Simplifying, Regularizing and Strengthening Sum-Product Network Structure Learning: Supplementary Material

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Extended Results

	NLTCS	MSNBC	KDDCup2k	Plants	Audio	Jester	Netflix	Accidents	Retail	Pumsb-star	DNA	Kosarek	MSWeb	Book	$\mathbf{EachMovie}$	WebKB	Reuters-52	BBC	Ad
LearnSPN																			
ho	15	10	15	5	5	15	10	10	15	20	15	15	15	15	10	15	10	10	5
λ	0.4	0.4	0.2	0.4	0.6	0.6	0.6	0.4	0.2	0.6	0.6	0.6	0.4	0.4	0.8	0.6	0.4	0.6	0.8
m	50	100	10	10	100	100	50	10	50	10	100	10	500	100	100	10	50	10	10
α	0.5	0.1	0.5	0.2	2.0	1.0	2.0	0.2	2.0	0.1	0.1	0.5	0.5	1.0	1.0	0.5	0.2	0.1	0.1
SPN-B																			
ho	5	5	5	5	5	5	5	10	10	10	15	5	5	5	5	5	5	5	5
m	10	50	10	10	50	10	50	10	50	10	50	10	10	50	10	10	10	10	10
α	2.0	1.0	2.0	1.0	2.0	2.0	2.0	0.2	2.0	0.1	0.1	2.0	1.0	2.0	2.0	2.0	1.0	1.0	0.1
SPN-BT																			
ρ	5	5	5	5	5	5	5	10	10	10	10	10	5	10	5	10	5	5	5
m	10	50	10	100	500	50	500	100	50	100	100	500	50	10	10	100	10	10	10
α	2.0	1.0	2.0	1.0	2.0	2.0	2.0	0.2	2.0	0.1	0.1	2.0	0.5	2.0	2.0	2.0	1.0	1.0	0.1
MT																			
k	20	30	20	30	22	16	30	30	4	26	6	6	10	4	6	2	4	2	2

Table 1: Best parameter configurations on each dataset, found on the validation set portion for LearnSPN, SPN-B, SPN-BT and MT.

	LearnSPN	SPN-B	SPN-BT	ID-SPN	SPN-BB	SPN-BTB	MT
NLTCS	183	114	108	310	1004	1041	290
MSNBC	7354	5922	5774	46266	7963	8275	8645
KDDCup2k	5800	3946	4525	32067	10633	12148	39857
Plants	1156	1420	276	18833	7515	3023	7414
Audio	1146	1561	131	21009	10466	4113	6566
Jester	1289	789	687	10412	17753	8566	3064
Netflix	1331	2369	152	30294	14871	4768	11402
Accidents	839	1006	722	15472	9198	8280	14073
Retail	253	173	161	4041	2317	2505	320
Pumsb-star	230	1010	612	20952	7819	7790	18533
\mathbf{DNA}	140	87	122	3040	2022	3049	228
Kosarek	225	1515	416	17799	16583	3642	18782
\mathbf{MSWeb}	369	1711	1444	19682	16881	18273	36076
\mathbf{Book}	457	832	389	61248	27473	16630	5918
EachMovie	307	939	946	118782	22506	29355	12100
\mathbf{WebKB}	307	1960	490	45451	29265	34952	931
Reuters-52	2538	5256	4333	70864	36109	135970	15082
BBC	1136	2645	2479	61471	56271	121007	1324
\mathbf{Ad}	668	1585	1356	87522	72632	58777	6850

Table 2: Times (in seconds) taken to learn the best models on each dataset for LearnSPN, SPN-B, SPN-BT, SPN-BB, SPN-BTB and MT and with default parameters values for ID-SPN. Experiments run on a 4-core Intel Xeon E312xx (Sandy Bridge) @2.0 GHz with 8Gb of RAM and Ubuntu 14.04.1, kernel 3.13.0-39.

Dumb-star 1.56e-09 1.16e-12 9.39e-24 4.31e-15 1.56e-18 1.56e-05 3.91e-31 NA 1.80e-24 2.29e-22 2.20e-26 2.30e-40 2.42e-08 4.69e-20 9.81e-01 Kosarek 3.13e-01 3.05e-01 2.14e-01 2.74e-01 1.89e-01 1.31e-01 2.85e-18 MSWeb 3.83e-02 3.77e-02 1.40e-02 1.84e-03 6.02e-04 6.00e-02 1.30e-06 BehMore 7.36e-01 5.78e-01 5.79e-01 5.58e-01 5.94e-01 1.16e-01 BehMorb 7.59e-01 2.37e-01 2.50e-01 8.98e-02 9.99e-01 1.16e-01 BBC 6.61e-01 7.65e-01 4.79e-01 6.57e-03 4.35e-02 7.29e-03 1.71e-02 2.61e-01 Ad 1.71e-06 3.65e-07 5.30e-01 8.79h-B SPN-BT								
MSNBC 1.86e-05 1.82e-05 1.24e-05 8.87e-06 1.26e-05 1.49e-04 0.00e-100 0								
MSNBC 1.86e-05 1.82e-05 1.24e-05 8.87e-06 1.26e-05 1.49e-04 0.00e-100 0	NIECC							
Non-Polants 0.00e+00 0.00e+00 0.00e+00 0.00e+00 0.00e+00 0.00e+00 1.60e+01 1.60e+01 1.60e+01 1.30e+01 1.30e+								
Name								
Netflix								
Netflix								
Accidentes								
Name								
Dumb-star 1.56e-09 1.16e-12 9.39e-24 4.31e-15 1.56e-18 1.56e-05 3.91e-31 Kosarek 3.13e-01 3.05e-01 2.14e-01 2.74e-01 1.89e-01 1.31e-01 2.85e-18 MSWeb 3.83e-02 3.37e-02 1.40e-02 1.84e-03 6.02e-04 6.00e-02 1.30e-06 Book 7.34e-01 6.39e-01 7.5e-01 5.72e-01 6.00e-02 1.30e-06 BedhMovie 7.89e-01 5.28e-01 2.77e-01 2.50e-01 8.98e-02 9.99e-01 1.16e-01 Reuters-52 2.50e-01 2.37e-01 3.7e-01 6.57e-03 4.35e-02 7.36e-01 7.7e-02 BBC 6.10e-1 7.65e-01 7.59e-01 8.79e-02 4.35e-02 7.2e-02 7.2e-01 MLTCS 2.90e-71 4.19e-80 SPN-B SPN-B SPN-B SPN-BT								
DNA 1.80e-24 2.29e-22 2.20e-26 2.30e-49 2.42e-08 4.69e-20 9.81e-01 MSWeb 3.33e-01 3.05e-01 2.14e-02 1.84e-03 6.02e-04 6.00e-02 1.30e-06 Book 7.34e-01 6.83e-01 5.72e-01 6.39e-01 4.45e-01 7.30e-01 3.72e-03 EachMovie 7.89e-01 7.86e-01 8.72e-01 5.51e-01 5.58e-01 5.94e-01 1.16e-01 WebKB 6.51e-01 2.37e-01 2.20e-01 4.35e-02 9.99e-01 1.44e-09 Betufers-52 2.50e-01 2.37e-01 3.20e-01 4.35e-02 7.90e-03 1.71e-02 2.61e-01 Add 1.71e-06 3.63e-07 5.30e-01 6.75e-03 7.90e-03 1.71e-02 2.61e-03 MSDRD SPN-BB SPN-BB SPN-BB SPN-BT	Retail	3.38e-01		1.03e-01		1.51e-01	7.65e-02	4.03e-145
