Scalable Model Selection for Belief Networks Supplemental Materials

Zhao Song[†], Yusuke Muraoka[*], Ryohei Fujimaki[*], Lawrence Carin[†]

[†]Department of ECE, Duke University
Durham, NC 27708, USA
{zhao.song, lcarin}@duke.edu

[*]NEC Data Science Research Laboratories
Cupertino, CA 95014, USA
{ymuraoka, rfujimaki}@nec-labs.com

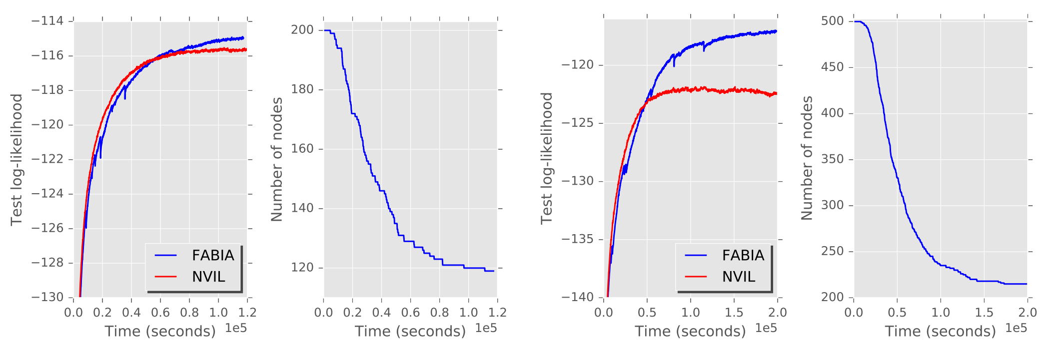
1 Derivation of Minibatch gFIC in (7)

We first note that an unbiased estimator for (5) is

$$\widehat{\mathrm{gFIC}_{\mathrm{SBN}}} = \max_q \mathbb{E}_q \Bigg[-\frac{M}{2} \sum_j \ln \Big(\frac{N_{T+1}}{N_{mini}} \sum_{i=1}^{N_{mini}} h_{i+N_T, j} \Big) + \frac{N_{T+1}}{N_{mini}} \sum_{i=1}^{N_{mini}} \ln \frac{p(\boldsymbol{v}_{i+N_T}, \boldsymbol{h}_{i+N_T} | \widehat{\boldsymbol{\theta}})}{q(\boldsymbol{h}_{i+N_T} | \boldsymbol{\phi})} + \frac{MJ - D_{\boldsymbol{\theta}}}{2} \ln N_{T+1} \Bigg] \tag{A1}$$

Simplifying and ignoring constant terms in (A1) leads to $\widetilde{\mathrm{gFIC}_{\mathrm{SBN}}}$ in (7) of the main text.

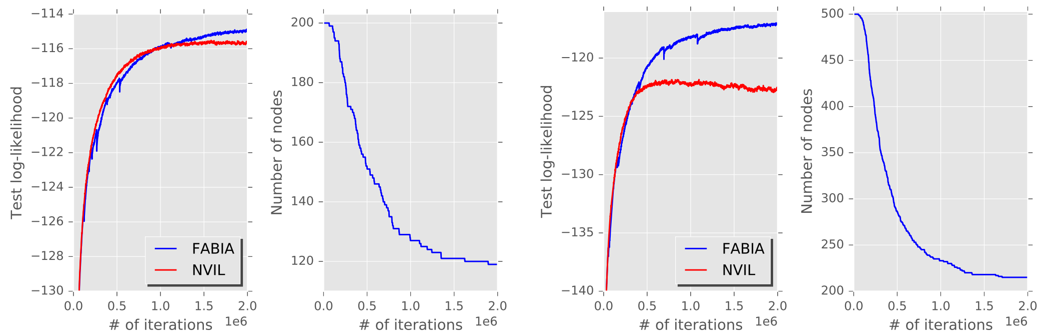
2 Additional Results



(a) (b)

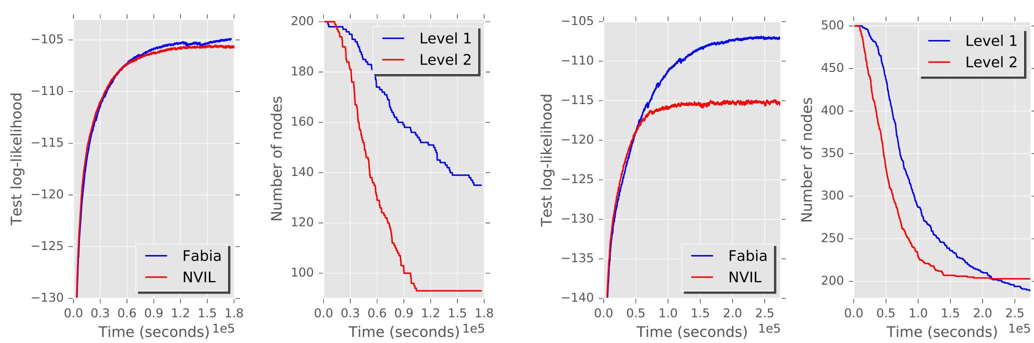
Figure A1: Test log-likelihood and the number of nodes in FABIA, as a function of CPU time on the MNIST dataset, for an SBN with initial size as (a) 200 (b) 500.

