Appendix: Tables of Numerical Experiment Results

Table 1: Results for order-3 nonnegative tensors with $n = 500$ samples

Tensor Size	**BCG with Weak Oracle** NMSE	Time (s)	**Alternating Least Squares** NMSE	Time (s)
$10 \times 10 \times 10$	0.004 ± 0.001	4.29 ± 0.194	0.058 ± 0.002	0.122 ± 0.003
$20 \times 20 \times 20$	0.070 ± 0.003	28.6 ± 0.753	0.174 ± 0.005	0.351 ± 0.012
$30 \times 30 \times 30$	0.220 ± 0.004	11.0 ± 0.671	0.287 ± 0.005	0.796 ± 0.030
$40 \times 40 \times 40$	0.300 ± 0.004	5.83 ± 0.202	0.351 ± 0.005	0.947 ± 0.043
$50 \times 50 \times 50$	0.371 ± 0.004	4.86 ± 0.090	0.406 ± 0.006	1.58 ± 0.093
$60 \times 60 \times 60$	0.434 ± 0.004	4.78 ± 0.063	0.454 ± 0.006	2.08 ± 0.105
$70 \times 70 \times 70$	0.500 ± 0.004	4.94 ± 0.063	0.503 ± 0.008	3.30 ± 0.140
$80 \times 80 \times 80$	0.554 ± 0.004	5.73 ± 0.112	0.539 ± 0.010	5.96 ± 0.226
$90 \times 90 \times 90$	0.594 ± 0.004	5.34 ± 0.077	0.576 ± 0.011	9.34 ± 0.302
$100 \times 100 \times 100$	0.641 ± 0.004	5.56 ± 0.072	0.666 ± 0.013	16.8 ± 0.568
Tensor Size	**Simple Low Rank TC (SiLRTC)** NMSE	Time (s)	**Trace Norm & ADMM (TNCP)** NMSE	Time (s)
$10 \times 10 \times 10$	0.609 ± 0.002	0.004 ± 0.000	0.290 ± 0.004	0.003 ± 0.000
$20 \times 20 \times 20$	0.939 ± 0.000	0.007 ± 0.000	0.454 ± 0.005	0.002 ± 0.000
$30 \times 30 \times 30$	0.981 ± 0.000	0.019 ± 0.000	0.476 ± 0.004	0.003 ± 0.000
$40 \times 40 \times 40$	0.992 ± 0.000	0.043 ± 0.000	0.468 ± 0.004	0.004 ± 0.000
$50 \times 50 \times 50$	0.996 ± 0.000	0.095 ± 0.001	0.481 ± 0.004	0.006 ± 0.000
$60 \times 60 \times 60$	0.998 ± 0.000	0.190 ± 0.002	0.474 ± 0.004	0.010 ± 0.000
$70 \times 70 \times 70$	0.999 ± 0.000	0.456 ± 0.003	0.477 ± 0.003	0.014 ± 0.000
$80 \times 80 \times 80$	0.999 ± 0.000	0.918 ± 0.008	0.477 ± 0.003	0.020 ± 0.000
$90 \times 90 \times 90$	0.999 ± 0.000	1.91 ± 0.032	0.481 ± 0.003	0.040 ± 0.001
$100 \times 100 \times 100$	0.999 ± 0.000	2.83 ± 0.050	0.482 ± 0.003	0.050 ± 0.001

Table 2: Results for increasing order nonnegative tensors and $n = 10,000$ samples

