Time Cost of nGrangerT

February 14, 2016

1 Correlation Stage Time Cost

```
X=randn(500,1e5); tic; R=getcovpd(X, 20); toc
```

1e5, sec	p=10	20	50	100	200	500	1000	$O(p^2 \cdot m \cdot L)$
od=20	0.0575	0.124	0.272	1.339	3.96	17.02	59.7	
od=40	0.096	0.223	0.494	2.67	7.71	32.14	118.1	$O(p^{1.9} \cdot m \cdot L)$

Table 1: getcovpd(), farxhp7, octave

Note:

- Matlab (2012b) will be 33% slower in these cases.
- getcovzpd() (for positive defined result) cost roughly the same time.

1e5, sec	p=10	20	50	100	200	500	1000	2000	4000
od=20	0.250	0.526	0.959	1.966	4.63	17.73	53.2		
od=40	0.486	0.922	1.786	3.792	8.90	35.1	104.0	333.9	1229.6

Table 2: getcovpd(). fardell, Matlab 2014a

1e5, sec	p=10	20	50	100	200	500	1000	2000		6000
od=20										
od=40							100.1			

Table 3: getcovpd(). far502, Matlab 2014a

2 Regression Stage Time Cost

```
tic; gc=RGrangerT(R); toc
```

sec	p=10	20	50	100	200	500	$O(p^4m^3)$
od=20	0.022	0.168	2.44	24.2	243.6	6870.3	
od=40	0.082	0.463	12.0	120.4	1358.2	oom	$O(p^{3.6}m^{2.3})$

Table 4: RGrangerT, farxhp7, octave

```
tic; gcq=RGrangerTfast(R); toc
```

sec	p=10	20	50	100	200	500	$O(p^3m^3)$
od=20	0.013	0.039	0.185	0.721	4.06	52.1	
od=40	0.038	0.105	0.736	4.63	27.2	oom	$O(p^{2.8}m^{2.7})$

Table 5: RGrangerTfast, farxhp7, octave

```
tic; gcq2=RGrangerTLevinson(R); toc
```

sec	p=10	20	50	100	200	500	1000	$O(p^3m^2\log m)$
od=20	0.018	0.044	0.1296	0.434	1.987	19.5	110.5	
od=40	0.044	0.101	0.3745	1.662	8.353	76.9	433.9	$O(p^{2.5}m^2\log m)$

Table 6: RGrangerTLevinson(). farxhp7, octave

[1]

Note:

RGrangerTfast: $p = 500$, $m = 20$, time cost: 13.2 sec in Solving A, 37.9 sec in inverting $covz$, 0.11 sec in geting GC. (Do a $covz * covz$ will cost 25.7 sec);

For Matlab (2012b), $p = 500$, $m = 20$, time cost: 7.7 sec in Solving A, 155.7 sec in inverting $covz$, 0.17 sec in geting GC; Which is, about 200% slower. (Do a $covz * covz$ will cost 23.3 sec)

sec	p=10	20	50	100	200	500	1000
od=20	0.020	0.125	1.251	9.73	104.5	2805.6	
od=40	0.084	0.395	4.617	47.1	534.7	16330.8	

Table 7: RGrangerT, fardell, Matlab 2014a

sec	p=10	20	50	100	200	500	1000	2000	$O(p^3m^3)$
od=20	0.008	0.055	0.133	0.598	2.639	27.2	192.4		
od=40	0.071	0.116	0.555	2.503	15.1	188.1	1434.1	oom	

Table 8: RGrangerTfast, fardell, Matlab 2014a

[1] oom: out-of-memory, 8GB for farxhp7

sec	p=10	20	50	100	200	500	1000	2000	3500	$O(p^3m^2 \log m)$
od=20	0.019	0.034	0.138	0.441	1.786	14.2	74.6	459.4		
od=40	0.043	0.129	0.435	1.496	6.765	53.6	285.2	1773.7		

Table 9: RGrangerTLevinson, fardell, Matlab 2014a

sec	p=10	20	50	100	200	500	1000	2000	6000	$O(p^3m^2 \log m)$
od=20										
od=40							329.0			

Table 10: RGrangerTLevinson, far502, Matlab 2014a

3 BlockLevinson

1e5, sec	p=10	20	50	100	200	500	1000	$O(p^3m^2)$
od=20	0.006	0.008	0.030	0.130	0.592	5.18	32.0	
od=40	0.011	0.023	0.095	0.474	2.006	19.36	117.9	$O(p^{2.6}m^{1.9})$

Table 11: BlockLevinson(). farxhp7, octave

4 AnalyseSeries

sec	p=10	20	50	100	200	500	1000	
od=20	0.0409	0.0739	0.196	0.951	5.294			
od=40	0.188	0.439	1.481	7.814	36.05	176.3		

Table 12: AnalyseSeriesLevinson() GC part. farxhp7, Matlab

sec	p=10	20	50	100	200	500	1000	
od=20	0.046	0.085	0.255	1.271	7.259			
od=40	0.205	0.471	1.691	9.022	42.64	247.0		

Table 13: AnalyseSeriesLevinson(). farxhp7, Matlab

sec	p=10	20	50	100	200	500	1000	
od=20	0.024	0.107	0.912	9.773	122.1			
od=40	0.062	0.284	3.107	41.95	405.9	9790.2		

Table 14: AnalyseSeriesFast(). farxhp7, Matlab

5 Time Cost

nGrangerT

$O(p^2 \cdot m \cdot L) + O(p^4 m^3)$
nGrangerTfast
$O(p^2 \cdot m \cdot L) + O(p^3 m^3)$
nGrangerTLevinson
$O(p^2 \cdot m \cdot L) + O(p^3 m^2 \log m)$
PDC, freqdecomposition based (N the length of FFT)
$O(p^2 \cdot L \cdot \log N) + O(p^3 N + p^2 N \log N)$
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