Discrete graphical model learning

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Contents

0.1 Activities log

June 19: Completed implementation of the L1L2 based graphical model learning code and tested it by recovering graph structure using samples drawn from a 3 node chain graph structured probability distribution, where each variable could take one of 3 values, and where the edge couplings were chosen uniformly at random. Informed pradeep.

June 20: Tried implementing $L1L\infty$ code. Did not work. See mail to pradeep for details.

June 21: Met Chao and Pradeep. Introduced Chao to the code. Tried splitting work, but did not hear back from her about contributing to experiments.

June 22: Tried to learn 4 and 64 node chain structured graphical models unsuccessfully. Found much better success with star structured graphical models.

June 23: Arranged to meet Ali : seems to be arranged by pradeep and sujay.

0.2 Time required in various steps

64 node chain timings for sampling and learning are shown in Tables 1 and 2.

0.3 Results

Results are described in Tables 3 and 4; and in figure 1.

Samples drawn		Time taken
1000		2.3s
15000		241s

Table 1: Time taken to sample from a 64 node chain graphical model.

Samples drawn		Time taken
150		279s (4.4s/node), 560s
1000		107s
10000		10000s (166.6m or 2h+46m).
15000		13203s (220m)

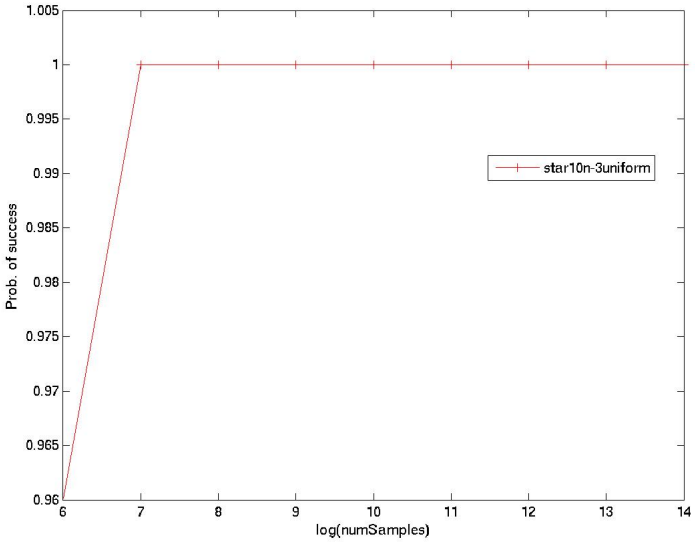
Table 2: Time taken to learn the structure of a 64 node chain graphical model.

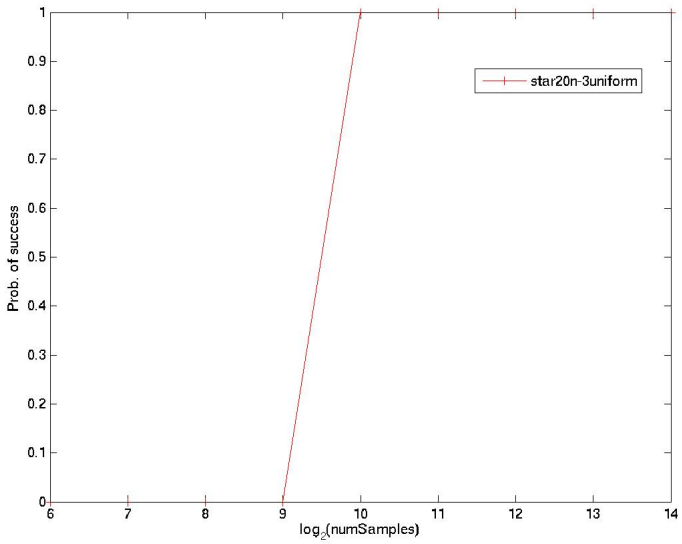
Nodes	Samples drawn	groupL1Bounds Explored (min, max region)	Probability of success
3	1500	$[10^{-2}..2]$	≈ 1
3	15000	$[10^{-2}..2]$	≈ 1
4	1000	$[10^{-2}..10^{2.0}]$ (? ,10^3)	at best, adds extra edge, omits needed edge
4	15000	$[10^{-2}..2]$	close to 1, but not quite
64	1000	$[10^{-5}..10^{2}]$	like 63 wrong edges, 3 correct edges
64	10000	10^{10}	Many extra edges were learned

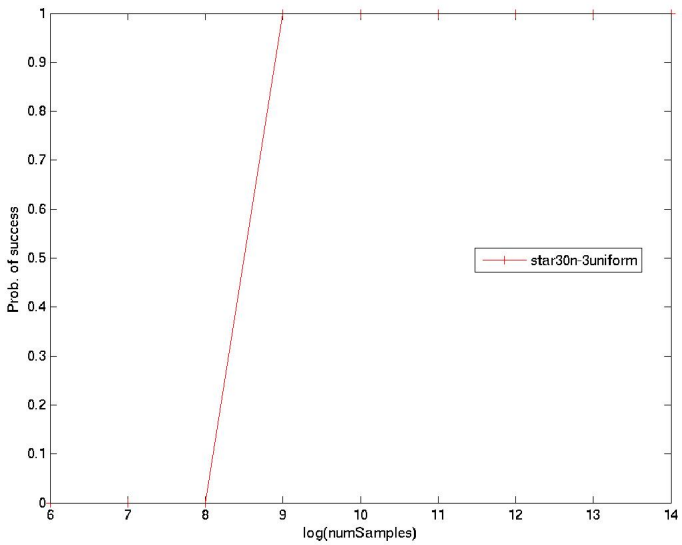
Table 3: Probability of success for chain graphical models.

Nodes	Samples drawn	groupL1Bounds Explored (min, max region)	Probability of success
3	1500	$[10^{-2}..2]$	≈ 1
3	15000	$[10^{-2}..2]$	≈ 1
30	2^{14}	$[10^{-2}..10^{0}] : 10^{-1}, 1$ seem good	≈ 1
50	2^{14}	$[10^{-2}..10^{0}] : 10^{-1}, 1$ seem good	≈ 1
70	2^{14}	$[10^{-2}..10^{0}] : 1$ seems too high	

Table 4: Probability of success for star graphical models.


star10n-3uniform
Prob. of success
log(numSamples)


star20n-3uniform
Prob. of success
log2(numSamples)


star30n-3uniform
Prob. of success
log(numSamples)