Maxeler Apps
Breast Mammogram ROI Extraction

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MAXIMUM PERFORMANCE COMPUTING

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Breast Mammogram ROI Extraction

- Automatically extracts a region of interest from the breast mammogram images
- Removes pectoral muscle and background which represent any artifact present outside the breast area, such as patient markings

Data Structure

- 2D images of 1024 x 1024 pixels
- A typical dataset consist of more than 200 patients

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Algorithms

- Background partition removal
- Pectoral muscle removal

Background Partition Removal

1. Start with the first row
2. Scan from left to right
3. While pixel is black go to the next pixel and after that go to the step 4
4. While pixel is not black go to the next pixel and after that go to the step 5
5. If it is a first row then set all other pixels in that row to black and go to the step 7, otherwise go to the step 6
6. If the above pixel is black then set the current pixel to black and go to the next pixel and repeat step 6, otherwise go to the next pixel and repeat step 6. If there is no more pixels in the current row then go to the step 7
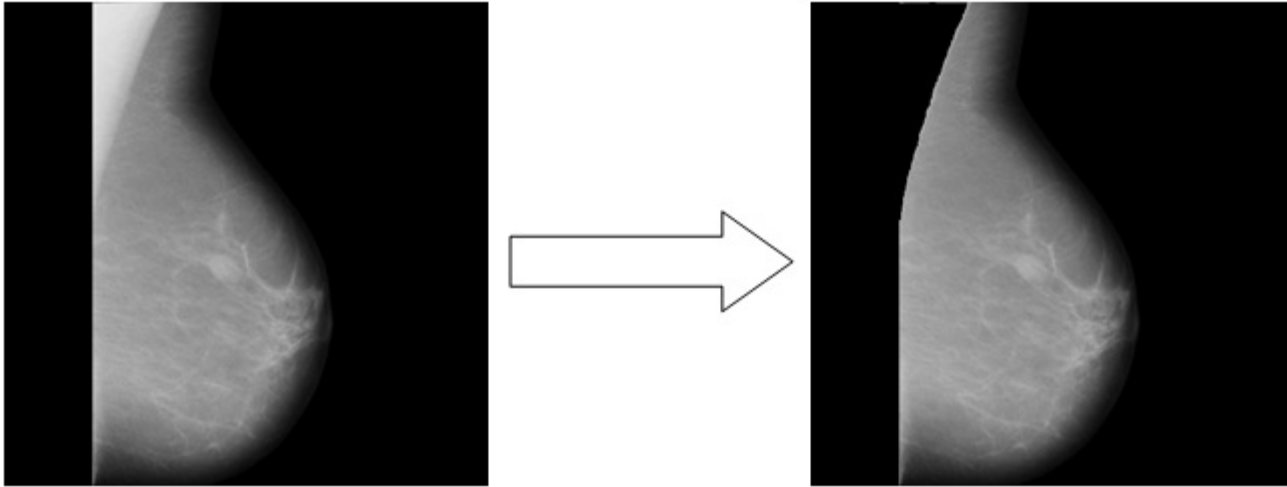7. Repeat steps 2 to 6 for the next row