Kosnek 3.13e-01 3.05e-01 2.14e-01 2.74e-01 1.89e-01 1.31e-01 2.85e-18 Book 7.34e-01 6.83e-02 1.40e-02 1.84e-03 6.02e-04 6.0e-02 1.30e-06 Book 7.34e-01 6.83e-01 5.72e-01 6.39e-01 4.45e-01 7.30e-01 1.72e-03 KehKB 6.51e-01 5.23e-01 2.77e-01 2.50e-01 8.98e-02 9.99e-01 1.16e-01 BC 6.61e-01 7.65e-01 4.79e-01 6.57e-03 7.90e-03 1.71e-02 6.61e-01 Add 1.71e-06 3.63e-07 5.30e-01 8.78e-18 PN-B SPN-B S	Pumsb-star	1.55e-09	1.16e-12	9.39e-24	4.31e-15	1.54e-18	1.56e-05	3.91e-31
MSWeb 3.88-0.2 3.37-0.2 1.40-0.2 1.84-0.3 6.02-0.4 6.00-0.2 1.30-0.6 BachMovie 7.34-0.1 6.83-0.1 5.72-0.1 5.51-0.1 5.58-0.1 5.94-0.1 1.16-0.1 WebKB 6.51-0.1 5.23-0.1 2.77-0.1 2.50-0.1 8.98-0.2 9.99-0.1 1.46-0.9 BC 2.50-0.1 2.37-0.1 3.20-0.1 4.35-0.0 4.35-0.2 2.99-0.1 1.44-0.9 BC 6.61-0.1 7.65-0.1 4.79-0.1 6.57-0.3 7.90-0.3 1.71-0.2 2.61-0.1 Add 1.71-0.6 3.63-0.7 5.30-0.1 8.78-0.3 7.90-0.3 1.71-0.2 2.61-0.1 MCT SPN-B SPN-BB SPN-BB SPN-BT		1.80e-24	2.29e-22	2.20e-26	2.30e-49	2.42e-08	4.69e-20	
Book 7.34e-01 6.83e-01 5.72e-01 6.39e-01 4.5e-01 5.94e-01 1.76e-01 WebKB 6.51e-01 5.23e-01 2.77e-01 2.51e-01 5.58e-01 5.94e-01 1.1de-01 WebKB 6.51e-01 5.23e-01 2.77e-01 2.50e-01 8.98e-02 9.99e-01 1.4de-09 BeU 6.61e-01 7.65e-01 4.79e-01 6.57e-03 7.90e-03 7.72e-01 2.72e-01 3.72e-03 7.72e-01 2.72e-01 4.75e-02 2.72e-01 3.72e-03 3.72e-03 3.72e-03 3.72e-03 3.72e-03 4.79e-01 6.57e-03 7.90e-03 7.2e-01 3.72e-03 3.72e-0		3.13e-01	3.05e-01	2.14e-01	2.74e-01	1.89e-01		
BachMovie 7.89e-01 7.86e-01 8.73e-01 5.16e-01 5.94e-01 1.16e-01 WebKB 6.51e-01 5.23e-01 2.77e-01 2.50e-01 8.98e-02 9.99e-01 1.44e-09 BBC 6.61e-01 7.65e-01 4.79e-01 6.57e-03 7.90e-03 7.17e-02 2.61e-03 Ad 1.71e-06 3.63e-07 5.30e-01 8.78e-01 7.90e-03 7.17e-02 2.61e-03 MC 3.70e-01 8.78e-01	MSWeb	3.83e-02	3.37e-02	1.40e-02	1.84e-03	6.02e-04	6.00e-02	1.30e-06
WebKB Reuters-52 6.51e-01 2.32e-01 2.77e-01 2.50e-01 8.98e-02 9.99e-01 1.44e-09 BBC 6.61e-01 7.65e-01 4.79e-01 6.57e-03 7.90e-03 1.71e-06 2.61e-01 Ad 1.71e-06 3.63e-07 5.30e-01 8.73e-14 2.12e-14 7.86e-06 6.21e-03 RD SPN-B SPN-B SPN-B SPN-B SPN-B SPN-BT SPN-BT <th>Book</th> <th>7.34e-01</th> <th>6.83e-01</th> <th>5.72e-01</th> <th>6.39e-01</th> <th>4.45e-01</th> <th>7.30e-01</th> <th>3.72e-03</th>	Book	7.34e-01	6.83e-01	5.72e-01	6.39e-01	4.45e-01	7.30e-01	3.72e-03
Reuters-52 2, 50e-01 2, 37e-01 3, 20e-01 4, 35e-02 4, 35e-02 7, 23e-01 3, 77e-01 2, 20e-01 4, 35e-02 7, 20e-03 1, 71e-02 2, 21e-01 Ad 1, 71e-06 3, 63e-07 5, 30e-01 8, 73e-14 2, 12e-14 7, 86e-06 6, 21e-03 Ruccolom SPN-B SPN-B SPN-B SPN-B SPN-B SPN-B SPN-BT Ade-22 KDDCUPAL 0.00e-400 0.00e-400 <th>EachMovie</th> <th>7.89e-01</th> <th>7.86e-01</th> <th>8.73e-01</th> <th>5.51e-01</th> <th>5.58e-01</th> <th>5.94e-01</th> <th>1.16e-01</th>	EachMovie	7.89e-01	7.86e-01	8.73e-01	5.51e-01	5.58e-01	5.94e-01	1.16e-01
BBC 6,61e-01 7,65e-01 4,79e-01 6,57e-03 7,90e-03 1,71e-02 2,61e-01 Ad 1,71e-06 3,63e-07 5,30e-01 8,73e-14 2,12e-14 7,86e-06 6,21e-03 SPN-B SPN-B SPN-B SPN-B SPN-BT SPN-BT SPN-BT SPN-BT NLTCS 2,01e-08 3,00e-11 2,94e-11 4,30e-11 1,98e-08 1,44e-23 1,37e-23 MSNBC 2,96e-71 4,11e-28 8,77e-22 6,59e-34 1,40e-71 2,08e-27 3,40e-22 KDDCupta 0,00e+00	WebKB	6.51e-01	5.23e-01	2.77e-01	2.50e-01	8.98e-02	9.99e-01	1.44e-09
Add 1.71e-06 3.63e-07 5.30e-01 8.73e-14 2.12e-14 7.86e-06 6.21e-03 Record (A) SPN.B SPN.B SPN.B SPN.B SPN.BT SPN.BT SPN.BT SPN.BT SPN.BT SPN.BT SPN.BTB SPN.BTB NLTCS 2.01e-08 3.00e-11 2.94e-11 4.30e-11 1.98e-08 1.44e-23 1.37e-23 MSNBC 2.90e-71 4.11e-28 8.77e-22 6.59e-34 1.40e-71 2.08e-27 3.40e-22 KDDCup2k 0.00e+00 0.00e+00 0.00e+00 0.00e+00 0.00e+00 0.00e+00 Plants 8.90e-12 7.30e-102 2.74e-126 4.52e-08 3.27e-03 9.16e-60 6.83e-95 Audio 3.19e-61 6.61e-102 7.40e-04 4.72e-35 5.42e-73 1.42e-110 1.12e-03 Metail 4.53e-14 3.15e-102 3.74e-11 1.66e-279 1.75e-61 7.79e-93 Retail 7.23e-01 9.1e-25 7.4ee<0	Reuters-52	2.50e-01	2.37e-01	3.20e-01	4.35e-02	4.35e-02	7.23e-01	3.77e-01
NLTCS	BBC	6.61e-01	7.65e-01	4.79e-01	6.57e-03	7.90e-03	1.71e-02	2.61e-01
NLTCS	\mathbf{Ad}	1.71e-06	3.63e-07	5.30e-01	8.73e-14	2.12e-14	7.86e-06	6.21e-03
NLTCS								
