ECE 4310: Intro to Computer Vision

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Lab 1: Convolution, separable filters, sliding windows

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**Purpose:**

The purpose of this lab is to create three separate filters: a normal 7x7 convolution, a separable filter (one 1x7 filter and one 7x1 filter), and a sliding window filter (a separable filter with a sliding 7x7 window).

**Results:**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Run 1 (ns) | Run 2 (ns) | | Run 3 (ns) | Run 4 (ns) | Run 5 (ns) | Run 6 (ns) | | Run 7 (ns) |
| Standard | 38540000 | 40056000 | 40542000 | | 38203000 | 39403000 | 39561000 | 32919000 | |
| Separable | 11665000 | 12082000 | 12150000 | | 11739000 | 11573000 | 11216000 | 10590000 | |
| Sliding | 5916000 | 5469000 | 4992000 | | 4749000 | 7767000 | 4711000 | 4554000 | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Run 8 (ns) | Run 9 (ns) | Run 10 (ns) | Average (ns) |
| Standard | 46427000 | 39437000 | 37397000 | **39248500** |
| Separable | 9317000 | 12388000 | 11365000 | **11408500** |
| Sliding | 4436000 | 5615000 | 6648000 | **5485700** |

Standard 7x7 Convolution Filter Code:

A screenshot of a cell phone

Description automatically generated

Separable Filter Code:

A screenshot of a cell phone

Description automatically generated

Sliding Filter Code:

A screenshot of text

Description automatically generated

Original Image:

A bridge over a river in a forest

Description automatically generated

Smoothed Image:

A picture containing outdoor, grass, field, photo

Description automatically generated

Example of output and diff commands:

A screenshot of a cell phone

Description automatically generated

**Conclusion:**

The results above were as expected; the standard 7x7 filter was the slowest, the separable filter was in the middle and the sliding filter was the fastest. The different filter speeds changed due to the amount of calculations needed to “smooth” the image. The most calculations was the standard 7x7 convolution filter and the least amount of calculations was the sliding filter. The three-pixel black edge on the smoothed picture is caused by zeros being added when it was off of the image. To reduce this edge, you would need a smaller matrix, but with a smaller matrix, you wouldn’t get an as smooth image. As shown above using the diff command, the smoothed images produced with three different types of filter is the same result each time just the time that it takes differs.