GSVD

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1 Performance

1.1 Stability

The following metrics are computed in each stability tests:

$$res_A = \frac{\|U^T AQ - CR\|_1}{max(m,n)\|A\|_1 \epsilon}$$

$$res_b = \frac{\|V^T BQ - SR\|_1}{max(p,n)\|B\|_1 \epsilon}$$

$$orth_U = \frac{\|I - U^T U\|_1}{m\epsilon}$$

$$orth_V = \frac{\|I - V^T V\|_1}{p\epsilon}$$

$$orth_Q = \frac{\|I - Q^T Q\|_1}{n\epsilon}$$

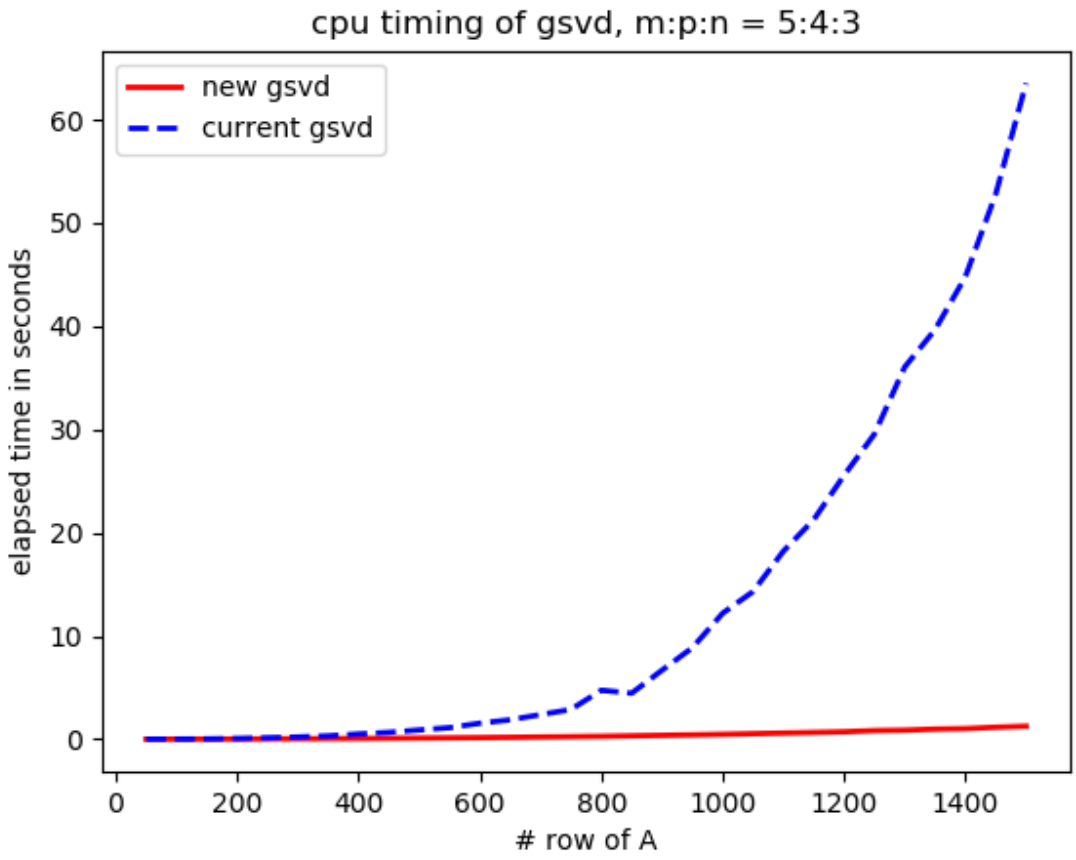
where ϵ is machine precision of input data type.