MSNBC 2.96e-71 4.11e-28 8.77e-22 6.59e-34 1.40e-71 2.08e-27 3.40e-22 KDDCup2k 0.00e+00 0.06e-05 4.32e-03 1.76e-61 4.83e-120 4.47e-200 4.72e-35 5.42e-73 1.74e-118 2.47e-200 Methix 4.53e-143 1.17e-03 1.08e-99 3.74e-11 1.66e-279 1.75e-61 7.97e-93 Retail 7.23e-01 9.91e-29 5.60e-29 5.03e-07 6.81e-01 1.01e-28 7.80e-99 DNA 2.15e-01 2.72e-55 7.41e-08 2.46e-104 2.05e-03 1.18e-58 1.54e-06 MSWeb 5.82e-07 <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th>SPN-BTB</th>								SPN-BTB
MSNBC 2.96e-71 4.11e-28 8.77e-22 6.59e-34 1.40e-71 2.08e-27 3.40e-22 KDDCup2k 0.00e+00 0.06e-05 4.32e-03 1.76e-61 4.83e-120 4.47e-200 4.72e-35 5.42e-73 1.74e-118 2.47e-200 Methix 4.53e-143 1.17e-03 1.08e-99 3.74e-11 1.66e-279 1.75e-61 7.97e-93 Retail 7.23e-01 9.91e-29 5.60e-29 5.03e-07 6.81e-01 1.01e-28 7.80e-99 DNA 2.15e-01 2.72e-55 7.41e-08 2.46e-104 2.05e-03 1.18e-58 1.54e-06 MSWeb 5.82e-07 <th>NLTCS</th> <th>2.01e-08</th> <th>3.00e-11</th> <th>2.94e-11</th> <th>4.30e-11</th> <th>1.98e-08</th> <th>1.44e-23</th> <th>1.37e-23</th>	NLTCS	2.01e-08	3.00e-11	2.94e-11	4.30e-11	1.98e-08	1.44e-23	1.37e-23
KDDCup2k 0.00e+00 6.83e-95 Audio 3.19e-61 6.37e-181 5.98e-199 6.08e-25 5.2e-53 1.74e-118 2.47e-200 Jester 1.22e-69 1.61e-102 7.40e-04 4.72e-35 5.42e-73 1.42e-110 1.12e-03 Netflix 4.53e-143 1.17e-203 6.19e-252 1.28e-82 6.20e-114 6.75e-92 1.75e-61 7.97e-93 Retail 7.23e-01 9.91e-29 5.60e-29 5.03e-07 6.81e-01 1.01e-28 7.80e-29 Pumsb-star 1.85e-56 1.30e-10 4.19e-35 1.59e-30 8.50e-33 1.91e-01 6.39e-29 DNA 2.38e-10 5.29e-66 6.13e-02 4.28e-18 2.07e-11 1.11e-40 MSWeb 5.82e-07 5.48e-31 8.98e-108 4.14e-19 3.51e-10 2.48e-08 3.48e-51 <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th>								
Plants 8.90e-12 7.30e-102 2.74e-126 4.52e-08 3.27e-03 9.16e-60 6.83e-95 Audio 3.19e-61 6.37e-181 5.98e-199 6.08e-25 1.52e-53 1.74e-118 2.47e-200 Jester 1.2e-69 1.61e-102 7.40e-04 4.72e-35 5.42e-73 1.42e-110 1.12e-03 Netflix 4.53e-143 1.17e-203 6.19e-252 1.28e-82 6.20e-114 6.75e-92 1.63e-221 Accidents 9.77e-281 2.71e-70 1.08e-99 3.74e-11 1.66e-279 1.75e-61 7.97e-93 Pumsb-star 1.85e-56 1.30e-10 4.19e-35 1.59e-30 8.50e-33 1.91e-01 6.39e-09 DNA 2.15e-01 2.72e-55 7.41e-08 2.46e-104 2.05e-02 1.18e-58 1.54e-09 MSWeb 5.82e-07 5.48e-31 8.98e-108 4.14e-19 3.51e-10 2.48e-08 3.48e-55 Book 1.39e-03 2.74e-17 3.74e-39 2.33e-02 6.25e-01 9.31e-25 8.94e-18								
Audio 3.19e-61 6.37e-181 5.98e-199 6.08e-25 1.52e-53 1.74e-118 2.47e-200 Jester 1.22e-69 1.61e-102 7.40e-04 4.72e-35 5.42e-73 1.42e-110 1.12e-03 Netflix 4.53e-143 1.17e-203 6.19e-252 1.28e-82 6.20e-114 6.75e-92 1.63e-221 Accidents 9.77e-281 2.71e-70 1.08e-99 3.74e-11 1.66e-279 1.75e-61 7.97e-93 Retail 7.23e-01 9.91e-29 5.60e-29 5.03e-07 6.81e-01 1.01e-28 7.80e-29 DNA 2.15e-01 2.72e-55 7.41e-08 2.46e-104 2.05e-02 1.18e-58 1.54e-06 Kosarek 1.38e-17 5.20e-05 5.29e-66 6.13e-02 4.28e-18 2.07e-11 1.11e-0 MSWeb 5.82e-07 5.48e-31 8.98e-108 4.14e-19 3.51e-10 2.48e-08 3.48e-55 Book 1.39e-02 1.25e-03 3.6e-59 5.03e-57 4.68e-01 2.2fe-60 2.6e-60								
Jester 1.22e-69 1.61e-102 7.40e-04 4.72e-35 5.42e-73 1.42e-110 1.12e-03 Netflix 4.53e-143 1.17e-203 6.19e-252 1.28e-82 6.20e-114 6.75e-92 1.63e-221 Accidents 9.7re-281 2.71e-70 1.08e-99 3.74e-11 1.66e-279 1.75e-61 7.97e-93 Retail 7.23e-01 9.91e-29 5.60e-29 5.03e-07 6.81e-01 1.01e-28 7.80e-29 Pumsb-star 1.85e-56 1.30e-10 4.19e-35 1.59e-30 8.50e-33 1.91e-01 6.39e-09 MSWeb 5.82e-07 5.48e-31 8.98e-108 4.14e-19 3.51e-10 2.48e-08 3.48e-55 Bok 1.39e-03 2.74e-17 3.74e-39 2.33e-02 6.25e-01 9.19e-22 9.98e-18 Bok 4.85e-29 3.31e-11 1.11e-75 2.54e-05 4.40e-12 2.50e-01 2.27e-36 Reuters-52 5.99e-01 4.63e-60 3.69e-59 5.03e-57 4.68e-01 2.24e-60 2.6e-00 <								
Netflix 4.53e-143 1.17e-203 6.19e-252 1.28e-82 6.20e-114 6.75e-92 1.63e-221 Accidents 9.77e-281 2.71e-70 1.08e-99 3.74e-11 1.66e-279 1.75e-61 7.97e-93 Retail 7.23e-01 9.91e-29 5.60e-29 5.03e-07 6.81e-01 1.01e-28 7.80e-29 Pumsb-star 1.85e-56 1.30e-10 4.19e-35 1.59e-30 8.50e-33 1.91e-01 6.39e-09 DNA 2.15e-01 2.72e-55 7.41e-08 2.46e-104 2.05e-02 1.18e-58 1.54e-06 Kosarek 1.38e-17 5.20e-05 5.29e-66 6.13e-02 4.28e-18 2.07e-11 1.11e-40 MSWeb 5.82e-07 5.48e-31 8.98e-108 4.14e-19 3.51e-10 2.48e-08 3.48e-55 8.94e-18 EachMovie 4.83e-02 1.23e-27 1.01e-27 3.74e-39 2.33e-02 6.25e-01 2.97e-36 Reuters-52 5.99e-01 4.63e-60 3.66e-59 5.03e-57 4.68e-15 2.79e-01								