Tensor Size	**BCG with Weak Oracle** NMSE	Time (s)	**Alternating Least Squares** NMSE	Time (s)
$10^{\times 4}$	0.001 ± 0.000	25.2 ± 1.11	0.007 ± 0.001	0.925 ± 0.025
$10^{\times 5}$	0.002 ± 0.000	40.7 ± 0.82	0.074 ± 0.006	1.13 ± 0.038
$10^{\times 6}$	0.008 ± 0.001	59.5 ± 1.20	0.412 ± 0.025	1.79 ± 0.097
$10^{\times 7}$	0.034 ± 0.004	530 ± 368	0.930 ± 0.019	1.28 ± 0.050
$10^{\times 8}$	0.156 ± 0.014	872 ± 66	0.986 ± 0.010	15.1 ± 0.199
Tensor Size	**Simple Low Rank TC (SiLRTC)** NMSE	Time (s)	**Trace Norm & ADMM (TNCP)** NMSE	Time (s)
$10^{\times 4}$	0.149 ± 0.004	0.017 ± 0.001	0.236 ± 0.002	0.004 ± 0.000
$10^{\times 5}$	0.870 ± 0.002	0.122 ± 0.005	0.728 ± 0.004	0.014 ± 0.000
$10^{\times 6}$	0.990 ± 0.000	1.59 ± 0.053	0.883 ± 0.003	0.261 ± 0.000
$10^{\times 7}$	0.999 ± 0.000	40 ± 1.23	0.943 ± 0.002	5.71 ± 0.010
$10^{\times 8}$	$*$	$*$	$*$	$*$

The $*$ symbol indicates that the algorithm was unable to run for the given tensor size.

Table 3: Results for nonnegative tensors with size $10^{\times 6}$ and increasing n samples

Sample Percent	**BCG with Weak Oracle**		**Alternating Least Squares**	
	NMSE	Time (s)	NMSE	Time (s)
0.01	0.989 ± 0.002	0.348 ± 0.016	1.000 ± 0.000	0.067 ± 0.001
0.1	0.457 ± 0.023	62.4 ± 4.79	1.000 ± 0.000	0.105 ± 0.001
1	0.007 ± 0.000	60.4 ± 1.32	0.389 ± 0.023	1.82 ± 0.098
10 ($n = 100,000$)	0.005 ± 0.000	413.7 ± 11.1	0.046 ± 0.005	15.03 ± 0.401
Sample Percent	**Simple Low Rank TC (SiLRTC)**		**Trace Norm & ADMM (TNCP)**	
	NMSE	Time (s)	NMSE	Time (s)
0.01	1.000 ± 0.000	1.20 ± 0.055	0.907 ± 0.004	0.261 ± 0.001
0.1	1.000 ± 0.000	1.24 ± 0.041	0.893 ± 0.003	0.260 ± 0.001
1	0.990 ± 0.000	1.67 ± 0.053	0.880 ± 0.003	0.266 ± 0.001
10 ($n = 100,000$)	0.862 ± 0.001	4.23 ± 0.141	0.800 ± 0.003	0.264 ± 0.001

Table 4: Results for nonnegative tensors with size $10^{\times 7}$ and increasing n samples

Sample Percent	**BCG with Weak Oracle**		**Alternating Least Squares**	
	NMSE	Time (s)	NMSE	Time (s)
0.01	0.873 ± 0.016	48.4 ± 3.42	1.000 ± 0.000	0.561 ± 0.003
0.1	0.029 ± 0.004	145 ± 36.6	0.877 ± 0.023	1.29 ± 0.043
1	0.011 ± 0.001	522 ± 11.7	0.220 ± 0.016	19.2 ± 0.603
10 ($n = 1,000,000$)	0.013 ± 0.001	5623 ± 381	0.052 ± 0.007	189 ± 4.89
Sample Percent	**Simple Low Rank TC (SiLRTC)**		**Trace Norm & ADMM (TNCP)**	
	NMSE	Time (s)	NMSE	Time (s)
0.01	1.000 ± 0.000	48.3 ± 7.95	0.950 ± 0.002	6.41 ± 0.152
0.1	1.000 ± 0.000	42.4 ± 1.46	0.938 ± 0.002	5.55 ± 0.007
1	0.989 ± 0.000	53.9 ± 1.96	0.933 ± 0.002	5.57 ± 0.007
10 ($n = 1,000,000$)	0.863 ± 0.001	106 ± 3.44	0.853 ± 0.002	5.65 ± 0.013