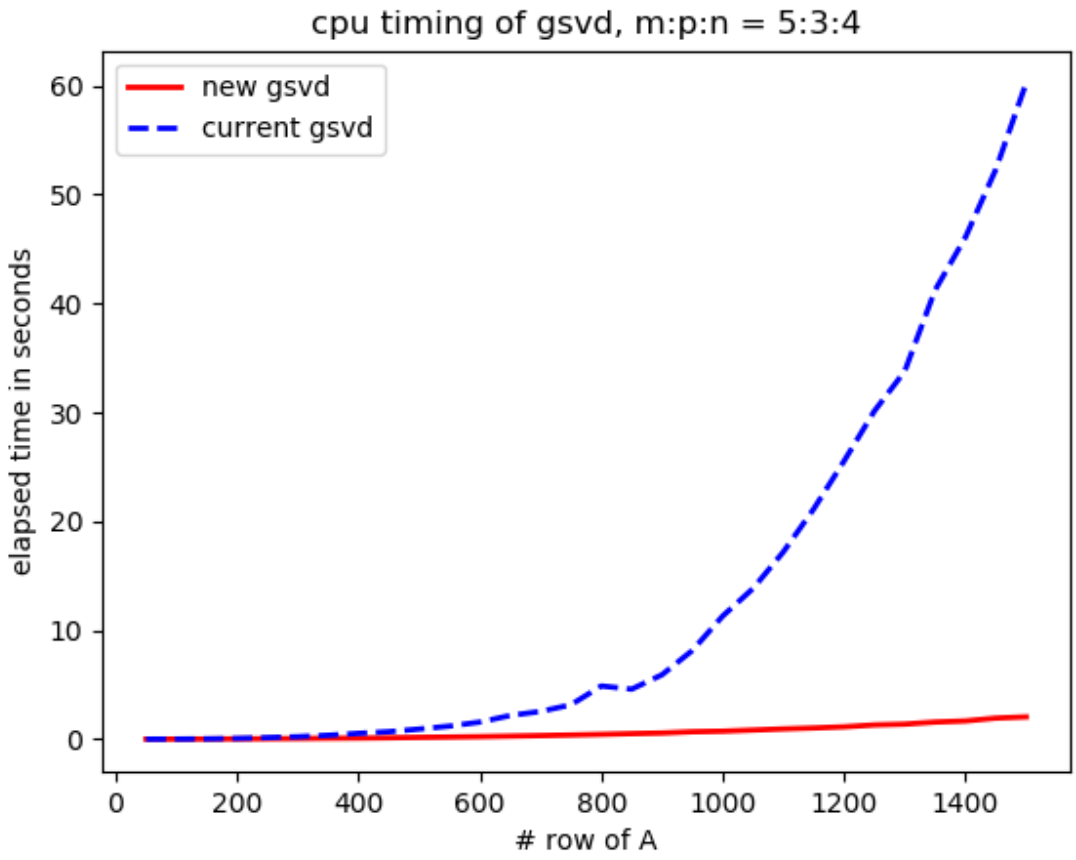
1.2 Timing

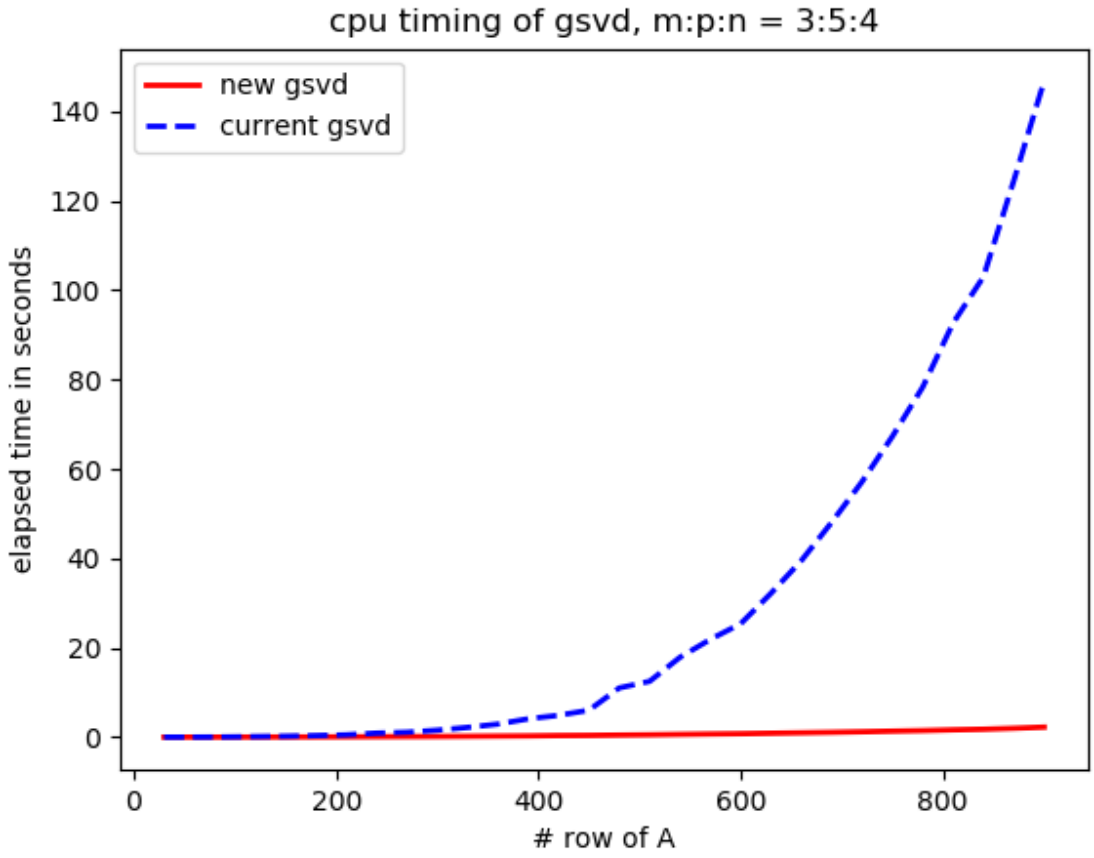
1. Test case 1: m:p:n = 5:4:3
2. Test case 2: m:p:n = 5:3:4
3. Test case 3: m:p:n = 3:5:4
4. Test case 4: m:p:n = 3:4:5