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Jester 2.56e-37 2.44e-01 2.61e-110 1.30e-09 1.55e-220 9.97e-08 4.80e-57 Netflix 1.93e-53 1.09e-08 4.19e-01 3.62e-20 1.14e-24 1.63e-02 4.88e-22 Accidents 1.31e-15 3.78e-248 1.75e-226 7.16e-307 6.64e-50 2.12e-112 1.96e-141 Retail 7.06e-07 2.10e-04 1.82e-04 6.56e-01 1.15e-13 1.33e-03 1.13e-03 Pumsb-star 1.32e-54 9.62e-43 1.71e-18 6.72e-157 8.03e-110 7.75e-80 9.17e-120 DNA 2.11e-110 5.24e-25 1.03e-12 1.12e-152 7.23e-42 2.43e-153 1.69e-124 Kosarek 8.13e-15 1.50e-10 2.57e-48 9.33e-02 3.96e-70 1.53e-02 1.23e-36 MSWeb 2.69e-22 4.21e-48 1.37e-92 4.37e-32 3.08e-164 4.56e-76 8.12e-97 Book 1.64e-07 2.11e-33 8.15e-14 9.54e-11 6.17e-101 3.11e-11 6.78e-33	$\begin{array}{c} MSNBC \\ KDDCup2k \end{array}$	4.39e-11 1.79e-34 0.00e+00	6.25e-03 5.88e-95 0.00e+00	6.25e-03 5.34e-06 0.00e+00	2.58e-03 1.45e-36 0.00e+00	4.27e-97 0.00e+00 0.00e+00	3.02e-91 0.00e+00	2.07e-18 0.00e+00
Netflix 1.93e-53 1.09e-08 4.19e-01 3.62e-20 1.14e-24 1.63e-02 4.88e-22 Accidents 1.31e-15 3.78e-248 1.75e-226 7.16e-307 6.64e-50 2.12e-112 1.96e-141 Retail 7.06e-07 2.10e-04 1.82e-04 6.56e-01 1.15e-13 1.33e-03 1.13e-03 Pumsb-star 1.32e-54 9.62e-43 1.71e-18 6.72e-157 8.03e-110 7.75e-80 9.17e-120 DNA 2.11e-110 5.24e-25 1.03e-12 1.12e-152 7.23e-42 2.43e-153 1.69e-124 Kosarek 8.13e-15 1.50e-10 2.57e-48 9.33e-02 3.96e-70 1.53e-02 1.23e-36 MSWeb 2.69e-22 4.21e-48 1.37e-92 4.37e-32 3.08e-164 4.56e-76 8.12e-97 Book 1.64e-07 2.11e-33 8.15e-14 9.54e-11 6.17e-101 3.11e-11 6.78e-33 EachMovie 2.23e-30 3.78e-17 2.51e-15 4.01e-24 1.30e-01 2.79e-51 7.66e-50	MSNBC KDDCup2k Plants	4.39e-11 1.79e-34 0.00e+00 4.35e-18	6.25e-03 5.88e-95 0.00e+00 6.21e-27	6.25e-03 5.34e-06 0.00e+00 6.83e-49	2.58e-03 1.45e-36 0.00e+00 6.39e-33	4.27e-97 0.00e+00 0.00e+00 1.20e-24	3.02e-91 0.00e+00 3.50e-93	2.07e-18 0.00e+00 1.05e-123
Accidents 1.31e-15 3.78e-248 1.75e-226 7.16e-307 6.64e-50 2.12e-112 1.96e-141 Retail 7.06e-07 2.10e-04 1.82e-04 6.56e-01 1.15e-13 1.33e-03 1.13e-03 Pumsb-star 1.32e-54 9.62e-43 1.71e-18 6.72e-157 8.03e-110 7.75e-80 9.17e-120 DNA 2.11e-110 5.24e-25 1.03e-12 1.12e-152 7.23e-42 2.43e-153 1.69e-124 Kosarek 8.13e-15 1.50e-10 2.57e-48 9.33e-02 3.96e-70 1.53e-02 1.23e-36 MSWeb 2.69e-22 4.21e-48 1.37e-92 4.37e-32 3.08e-164 4.56e-76 8.12e-97 Book 1.64e-07 2.11e-33 8.15e-14 9.54e-11 6.17e-101 3.11e-11 6.78e-33 EachMovie 2.23e-30 3.78e-17 2.51e-15 4.01e-24 1.30e-01 2.79e-51 7.66e-50 WebKB 1.43e-21 1.09e-08 2.12e-05 8.16e-36 1.75e-38 7.68e-13 3.36e-53	MSNBC KDDCup2k Plants Audio	4.39e-11 1.79e-34 0.00e+00 4.35e-18 1.05e-18	6.25e-03 5.88e-95 0.00e+00 6.21e-27 2.02e-06	6.25e-03 5.34e-06 0.00e+00 6.83e-49 6.36e-14	2.58e-03 1.45e-36 0.00e+00 6.39e-33 1.44e-14	4.27e-97 0.00e+00 0.00e+00 1.20e-24 1.67e-06	3.02e-91 0.00e+00 3.50e-93 2.15e-32	2.07e-18 0.00e+00 1.05e-123 6.78e-58
Retail 7.06e-07 2.10e-04 1.82e-04 6.56e-01 1.15e-13 1.33e-03 1.13e-03 Pumsb-star 1.32e-54 9.62e-43 1.71e-18 6.72e-157 8.03e-110 7.75e-80 9.17e-120 DNA 2.11e-110 5.24e-25 1.03e-12 1.12e-152 7.23e-42 2.43e-153 1.69e-124 Kosarek 8.13e-15 1.50e-10 2.57e-48 9.33e-02 3.96e-70 1.53e-02 1.23e-96 MSWeb 2.69e-22 4.21e-48 1.37e-92 4.37e-32 3.08e-164 4.56e-76 8.12e-97 Book 1.64e-07 2.11e-33 8.15e-14 9.54e-11 6.17e-101 3.11e-11 6.78e-33 EachMovie 2.23e-30 3.78e-17 2.51e-15 4.01e-24 1.30e-01 2.79e-51 7.66e-50 WebKB 1.43e-21 1.09e-08 2.12e-05 8.16e-36 1.75e-38 7.68e-13 3.6e-53 Reuters-52 2.73e-60 5.84e-34 1.33e-33 3.85e-72 5.43e-11 1.29e-112 9.45e-113	MSNBC KDDCup2k Plants Audio Jester	4.39e-11 1.79e-34 0.00e+00 4.35e-18 1.05e-18 2.56e-37	6.25e-03 5.88e-95 0.00e+00 6.21e-27 2.02e-06 2.44e-01	6.25e-03 5.34e-06 0.00e+00 6.83e-49 6.36e-14 2.61e-110	2.58e-03 1.45e-36 0.00e+00 6.39e-33 1.44e-14 1.30e-09	4.27e-97 0.00e+00 0.00e+00 1.20e-24 1.67e-06 1.55e-220	3.02e-91 0.00e+00 3.50e-93 2.15e-32 9.97e-08	2.07e-18 0.00e+00 1.05e-123 6.78e-58 4.80e-57
