A black background with white squares

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Fig. 1 Spatial dataflow architecture of our system

Noise Reduction (Median Filter)

We applied median filter for noise reduction in our system, where the output pixel is the median of the current and surrounding nine pixels. We applied an algorithm developed by Bevara and Sanki, which allows concurrent sorting of three numbers in groups to compute the median. The filter is scalable by scaling the number of computational units through the top module.

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| A diagram of a diagram  Description automatically generated  Fig. 2 Algorithm by Bevara and Sanki | Fig. 3 Schematic of median filter computational unit |

Edge Detection (Sobel Filter)

The Sobel filter module is designed to contain multiple computational units that can be scaled to allow concurrent processing images of various sizes, where the number of computational units are flexible. The modularization design of the system also allows reusing of calculations by sharing and exchanging the weighted sums between different sub-modules to achieve high-performance and efficient processing of edge detection.

A black background with white circles and red lines

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Fig 4. Illustration on flexibility of filter

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| Fig 5. Sobel filter computational unit | **Progress** |

**Conclusion**

We hope that this project would provide a high-performance, efficient and scalable way to accelerate image processing through hardware acceleration, which would help the ever-changing industry of high-performance computing and machine learning fields.