Comparison of Speedup with and without SIMD

Metta Saketh Srinivasa Rao

mettas@oregonstate.edu

1. What machine did you run this on?

   This project was run on the Rabbit server.

2. Show the 2 tables of performances for each array size and the corresponding speedups.

   Table of C[i] = A[i] * B[i] experiment data

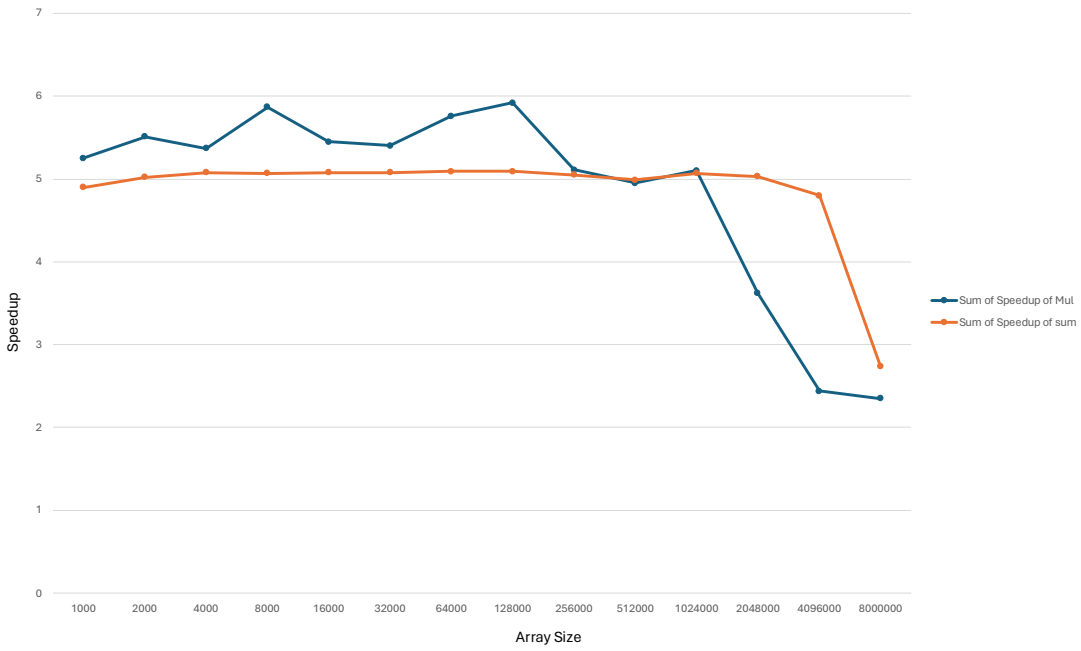
ArraySize	NonSimdMul	SimdMul	Speedup of Mul
1000	123.76	649.35	5.25
2000	121.21	667.33	5.51
4000	123.29	661.49	5.37
8000	123.92	727.87	5.87
16000	134.22	731.56	5.45
32000	144.38	779.54	5.4
64000	164.89	949.03	5.76
128000	194.94	1154.23	5.92
256000	327.1	1671.84	5.11
512000	325.32	1608.88	4.95
1024000	327.83	1673.33	5.1
2048000	321.12	1161.5	3.62
4096000	332.58	812.7	2.44
8000000	340.62	800.27	2.35

   Table of sum = ΣA[i]*B[i] experiment data

ArraySize	NonSimdMulSum	SimdMulSum	Speedup of sum
1000	131.75	645.16	4.9
2000	132.48	665.11	5.02
4000	132.73	673.74	5.08
8000	143.97	729.33	5.07
16000	155.13	787.87	5.08
32000	177.29	900.5	5.08
64000	221.61	1127.51	5.09
128000	354.54	1804.9	5.09
256000	354.5	1791.85	5.05

512000	352.25	1757.43	4.99
1024000	354.04	1795.81	5.07
2048000	353.7	1780.06	5.03
4096000	344.65	1028.23	2.98
8000000	355.75	973.24	2.74

3. Show the graphs (or graph) of SIMD/non-SIMD speedup versus array size (either one graph with two curves, or two graphs each with one curve)



4. What patterns are you seeing in the speedups?

   The speedup of sum is nearly constant but drops drastically from 4 million. But the speedup for mul dropped drastically from 1 million array size.

