in a Zoom call), it can do smoothing (such as using a median filter to take the median value of neighboring pixels), it can do sharpening (which usually uses edge detection), you can also use filters to change the colors of an image.

- What are a couple of ways of handling boundary issues (the edges of the image) when applying a filter?

1) You could pad the image with constant values on the edges
2) You could repeat the edge values which effectively "thickens" the edge

- If you have a 3x3 filter, how many operations per pixel are required for convolution? What about a 5x5 filter? What about a 7x7 filter? What about a 1x11 filter?

When doing a convolution, each pixel must go through multiplications and additions. Multiplications occur when you place the center of the filter over a pixel, additions occur after performing all the multiplications because you sum the results.

For a 3x3 filter => 3 x 3 + [8 add]= 17 operations

5x5 filter =>5 x 5 + [24 add]= 49 operations

7x7 filter => 7 x 7 + [48 add]= 97 operations

1x11 filter => 1 x 11 + [10 add] = 21 operations

- Full convolution is convolution where the result contains all possible ways the two filters could overlap. What happens if you do full convolution between the following two filters?

[1 2 1] | -1 |

X | 0 |

| 1 |

To do a full convolution on those filters you need to do the following:

1) Multiply and shift the elements of the 1st filter by each element in the 2nd filter
2) Do additions

[1 * (-1) 1*0 + 2*(-1) 1*1 + 2*0 + 1*(-1) 2*1 + 1*0 1*1]

3) The result of the full convolution for these two filters: [-1 -2 0 2 1]