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Result of
the Background Partition Removal
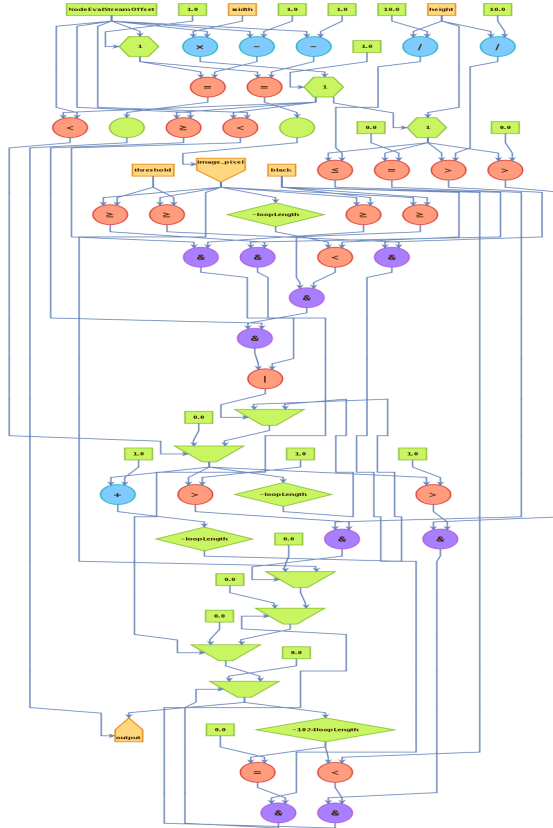
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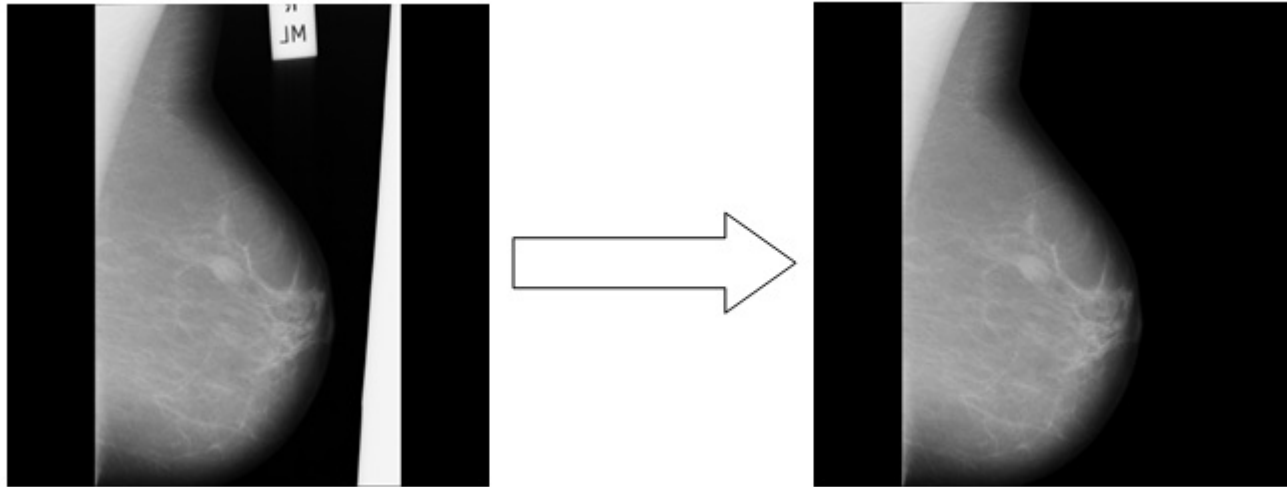
Pectoral Muscle Removal

1. Start with the first row
2. Scan from left to right side
3. While pixel value is less than the threshold value go to the next pixel
4. If the pixel belongs to the first tenth part of the mammogram then if the pixel value is greater than or equal to the threshold value set the current pixel value to black and go to the next pixel and repeat the step 4, otherwise go to step 6; If the pixel does not belong to the first tenth part of the mammogram anymore then go to the step 5
5. If the pixel value is greater than or equal to the threshold value and the above pixel is black then set the current pixel value to black and go to the next pixel and repeat the step 5, otherwise go to step 6
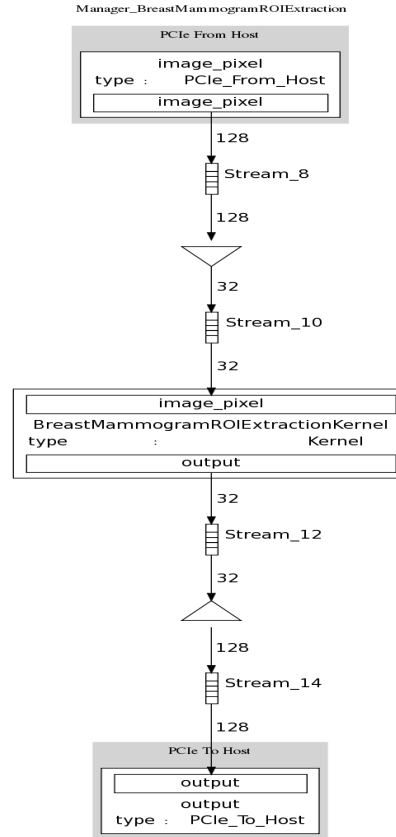6. Repeat steps 2 to 5 for the next row

Result of the Pectoral Muscle Removal

Kernel Graph

Manager Graph

Manager_BreastMammogramROIExtraction

PCIe From Host

image_pixel
type :   PCIe_From_Host
image_pixel

128

Stream_8

128

32

Stream_10

32

image_pixel
BreastMammogramROIExtractionKernel
type   :   Kernel
output

32

Stream_12

32

128

Stream_14

128

PCIe To Host

output
output
type :   PCIe_To_Host

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Resource Usage

LUTs	FFs	BRAMs	DSPs	
524800	1049600	2567	1963	total available resources for FPGA
12723	16692	74	2	total resources used
2.42%	1.59%	2.88%	0.10%	% of available
3720	5035	2	2	used by kernels
0.71%	0.48%	0.08%	0.10%	% of available
8015	9786	59	0	used by manager
1.53%	0.93%	2.30%	0.00%	% of available
4942	6858	14	2	stray resources
0.94%	0.65%	0.55%	0.10%	% of available

✷ For Maia MAX4 Card

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Conclusion and Future Work

- The experimental results showed that there is **significant speedup**, **near to seven times**, in algorithm execution on DFE compared to the general purpose processor
- Further work on this research may be in implementing some other algorithms on the DFE, such as algorithm that detects potential tumor and in exploring those acceleration results

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