31st Conference on Neural Information Processing Systems (NIPS 2017), Long Beach, CA, USA.



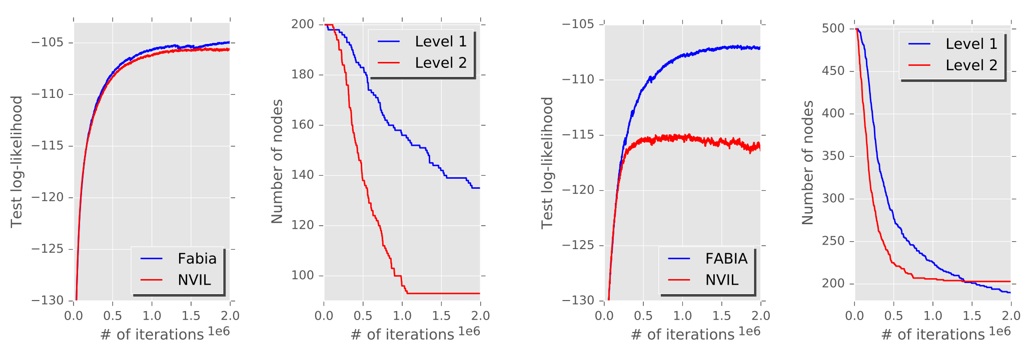
(a) (b)

Figure A2: Test log-likelihood and the number of nodes in FABIA, as a function of the number of iterations on the MNIST dataset, for an SBN with initial size as (a) 200 (b) 500.



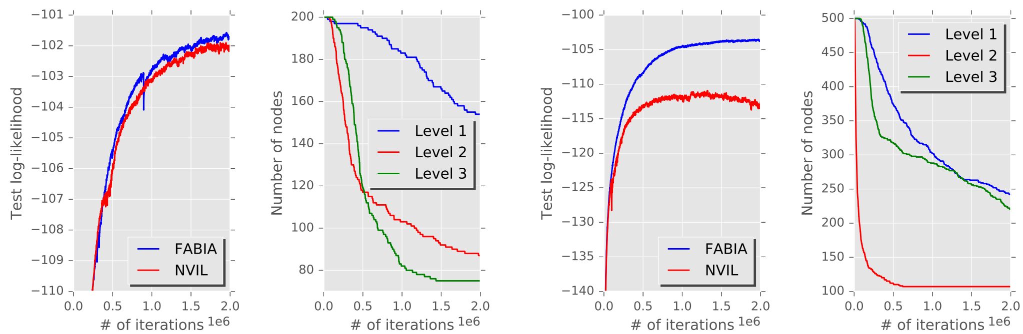
(a) (b)

Figure A3: Test log-likelihood and the number of nodes in FABIA, as a function of CPU time on the MNIST dataset, for an SBN with initial size as (a) 200-200 (b) 500-500.



(a) (b)

Figure A4: Test log-likelihood and the number of nodes in FABIA, as a function of the number of iterations on the MNIST dataset, for an SBN with initial size as (a) 200-200 (b) 500-500.



(a) (b)

Figure A5: Test log-likelihood and the number of nodes in FABIA, as a function of the number of iterations on the MNIST dataset, for an SBN with initial size as (a) 200-200-200 (b) 500-500-500.

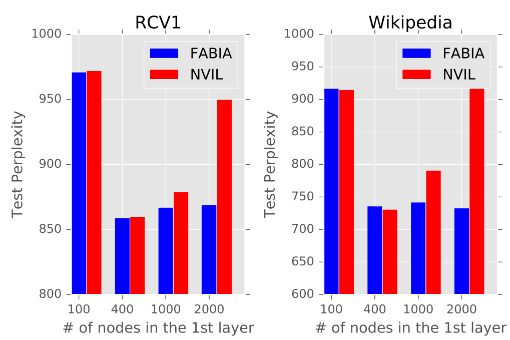


Figure A6: Test perplexities as a function of number of nodes in the first layer, in the three-layer case.

Table 1: Test perplexities and model size on the benchmarks, for NVIL and FABIA with three layers. FABIA starts from a model initialized with 400 hidden units in each layer.

	RCV1		Wikipedia	
	Size	Perplexity	Size	Perplexity
NVIL	400-400-400	859	400-400-400	731
FABIA	398-46-10	860	400-36-9	737