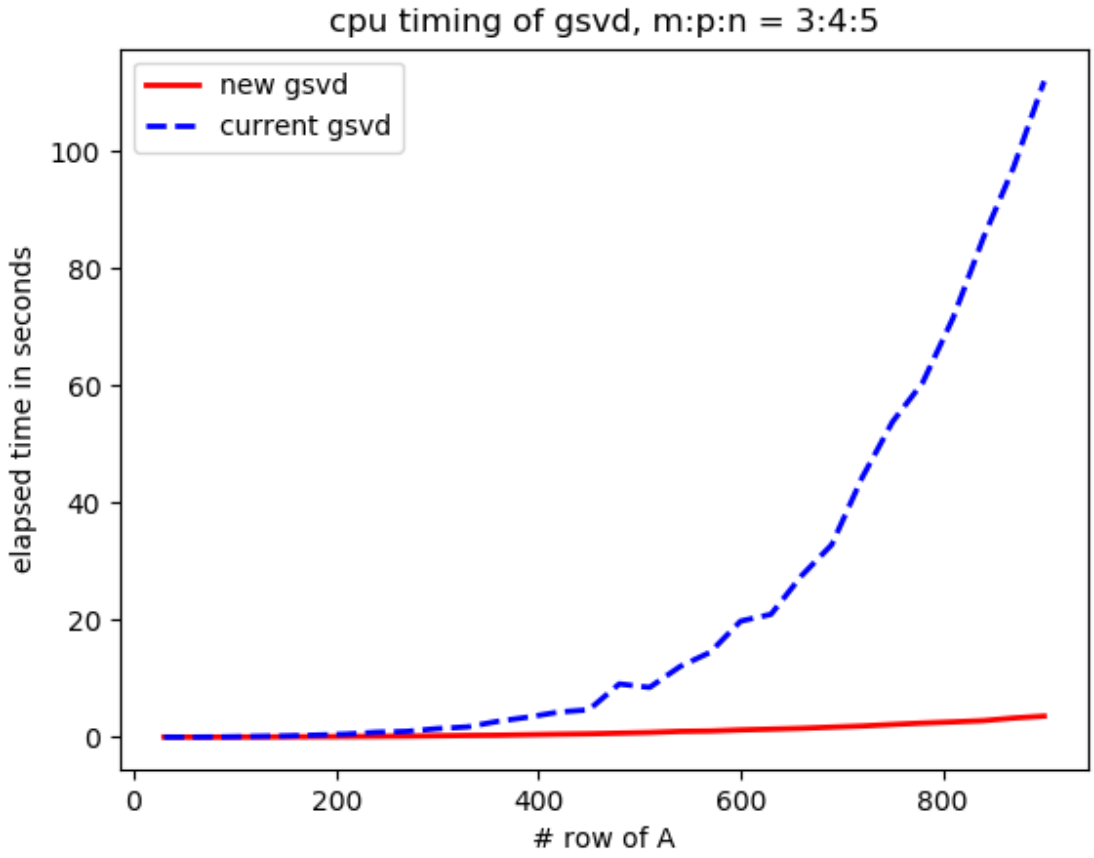
	m	p	n	r	res_A	res_B	$orth_U$	$orth_V$	$orth_Q$
$m \geq n$ $p \geq n$	60	50	40	40	0.1607	0.2710	0.7924	1.0079	0.4609
	300	250	200	200	0.0369	0.0484	0.5041	0.6408	0.3202
	900	750	600	600	0.0181	0.0193	0.3952	0.5157	0.2307
	1500	1250	1000	1000	0.0120	0.0142	0.3702	0.4129	0.1847
$m \geq n > p$	60	40	50	50	0.1529	0.2261	0.7653	1.1960	0.6074
	300	200	250	250	0.0412	0.0620	0.5559	0.7492	0.3150
	900	600	750	750	0.0169	0.0232	0.4174	0.5250	0.2411
	1500	1000	1250	1250	0.0122	0.0160	0.3726	0.4723	0.2080
$p \geq n > m$	40	60	50	50	0.1672	0.2028	1.1293	0.9373	0.4217
	200	300	250	250	0.0595	0.0530	0.7064	0.5855	0.3065
	600	900	750	750	0.0231	0.0231	0.5178	0.4186	0.2112
	1000	1500	1250	1250	0.0164	0.0153	0.4543	0.3673	0.1778
$n > m$ $n > p$	20	30	60	50	0.0483	0.0464	0.5472	0.5358	0.4547
	200	300	600	500	0.0120	0.0105	0.3036	0.3030	0.2374
	400	600	1200	1000	0.0081	0.0072	0.2888	0.2813	0.2315
	1000	1500	3000	2500	0.0053	0.0047	0.2700	0.2605	0.2410