Pumsb-star 1.32e-54 9.62e-43 1.71e-18 6.72e-157 8.03e-110 7.75e-80 9.17e-120 DNA 2.11e-110 5.24e-25 1.03e-12 1.12e-152 7.23e-42 2.43e-153 1.69e-124 Kosarek 8.13e-15 1.50e-10 2.57e-48 9.33e-02 3.96e-70 1.53e-02 1.23e-36 MSWeb 2.69e-22 4.21e-48 1.37e-92 4.37e-32 3.08e-164 4.56e-76 8.12e-97 Book 1.64e-07 2.11e-33 8.15e-14 9.54e-11 6.17e-101 3.11e-11 6.78e-33 EachMovie 2.23e-30 3.78e-17 2.51e-15 4.01e-24 1.30e-01 2.79e-51 7.66e-50 WebKB 1.43e-21 1.09e-08 2.12e-05 8.16e-36 1.75e-38 7.68e-13 3.36e-53 Reuters-52 2.73e-60 5.84e-34 1.33e-33 3.85e-72 5.43e-11 1.29e-112 9.45e-113 BBC 3.88e-26 3.93e-17 3.81e-15 1.91e-34 2.23e-01 1.16e-38 2.03e-38 <th>MSNBC KDDCup2k Plants Audio Jester Netflix</th> <th>4.39e-11 1.79e-34 0.00e+00 4.35e-18 1.05e-18 2.56e-37 1.93e-53</th> <th>6.25e-03 5.88e-95 0.00e+00 6.21e-27 2.02e-06 2.44e-01 1.09e-08</th> <th>6.25e-03 5.34e-06 0.00e+00 6.83e-49 6.36e-14 2.61e-110 4.19e-01</th> <th>2.58e-03 1.45e-36 0.00e+00 6.39e-33 1.44e-14 1.30e-09 3.62e-20</th> <th>4.27e-97 0.00e+00 0.00e+00 1.20e-24 1.67e-06 1.55e-220 1.14e-24</th> <th>3.02e-91 0.00e+00 3.50e-93 2.15e-32 9.97e-08 1.63e-02</th> <th>2.07e-18 0.00e+00 1.05e-123 6.78e-58 4.80e-57 4.88e-22</th>	MSNBC KDDCup2k Plants Audio Jester Netflix	4.39e-11 1.79e-34 0.00e+00 4.35e-18 1.05e-18 2.56e-37 1.93e-53	6.25e-03 5.88e-95 0.00e+00 6.21e-27 2.02e-06 2.44e-01 1.09e-08	6.25e-03 5.34e-06 0.00e+00 6.83e-49 6.36e-14 2.61e-110 4.19e-01	2.58e-03 1.45e-36 0.00e+00 6.39e-33 1.44e-14 1.30e-09 3.62e-20	4.27e-97 0.00e+00 0.00e+00 1.20e-24 1.67e-06 1.55e-220 1.14e-24	3.02e-91 0.00e+00 3.50e-93 2.15e-32 9.97e-08 1.63e-02	2.07e-18 0.00e+00 1.05e-123 6.78e-58 4.80e-57 4.88e-22
DNA 2.11e-110 5.24e-25 1.03e-12 1.12e-152 7.23e-42 2.43e-153 1.69e-124 Kosarek 8.13e-15 1.50e-10 2.57e-48 9.33e-02 3.96e-70 1.53e-02 1.23e-36 MSWeb 2.69e-22 4.21e-48 1.37e-92 4.37e-32 3.08e-164 4.56e-76 8.12e-97 Book 1.64e-07 2.11e-33 8.15e-14 9.54e-11 6.17e-101 3.11e-11 6.78e-33 EachMovie 2.23e-30 3.78e-17 2.51e-15 4.01e-24 1.30e-01 2.79e-51 7.66e-50 WebKB 1.43e-21 1.09e-08 2.12e-05 8.16e-36 1.75e-38 7.68e-13 3.36e-53 Reuters-52 2.73e-60 5.84e-34 1.33e-33 3.85e-72 5.43e-11 1.29e-112 9.45e-113 BBC 3.88e-26 3.93e-17 3.81e-15 1.91e-34 2.23e-01 1.16e-38 2.03e-38	MSNBC KDDCup2k Plants Audio Jester Netflix Accidents	4.39e-11 1.79e-34 0.00e+00 4.35e-18 1.05e-18 2.56e-37 1.93e-53 1.31e-15	6.25e-03 5.88e-95 0.00e+00 6.21e-27 2.02e-06 2.44e-01 1.09e-08 3.78e-248	6.25e-03 5.34e-06 0.00e+00 6.83e-49 6.36e-14 2.61e-110 4.19e-01 1.75e-226	2.58e-03 1.45e-36 0.00e+00 6.39e-33 1.44e-14 1.30e-09 3.62e-20 7.16e-307	4.27e-97 0.00e+00 0.00e+00 1.20e-24 1.67e-06 1.55e-220 1.14e-24 6.64e-50	3.02e-91 0.00e+00 3.50e-93 2.15e-32 9.97e-08 1.63e-02 2.12e-112	2.07e-18 0.00e+00 1.05e-123 6.78e-58 4.80e-57 4.88e-22 1.96e-141
Kosarek 8.13e-15 1.50e-10 2.57e-48 9.33e-02 3.96e-70 1.53e-02 1.23e-36 MSWeb 2.69e-22 4.21e-48 1.37e-92 4.37e-32 3.08e-164 4.56e-76 8.12e-97 Book 1.64e-07 2.11e-33 8.15e-14 9.54e-11 6.17e-101 3.11e-11 6.78e-33 EachMovie 2.23e-30 3.78e-17 2.51e-15 4.01e-24 1.30e-01 2.79e-51 7.66e-50 WebKB 1.43e-21 1.09e-08 2.12e-05 8.16e-36 1.75e-38 7.68e-13 3.36e-53 Reuters-52 2.73e-60 5.84e-34 1.33e-33 3.85e-72 5.43e-11 1.29e-112 9.45e-113 BBC 3.88e-26 3.93e-17 3.81e-15 1.91e-34 2.23e-01 1.16e-38 2.03e-38	MSNBC KDDCup2k Plants Audio Jester Netflix Accidents Retail	4.39e-11 1.79e-34 0.00e+00 4.35e-18 1.05e-18 2.56e-37 1.93e-53 1.31e-15 7.06e-07	6.25e-03 5.88e-95 0.00e+00 6.21e-27 2.02e-06 2.44e-01 1.09e-08 3.78e-248 2.10e-04	6.25e-03 5.34e-06 0.00e+00 6.83e-49 6.36e-14 2.61e-110 4.19e-01 1.75e-226 1.82e-04	2.58e-03 1.45e-36 0.00e+00 6.39e-33 1.44e-14 1.30e-09 3.62e-20 7.16e-307 6.56e-01	4.27e-97 0.00e+00 0.00e+00 1.20e-24 1.67e-06 1.55e-220 1.14e-24 6.64e-50 1.15e-13	3.02e-91 0.00e+00 3.50e-93 2.15e-32 9.97e-08 1.63e-02 2.12e-112 1.33e-03	2.07e-18 0.00e+00 1.05e-123 6.78e-58 4.80e-57 4.88e-22 1.96e-141 1.13e-03
MSWeb 2.69e-22 4.21e-48 1.37e-92 4.37e-32 3.08e-164 4.56e-76 8.12e-97 Book 1.64e-07 2.11e-33 8.15e-14 9.54e-11 6.17e-101 3.11e-11 6.78e-33 EachMovie 2.23e-30 3.78e-17 2.51e-15 4.01e-24 1.30e-01 2.79e-51 7.66e-50 WebKB 1.43e-21 1.09e-08 2.12e-05 8.16e-36 1.75e-38 7.68e-13 3.36e-53 Reuters-52 2.73e-60 5.84e-34 1.33e-33 3.85e-72 5.43e-11 1.29e-112 9.45e-113 BBC 3.88e-26 3.93e-17 3.81e-15 1.91e-34 2.23e-01 1.16e-38 2.03e-38	MSNBC KDDCup2k Plants Audio Jester Netflix Accidents Retail Pumsb-star	4.39e-11 1.79e-34 0.00e+00 4.35e-18 1.05e-18 2.56e-37 1.93e-53 1.31e-15 7.06e-07 1.32e-54	6.25e-03 5.88e-95 0.00e+00 6.21e-27 2.02e-06 2.44e-01 1.09e-08 3.78e-248 2.10e-04 9.62e-43	6.25e-03 5.34e-06 0.00e+00 6.83e-49 6.36e-14 2.61e-110 4.19e-01 1.75e-226 1.82e-04 1.71e-18	2.58e-03 1.45e-36 0.00e+00 6.39e-33 1.44e-14 1.30e-09 3.62e-20 7.16e-307 6.56e-01 6.72e-157	4.27e-97 0.00e+00 0.00e+00 1.20e-24 1.67e-06 1.55e-220 1.14e-24 6.64e-50 1.15e-13 8.03e-110	3.02e-91 0.00e+00 3.50e-93 2.15e-32 9.97e-08 1.63e-02 2.12e-112 1.33e-03 7.75e-80	2.07e-18 0.00e+00 1.05e-123 6.78e-58 4.80e-57 4.88e-22 1.96e-141 1.13e-03 9.17e-120
