

Konstantin Zelmanovich, Claudio Del Valle A

Dr. Nagarajan Kandasamy

ECEC 413 – Introduction to Parallel Computer Architecture

Assignment 4

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CUDA: Box Blur Filter

In the below code, a pragma was used during the initialization part, allowing for CUDA to parallelize this functionality. The results of speedup are provided below.

```
91  /* FIXME: Complete this function to calculate the blur on the GPU. */
92  void
93  compute_on_device (const image_t in, image_t out)
94  {
95      float *din = in.element;
96      float *dout;
97      int n = in.size;
98      int size = sizeof (float) * (n * n);
99
100     // Allocate memory on device for input array
101     cudaMalloc ((void**) &din, size);
102     check_CUDA_error ("Error allocating memory");
103
104     // Copy data from host to device
105     cudaMemcpy (din, in.element, size, cudaMemcpyHostToDevice);
106     check_CUDA_error ("Error copying data from host to device");
107
108     // Allocate memory on device for output array
109     cudaMalloc ((void**) &dout, size);
110     check_CUDA_error ("Error allocating memory");
111
112     dim3 threads (32, 32); // Threads per block
113     dim3 grid (n/threads.x, n/threads.y);
114     struct timeval start, stop;
115     gettimeofday(&start, NULL);
116     blur_filter_kernel<<<grid, threads>>>(din, dout, n);
117     gettimeofday(&stop, NULL);
118     printf ("Parallel time: %f seconds\n", (float) (stop.tv_sec - start.tv_sec + (stop.tv_usec - start.tv_usec) / (float) 1000000));
119     check_CUDA_error ("Error in kernel");
120
121     cudaMemcpy (out.element, dout, sizeof (float) * (n * n), cudaMemcpyDeviceToHost);
122     check_CUDA_error ("Error copying result from device");
123
124     cudaFree(din);
125     cudaFree(dout);
126     check_CUDA_error ("Error freeing memory");
127
128     return;
129 }
```

Table 1: Timing results

Matrix Size	Serial Time (s)	Parallel Time (s)	Speedup
512	0.01	0.000047	212.7
1024	0.04	0.00005	800
2048	0.13	0.000067	1940.2
4096	0.47	0.000073	6438.3
8092	1.69	0.000072	23472.2

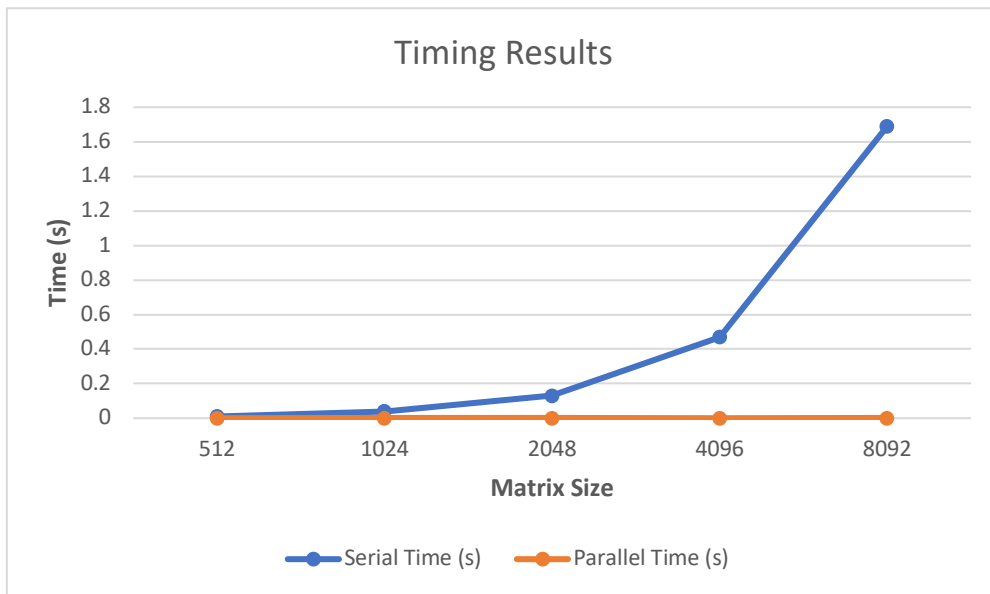


Figure 1: Timing results