Table 1: Stability profiling for GSVD


cpu timing of gsvd, m:p:n = 5:4:3
new gsvd
current gsvd
elapsed time in seconds
0
10
20
30
40
50
60
0
200
400
600
800
1000
1200
1400
row of A


cpu timing of gsvd, m:p:n = 5:3:4
new gsvd
current gsvd
elapsed time in seconds
row of A
0
10
20
30
40
50
60
0
200
400
600
800
1000
1200
1400


cpu timing of gsvd, m:p:n = 3:5:4
new gsvd
current gsvd
elapsed time in seconds
0
20
40
60
80
100
120
140
0
200
400
600
800
row of A


cpu timing of gsvd, m:p:n = 3:4:5
new gsvd
current gsvd
elapsed time in seconds
0
20
40
60
80
100
0
200
400
600
800
row of A

	m	p	n	t_{pre}	p_{pre}	t_{qr}	p_{qr}	t_{csd}	p_{csd}	t_{all}
$m \geq n$ $p \geq n$	1500	1200	1000	0.6242	41.13%	0.1683	11.09%	0.6011	39.61%	1.5175
	500	500	500	0.0651	26.78%	0.0347	14.29%	0.1191	48.94%	0.2433
	650	310	230	0.0418	54.63%	0.0084	11.08%	0.0195	25.47%	0.0766
	430	610	210	0.0345	47.65%	0.0067	9.25%	0.0247	34.11%	0.0725
$m \geq n > p$	1500	1000	1200	1.500	60.09%	0.1815	7.27%	0.6811	27.28%	2.4963
	720	220	540	0.1182	73.65%	0.0074	4.61%	0.0256	15.94%	0.1605
	440	180	440	0.0651	65.84%	0.0053	5.37%	0.0221	22.41%	0.0989
	370	290	350	0.0659	51.61%	0.0123	9.65%	0.0400	31.34%	0.1278
$p \geq n > m$	1000	1500	1200	0.5234	23.23%	0.2789	12.37%	1.2630	56.06%	2.2529
	250	300	300	0.0205	24.96%	0.0129	15.75%	0.0397	48.25%	0.0822
	360	660	600	0.0645	18.33%	0.0436	12.39%	0.2103	59.72%	0.3521
	130	520	480	0.0311	14.52%	0.0215	10.02%	0.1391	64.79%	0.2146
$n > m$ $n > p$	1000	1200	1500	1.7532	48.51%	0.2038	5.64%	1.4467	40.03%	3.6136
	260	600	770	0.2791	38.86%	0.0441	6.14%	0.3459	48.17%	0.7181
	370	250	700	0.1385	86.69%	0	0%	0	0%	0.1598
	120	120	400	0.0296	96.70%	0	0%	0	0%	0.0307

Table 2: Time profiling for GSVD