Book 1.64e-07 2.11e-33 8.15e-14 9.54e-11 6.17e-101 3.11e-11 6.78e-33 EachMovie 2.23e-30 3.78e-17 2.51e-15 4.01e-24 1.30e-01 2.79e-51 7.66e-50 WebKB 1.43e-21 1.09e-08 2.12e-05 8.16e-36 1.75e-38 7.68e-13 3.36e-53 Reuters-52 2.73e-60 5.84e-34 1.33e-33 3.85e-72 5.43e-11 1.29e-112 9.45e-113 BBC 3.88e-26 3.93e-17 3.81e-15 1.91e-34 2.23e-01 1.16e-38 2.03e-38	MSNBC KDDCup2k Plants Audio Jester Netflix Accidents Retail Pumsb-star DNA	4.39e-11 1.79e-34 0.00e+00 4.35e-18 1.05e-18 2.56e-37 1.93e-53 1.31e-15 7.06e-07 1.32e-54 2.11e-110	6.25e-03 5.88e-95 0.00e+00 6.21e-27 2.02e-06 2.44e-01 1.09e-08 3.78e-248 2.10e-04 9.62e-43 5.24e-25	6.25e-03 5.34e-06 0.00e+00 6.83e-49 6.36e-14 2.61e-110 4.19e-01 1.75e-226 1.82e-04 1.71e-18 1.03e-12	2.58e-03 1.45e-36 0.00e+00 6.39e-33 1.44e-14 1.30e-09 3.62e-20 7.16e-307 6.56e-01 6.72e-157 1.12e-152	4.27e-97 0.00e+00 0.00e+00 1.20e-24 1.67e-06 1.55e-220 1.14e-24 6.64e-50 1.15e-13 8.03e-110 7.23e-42	3.02e-91 0.00e+00 3.50e-93 2.15e-32 9.97e-08 1.63e-02 2.12e-112 1.33e-03 7.75e-80 2.43e-153	$\begin{array}{c} 2.07\text{e-}18 \\ 0.00\text{e+}00 \\ 1.05\text{e-}123 \\ 6.78\text{e-}58 \\ 4.80\text{e-}57 \\ 4.88\text{e-}22 \\ 1.96\text{e-}141 \\ 1.13\text{e-}03 \\ 9.17\text{e-}120 \\ 1.69\text{e-}124 \end{array}$
EachMovie 2.23e-30 3.78e-17 2.51e-15 4.01e-24 1.30e-01 2.79e-51 7.66e-50 WebKB 1.43e-21 1.09e-08 2.12e-05 8.16e-36 1.75e-38 7.68e-13 3.36e-53 Reuters-52 2.73e-60 5.84e-34 1.33e-33 3.85e-72 5.43e-11 1.29e-112 9.45e-113 BBC 3.88e-26 3.93e-17 3.81e-15 1.91e-34 2.23e-01 1.16e-38 2.03e-38	MSNBC KDDCup2k Plants Audio Jester Netflix Accidents Retail Pumsb-star DNA Kosarek	4.39e-11 1.79e-34 0.00e+00 4.35e-18 1.05e-18 2.56e-37 1.93e-53 1.31e-15 7.06e-07 1.32e-54 2.11e-110 8.13e-15	6.25e-03 5.88e-95 0.00e+00 6.21e-27 2.02e-06 2.44e-01 1.09e-08 3.78e-248 2.10e-04 9.62e-43 5.24e-25 1.50e-10	6.25e-03 5.34e-06 0.00e+00 6.83e-49 6.36e-14 2.61e-110 4.19e-01 1.75e-226 1.82e-04 1.71e-18 1.03e-12 2.57e-48	2.58e-03 1.45e-36 0.00e+00 6.39e-33 1.44e-14 1.30e-09 3.62e-20 7.16e-307 6.56e-01 6.72e-157 1.12e-152 9.33e-02	4.27e-97 0.00e+00 0.00e+00 1.20e-24 1.67e-06 1.55e-220 1.14e-24 6.64e-50 1.15e-13 8.03e-110 7.23e-42 3.96e-70	$\begin{array}{c} 3.02\text{e-}91 \\ 0.00\text{e+}00 \\ 3.50\text{e-}93 \\ 2.15\text{e-}32 \\ 9.97\text{e-}08 \\ 1.63\text{e-}02 \\ 2.12\text{e-}112 \\ 1.33\text{e-}03 \\ 7.75\text{e-}80 \\ 2.43\text{e-}153 \\ 1.53\text{e-}02 \end{array}$	$\begin{array}{c} 2.07\text{e-}18 \\ 0.00\text{e+}00 \\ 1.05\text{e-}123 \\ 6.78\text{e-}58 \\ 4.80\text{e-}57 \\ 4.88\text{e-}22 \\ 1.96\text{e-}141 \\ 1.13\text{e-}03 \\ 9.17\text{e-}120 \\ 1.69\text{e-}124 \\ 1.23\text{e-}36 \end{array}$
WebKB 1.43e-21 1.09e-08 2.12e-05 8.16e-36 1.75e-38 7.68e-13 3.36e-53 Reuters-52 2.73e-60 5.84e-34 1.33e-33 3.85e-72 5.43e-11 1.29e-112 9.45e-113 BBC 3.88e-26 3.93e-17 3.81e-15 1.91e-34 2.23e-01 1.16e-38 2.03e-38	MSNBC KDDCup2k Plants Audio Jester Netflix Accidents Retail Pumsb-star DNA Kosarek MSWeb	4.39e-11 1.79e-34 0.00e+00 4.35e-18 1.05e-18 2.56e-37 1.93e-53 1.31e-15 7.06e-07 1.32e-54 2.11e-110 8.13e-15 2.69e-22	6.25e-03 5.88e-95 0.00e+00 6.21e-27 2.02e-06 2.44e-01 1.09e-08 3.78e-248 2.10e-04 9.62e-43 5.24e-25 1.50e-10 4.21e-48	6.25e-03 5.34e-06 0.00e+00 6.83e-49 6.36e-14 2.61e-110 4.19e-01 1.75e-226 1.82e-04 1.71e-18 1.03e-12 2.57e-48 1.37e-92	2.58e-03 1.45e-36 0.00e+00 6.39e-33 1.44e-14 1.30e-09 3.62e-20 7.16e-307 6.56e-01 6.72e-157 9.33e-02 4.37e-32	4.27e-97 0.00e+00 0.00e+00 1.20e-24 1.67e-06 1.55e-220 1.14e-24 6.64e-50 1.15e-13 8.03e-110 7.23e-42 3.96e-70 3.08e-164	$\begin{array}{c} 3.02\text{e-}91 \\ 0.00\text{e}+00 \\ 3.50\text{e-}93 \\ 2.15\text{e-}32 \\ 9.97\text{e-}08 \\ 1.63\text{e-}02 \\ 2.12\text{e-}112 \\ 1.33\text{e-}03 \\ 7.75\text{e-}80 \\ 2.43\text{e-}153 \\ 1.53\text{e-}02 \\ 4.56\text{e-}76 \end{array}$	2.07e-18 0.00e+00 1.05e-123 6.78e-58 4.80e-57 4.88e-22 1.96e-141 1.13e-03 9.17e-120 1.69e-124 1.23e-36 8.12e-97