5. Are they consistent across a variety of array sizes?

   The speedup for sum and multiplication experiments drops drastically for larger size of arrays, for mul it's from 1 million array size and for sum it's 4 million array size.

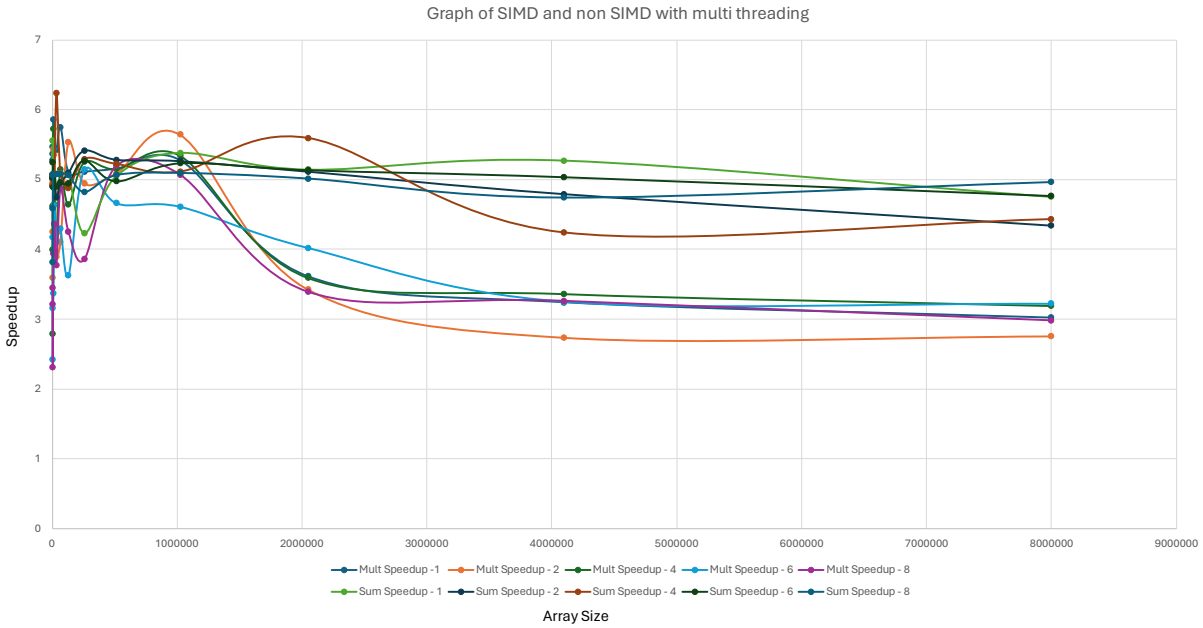
6. Why or why not, do you think?

   The hardware we are using right now cannot handle this large of an array. This is why the speedup drops significantly after 4 million array size even with SIMD usage.

Extra Credit:

Array Size	Threads	Non SIMD mult	SIMD mult	Mult Speedup	Non SIMD Sum	SIMD Sum	Sum Speedup
1000	1	144.13	760.45	5.28	153.85	754.72	4.91
2000	1	124.3	667.56	5.37	127.66	709.22	5.56
4000	1	173.25	947.64	5.47	188.17	955.11	5.08
8000	1	133.78	784.16	5.86	155.04	784.93	5.06
16000	1	164.57	896.36	5.45	188.36	956.31	5.08
32000	1	154.38	837.19	5.42	199.47	1013.81	5.08
64000	1	174.59	1003.06	5.75	232.71	1183.83	5.09
128000	1	328.2	1673.16	5.1	354.48	1797.58	5.07
256000	1	326.51	1668.9	5.11	354.48	1498.79	4.23
512000	1	323.9	1668.99	5.15	353.78	1785.7	5.05
1024000	1	301.46	1588.49	5.27	331.44	1783.97	5.38
2048000	1	275.14	994.15	3.61	300.65	1545.79	5.14
4096000	1	275.15	892.17	3.24	289.19	1524.72	5.27
8000000	1	287.88	868.83	3.02	301.94	1433.4	4.75
1000	2	205.55	738.55	3.59	219.64	1075.27	4.9
2000	2	174.89	744.05	4.25	187.78	941.62	5.01
4000	2	193.4	957.63	4.95	210.32	1067.24	5.07
8000	2	133.41	723.92	5.43	143.97	729.2	5.07
16000	2	154.58	826.36	5.35	177.27	900.5	5.08
32000	2	303.24	1180.11	3.89	354.52	1680.23	4.74
64000	2	321.14	1320.21	4.11	354.66	1756.79	4.95
128000	2	168.48	931.15	5.53	232.61	1184.71	5.09
256000	2	243.55	1202.67	4.94	329.52	1783.34	5.41
512000	2	301.18	1534.36	5.09	306.67	1618.83	5.28
1024000	2	248.69	1401.98	5.64	286.74	1508.31	5.26
2048000	2	256.22	877.54	3.42	299.89	1531.25	5.11
4096000	2	279.36	763.49	2.73	305.86	1466.23	4.79
8000000	2	272.15	747.8	2.75	316.72	1374.65	4.34
1000	4	270.05	753.01	2.79	291.54	1434.7	4.92
2000	4	143.89	664.45	4.62	154.54	774.59	5.01
4000	4	205.76	820.18	3.99	221.34	1122.34	5.07
8000	4	282.91	1617.79	5.72	320.86	1625.03	5.06
16000	4	183.23	849.44	4.64	199.41	1011.95	5.07
32000	4	215.82	912.88	4.23	243.76	1520.84	6.24
64000	4	292.72	1504.71	5.14	321.34	1633.61	5.08
128000	4	295.03	1368.18	4.64	321.27	1564.89	4.87

256000	4	279.35	1467.43	5.25	316.61	1676.06	5.29
512000	4	268.83	1383.44	5.15	298.92	1561.32	5.22
1024000	4	267.48	1428.87	5.34	292.92	1496.78	5.11
2048000	4	262.74	943.04	3.59	289.57	1619.33	5.59
4096000	4	253.15	850.12	3.36	305.91	1296.2	4.24
8000000	4	271.49	864.73	3.19	294.39	1304.37	4.43
1000	6	239.52	998	4.17	278.71	1400.55	5.03
2000	6	270.6	655.09	2.42	308.21	1546.8	5.02
4000	6	273.95	866.74	3.16	321.05	1682.8	5.24
8000	6	294.55	991.33	3.37	321.04	1569.24	4.89
16000	6	195.42	905.69	4.63	210.46	1067.38	5.07
32000	6	266.97	1098.22	4.11	321.36	1574.18	4.9
64000	6	293.25	1257.47	4.29	321.31	1589.83	4.95
128000	6	296.8	1074.26	3.62	331.27	1636.35	4.94
256000	6	265.62	1364.17	5.14	300.2	1583.27	5.27
512000	6	262.37	1221.65	4.66	287.39	1428.16	4.97
1024000	6	281.35	1296.33	4.61	287.04	1502.61	5.23
2048000	6	273.91	1100.81	4.02	280.56	1438.8	5.13
4096000	6	261.61	849.25	3.25	285.17	1434.38	5.03
8000000	6	258.71	832.69	3.22	284.02	1351.78	4.76
1000	8	187.02	645.16	3.45	283.77	1084.6	3.82
2000	8	256.11	590.67	2.31	287.11	1315.8	4.58
4000	8	266.56	854.88	3.21	287.73	1459.32	5.07
8000	8	265.69	1046.44	3.94	287.93	1456.93	5.06
16000	8	264.73	1155.23	4.36	288.07	1463.86	5.08
32000	8	266.12	1003.23	3.77	288.06	1464	5.08
64000	8	266.94	1299.02	4.87	288.13	1464.26	5.08
128000	8	273.55	1163.92	4.25	310.25	1569.97	5.06
256000	8	271.95	1048.7	3.86	303.51	1462.77	4.82
512000	8	263.22	1369.9	5.2	287.49	1455.48	5.06
1024000	8	265.27	1345.61	5.07	286.08	1457.19	5.09
2048000	8	262.13	889.23	3.39	286.57	1435.92	5.01
4096000	8	257.4	838.52	3.26	285.23	1351.51	4.74
8000000	8	258.15	769.76	2.98	286.37	1419.89	4.96



The graphs above show that even if we use multi-threading, the process would be slow for multiplication of the arrays than the sum of the array. We can also see that as the speedup decreases as we increase the size of the array.