Reuters-52 2.73e-60 5.84e-34 1.33e-33 3.85e-72 5.43e-11 1.29e-112 9.45e-113 BBC 3.88e-26 3.93e-17 3.81e-15 1.91e-34 2.23e-01 1.16e-38 2.03e-38	MSNBC KDDCup2k Plants Audio Jester Netflix Accidents Retail Pumsb-star DNA Kosarek MSWeb Book	4.39e-11 1.79e-34 0.00e+00 4.35e-18 1.05e-18 2.56e-37 1.93e-53 1.31e-15 7.06e-07 1.32e-54 2.11e-110 8.13e-15 2.69e-22 1.64e-07	6.25e-03 5.88e-95 0.00e+00 6.21e-27 2.02e-06 2.44e-01 1.09e-08 3.78e-248 2.10e-04 9.62e-43 5.24e-25 1.50e-10 4.21e-48 2.11e-33	6.25e-03 5.34e-06 0.00e+00 6.83e-49 6.36e-14 2.61e-110 1.75e-226 1.82e-04 1.71e-18 1.03e-12 2.57e-48 1.37e-92 8.15e-14	2.58e-03 1.45e-36 0.00e+00 6.39e-33 1.44e-14 1.30e-09 3.62e-20 7.16e-307 6.56e-01 6.72e-157 1.12e-152 9.33e-02 4.37e-32 9.54e-11	4.27e-97 0.00e+00 0.00e+00 1.20e-24 1.67e-06 1.55e-220 1.14e-24 6.64e-50 1.15e-13 8.03e-110 7.23e-42 3.96e-70 3.08e-164 6.17e-101	$\begin{array}{c} 3.02\text{e-}91 \\ 0.00\text{e}+00 \\ 3.50\text{e-}93 \\ 2.15\text{e-}32 \\ 9.97\text{e-}08 \\ 1.63\text{e-}02 \\ 2.12\text{e-}112 \\ 1.33\text{e-}03 \\ 7.75\text{e-}80 \\ 2.43\text{e-}153 \\ 1.53\text{e-}02 \\ 4.56\text{e-}76 \\ 3.11\text{e-}11 \end{array}$	$\begin{array}{c} 2.07 \text{e-} 18 \\ 0.00 \text{e+} 00 \\ 1.05 \text{e-} 123 \\ 6.78 \text{e-} 58 \\ 4.80 \text{e-} 57 \\ 4.88 \text{e-} 22 \\ 1.96 \text{e-} 141 \\ 1.13 \text{e-} 03 \\ 9.17 \text{e-} 120 \\ 1.69 \text{e-} 124 \\ 1.23 \text{e-} 36 \\ 8.12 \text{e-} 97 \\ 6.78 \text{e-} 33 \end{array}$
BBC 3.88e-26 3.93e-17 3.81e-15 1.91e-34 2.23e-01 1.16e-38 2.03e-38	MSNBC KDDCup2k Plants Audio Jester Netflix Accidents Retail Pumsb-star DNA Kosarek MSWeb Book EachMovie	4.39e-11 1.79e-34 0.00e+00 4.35e-18 1.05e-18 2.56e-37 1.93e-53 1.31e-15 7.06e-07 1.32e-54 2.11e-110 8.13e-15 2.69e-22 1.64e-07 2.23e-30	6.25e-03 5.88e-95 0.00e+00 6.21e-27 2.02e-06 2.44e-01 1.09e-08 3.78e-248 2.10e-04 9.62e-43 5.24e-25 1.50e-10 4.21e-48 2.11e-33 3.78e-17	6.25e-03 5.34e-06 0.00e+00 6.83e-49 6.36e-14 2.61e-110 4.19e-01 1.75e-226 1.82e-04 1.71e-18 1.03e-12 2.57e-48 1.37e-92 8.15e-14 2.51e-15	2.58e-03 1.45e-36 0.00e+00 6.39e-33 1.44e-14 1.30e-09 3.62e-20 7.16e-307 6.56e-01 6.72e-157 1.12e-152 9.33e-02 4.37e-32 9.54e-11 4.01e-24	4.27e-97 0.00e+00 0.00e+00 1.20e-24 1.67e-06 1.55e-220 1.14e-24 6.64e-50 1.15e-13 8.03e-110 7.23e-42 3.96e-70 3.08e-164 6.17e-101 1.30e-01	$\begin{array}{c} 3.02\text{e-}91 \\ 0.00\text{e+}00 \\ 3.50\text{e-}93 \\ 2.15\text{e-}32 \\ 9.97\text{e-}08 \\ 1.63\text{e-}02 \\ 2.12\text{e-}112 \\ 1.33\text{e-}03 \\ 7.75\text{e-}80 \\ 2.43\text{e-}153 \\ 1.53\text{e-}02 \\ 4.56\text{e-}76 \\ 3.11\text{e-}11 \\ 2.79\text{e-}51 \end{array}$	2.07e-18 0.00e+00 1.05e-123 6.78e-58 4.80e-57 4.88e-22 1.96e-141 1.13e-03 9.17e-120 1.69e-124 1.23e-36 8.12e-97 6.78e-33 7.66e-50
	MSNBC KDDCup2k Plants Audio Jester Netflix Accidents Retail Pumsb-star DNA Kosarek MSWeb Book EachMovie WebKB	4.39e-11 1.79e-34 0.00e+00 4.35e-18 1.05e-18 2.56e-37 1.93e-53 1.31e-15 7.06e-07 1.32e-54 2.11e-110 8.13e-15 2.69e-22 1.64e-07 2.23e-30 1.43e-21	6.25e-03 5.88e-95 0.00e+00 6.21e-27 2.02e-06 2.44e-01 1.09e-08 3.78e-248 2.10e-04 9.62e-43 5.24e-25 1.50e-10 4.21e-48 2.11e-33 3.78e-17 1.09e-08	6.25e-03 5.34e-06 0.00e+00 6.83e-49 6.36e-14 2.61e-110 4.19e-01 1.75e-226 1.82e-04 1.71e-18 1.03e-12 2.57e-48 1.37e-92 8.15e-14 2.51e-15 2.12e-05	2.58e-03 1.45e-36 0.00e+00 6.39e-33 1.44e-14 1.30e-09 3.62e-20 7.16e-307 6.56e-01 6.72e-157 1.12e-152 9.33e-02 4.37e-32 9.54e-11 4.01e-24 8.16e-36	4.27e-97 0.00e+00 0.00e+00 1.20e-24 1.67e-06 1.55e-220 1.14e-24 6.64e-50 1.15e-13 8.03e-110 7.23e-42 3.96e-70 3.08e-164 6.17e-101 1.30e-01 1.75e-38	$\begin{array}{c} 3.02\text{e-}91 \\ 0.00\text{e}+00 \\ 3.50\text{e-}93 \\ 2.15\text{e-}32 \\ 9.97\text{e-}08 \\ 1.63\text{e-}02 \\ 2.12\text{e-}112 \\ 1.33\text{e-}03 \\ 7.75\text{e-}80 \\ 2.43\text{e-}153 \\ 1.53\text{e-}02 \\ 4.56\text{e-}76 \\ 3.11\text{e-}11 \\ 2.79\text{e-}51 \\ 7.68\text{e-}13 \end{array}$	$\begin{array}{c} 2.07 \text{e-} 18 \\ 0.00 \text{e+} 00 \\ 1.05 \text{e-} 123 \\ 6.78 \text{e-} 58 \\ 4.80 \text{e-} 57 \\ 4.88 \text{e-} 22 \\ 1.96 \text{e-} 141 \\ 1.13 \text{e-} 03 \\ 9.17 \text{e-} 120 \\ 1.69 \text{e-} 124 \\ 1.23 \text{e-} 36 \\ 8.12 \text{e-} 97 \\ 6.78 \text{e-} 33 \\ 7.66 \text{e-} 50 \\ 3.36 \text{e-} 53 \end{array}$
Ad 1.99e-02 2.15e-63 5.39e-67 1.04e-35 4.32e-35 5.28e-17 1.06e-18	MSNBC KDDCup2k Plants Audio Jester Netflix Accidents Retail Pumsb-star DNA Kosarek MSWeb Book EachMovie WebKB Reuters-52	4.39e-11 1.79e-34 0.00e+00 4.35e-18 1.05e-18 2.56e-37 1.93e-53 1.31e-15 7.06e-07 1.32e-54 2.11e-110 8.13e-15 2.69e-22 1.64e-07 2.23e-30 1.43e-21 2.73e-60	6.25e-03 5.88e-95 0.00e+00 6.21e-27 2.02e-06 2.44e-01 1.09e-08 3.78e-248 2.10e-04 9.62e-43 5.24e-25 1.50e-10 4.21e-48 2.11e-33 3.78e-17 1.09e-08 5.84e-34	6.25e-03 5.34e-06 0.00e+00 6.83e-49 6.36e-14 2.61e-110 4.19e-01 1.75e-226 1.82e-04 1.71e-18 1.03e-12 2.57e-48 1.37e-92 8.15e-14 2.51e-15 2.12e-05 1.33e-33	2.58e-03 1.45e-36 0.00e+00 6.39e-33 1.44e-14 1.30e-09 3.62e-20 7.16e-307 6.56e-01 6.72e-157 1.12e-152 9.33e-02 4.37e-32 9.54e-11 4.01e-24 8.16e-36 3.85e-72	4.27e-97 0.00e+00 0.00e+00 1.20e-24 1.67e-06 1.55e-220 1.14e-24 6.64e-50 1.15e-13 8.03e-110 7.23e-42 3.96e-70 3.08e-164 6.17e-101 1.30e-01 1.75e-38 5.43e-11	$\begin{array}{c} 3.02\text{e-}91 \\ 0.00\text{e}+00 \\ 3.50\text{e-}93 \\ 2.15\text{e-}32 \\ 9.97\text{e-}08 \\ 1.63\text{e-}02 \\ 2.12\text{e-}112 \\ 1.33\text{e-}03 \\ 7.75\text{e-}80 \\ 2.43\text{e-}153 \\ 1.53\text{e-}02 \\ 4.56\text{e-}76 \\ 3.11\text{e-}11 \\ 2.79\text{e-}51 \\ 7.68\text{e-}13 \\ 1.29\text{e-}112 \end{array}$	$\begin{array}{c} 2.07 \text{e-} 18 \\ 0.00 \text{e+} 00 \\ 1.05 \text{e-} 123 \\ 6.78 \text{e-} 58 \\ 4.80 \text{e-} 57 \\ 4.88 \text{e-} 22 \\ 1.96 \text{e-} 141 \\ 1.13 \text{e-} 03 \\ 9.17 \text{e-} 120 \\ 1.69 \text{e-} 124 \\ 1.23 \text{e-} 36 \\ 8.12 \text{e-} 97 \\ 6.78 \text{e-} 33 \\ 7.66 \text{e-} 50 \\ 3.36 \text{e-} 53 \\ 9.45 \text{e-} 113 \end{array}$
	MSNBC KDDCup2k Plants Audio Jester Netflix Accidents Retail Pumsb-star DNA Kosarek MSWeb Book EachMovie WebKB Reuters-52 BBC	4.39e-11 1.79e-34 0.00e+00 4.35e-18 1.05e-18 2.56e-37 1.93e-53 1.31e-15 7.06e-07 1.32e-54 2.11e-110 8.13e-15 2.69e-22 1.64e-07 2.23e-30 1.43e-21 2.73e-60 3.88e-26	6.25e-03 5.88e-95 0.00e+00 6.21e-27 2.02e-06 2.44e-01 1.09e-08 3.78e-248 2.10e-04 9.62e-43 5.24e-25 1.50e-10 4.21e-48 2.11e-33 3.78e-17 1.09e-08 5.84e-34 3.93e-17	6.25e-03 5.34e-06 0.00e+00 6.83e-49 6.36e-14 2.61e-110 4.19e-01 1.75e-226 1.82e-04 1.71e-18 2.57e-48 1.37e-92 8.15e-14 2.51e-15 2.12e-05 1.33e-33 3.81e-15	2.58e-03 1.45e-36 0.00e+00 6.39e-33 1.44e-14 1.30e-09 3.62e-20 7.16e-307 6.56e-01 6.72e-157 9.33e-02 4.37e-32 9.54e-11 4.01e-24 8.16e-36 3.85e-72 1.91e-34	4.27e-97 0.00e+00 0.00e+00 1.20e-24 1.67e-06 1.55e-220 1.14e-24 6.64e-50 1.15e-13 8.03e-110 3.08e-164 6.17e-101 1.30e-01 1.75e-38 5.43e-11 2.23e-01	$\begin{array}{c} 3.02\text{e-}91 \\ 0.00\text{e}+00 \\ 3.50\text{e-}93 \\ 2.15\text{e-}32 \\ 9.97\text{e-}08 \\ 1.63\text{e-}02 \\ 2.12\text{e-}112 \\ 1.33\text{e-}03 \\ 7.75\text{e-}80 \\ 2.43\text{e-}153 \\ 1.53\text{e-}02 \\ 4.56\text{e-}76 \\ 3.11\text{e-}11 \\ 2.79\text{e-}51 \\ 7.68\text{e-}13 \\ 1.29\text{e-}112 \\ 1.16\text{e-}38 \end{array}$	$\begin{array}{c} 2.07 \text{e-} 18 \\ 0.00 \text{e+} 00 \\ 1.05 \text{e-} 123 \\ 6.78 \text{e-} 58 \\ 4.80 \text{e-} 57 \\ 4.88 \text{e-} 22 \\ 1.96 \text{e-} 141 \\ 1.13 \text{e-} 03 \\ 9.17 \text{e-} 120 \\ 1.69 \text{e-} 124 \\ 1.23 \text{e-} 36 \\ 8.12 \text{e-} 97 \\ 6.78 \text{e-} 33 \\ 7.66 \text{e-} 50 \\ 3.36 \text{e-} 53 \\ 9.45 \text{e-} 113 \\ 2.03 \text{e-} 38 \end{array}$

Table 3: Pairwise Wilcoxon signed rank test p-values for the comparisons of test log likelihoods for each algorithmic pair (columns) on all datasets (rows).

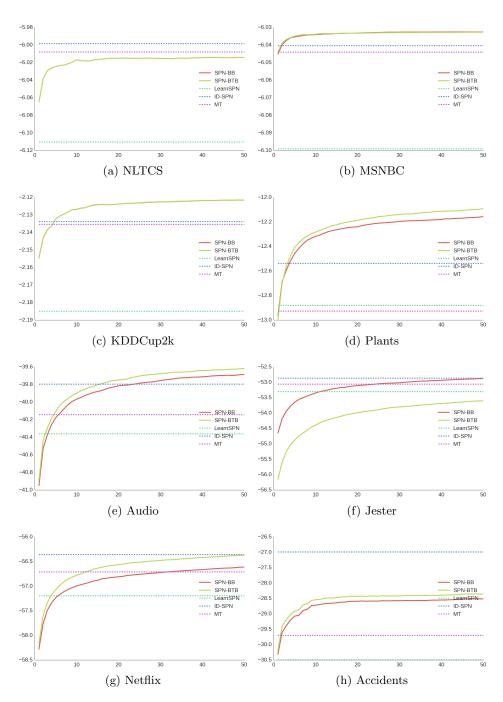


Fig. 1: Average test likelihood values (y-axis) for SPN-BB and SPN-BTB while increasing k (x-axis) on NLTCS, MSNBC, KDDCup2k, Plants, Audio, Jester, Netflix, Accidents. The best values for LearnSPN, ID-SPN and MT are reported as well.

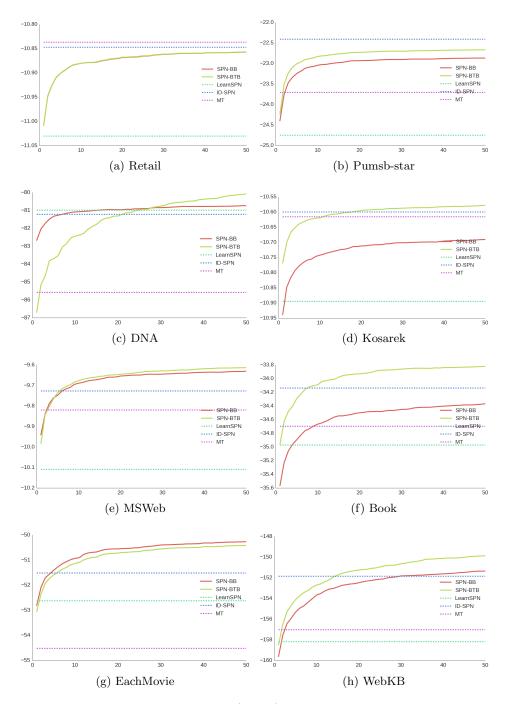


Fig. 2: Average test likelihood values (y-axis) for SPN-BB and SPN-BTB while increasing k (x-axis)on Retail, Pumsb-star, DNA, Kosarek, MSWeb, Book, Each-Movie, WebKB. The best values for LearnSPN, ID-SPN and MT are reported as well.

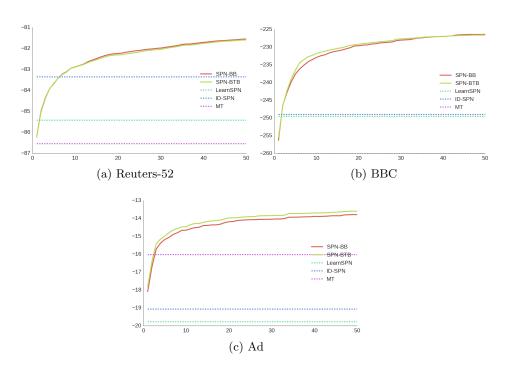


Fig. 3: Average test likelihood values (y-axis) for SPN-BB and SPN-BTB while increasing k (x-axis) on Reuters-52, BBC and Ad. The best values for LearnSPN, ID-SPN and MT are reported as well.