Streaming Bayes GFlowNets

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I. Background: GFlowNets

GFlowNets are amortized algorithms for sampling from distributions over compositional objects, i.e., over objects that can be sequentially constructed from an initial state through the application of simple actions (e.g., graphs via edge-addition).

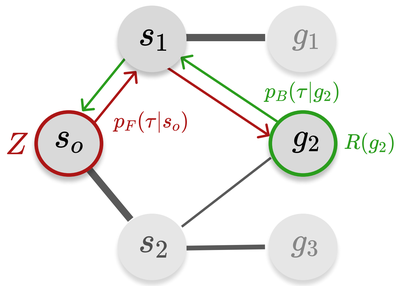

Figure 1: An illustration of the state graph as a DAG on $\mathcal{S}$.

II. Streaming Bayes GFlowNets

We introduce **Streaming Bayes GFlowNets** (SB-GFlowNets) as a general-purpose tool for streaming Bayesian inference over **discrete spaces**. Our model leverages a **GFlowNet** as a surrogate prior when updating the current posterior approximation based on new data, thereby **avoiding to repeatedly process old data** and **significantly accelerating** training convergence in a streaming setting.

Linear preference learning with integer-valued features.

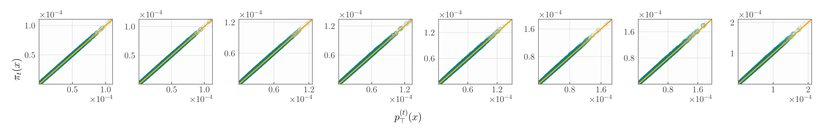

Figure 3: SB-GFlowNets accurately sample from the posterior distribution over the utility in integer-valued preference learning.

Online Bayesian phylogenetic inference.

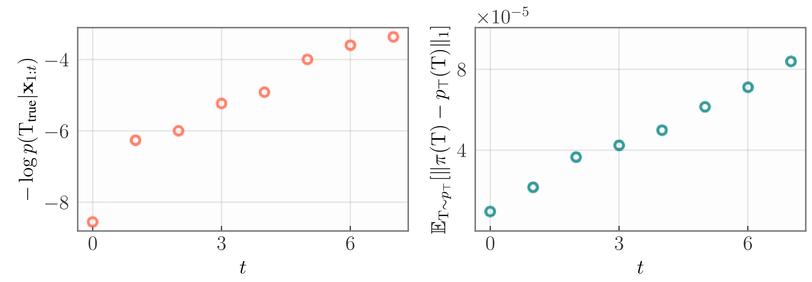

Figure 4: SB-GFlowNet's probability mass associated to the true phylogenetic tree increases as we observe more sequences.

Streaming Bayesian structure learning with DAG-GFlowNets.

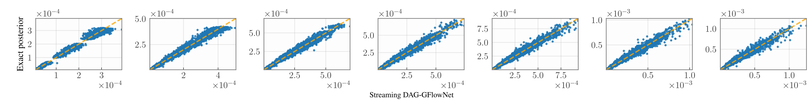

Figure 5: SB-GFlowNets accurately sample from an evolving belief distribution in a structure learning setting.

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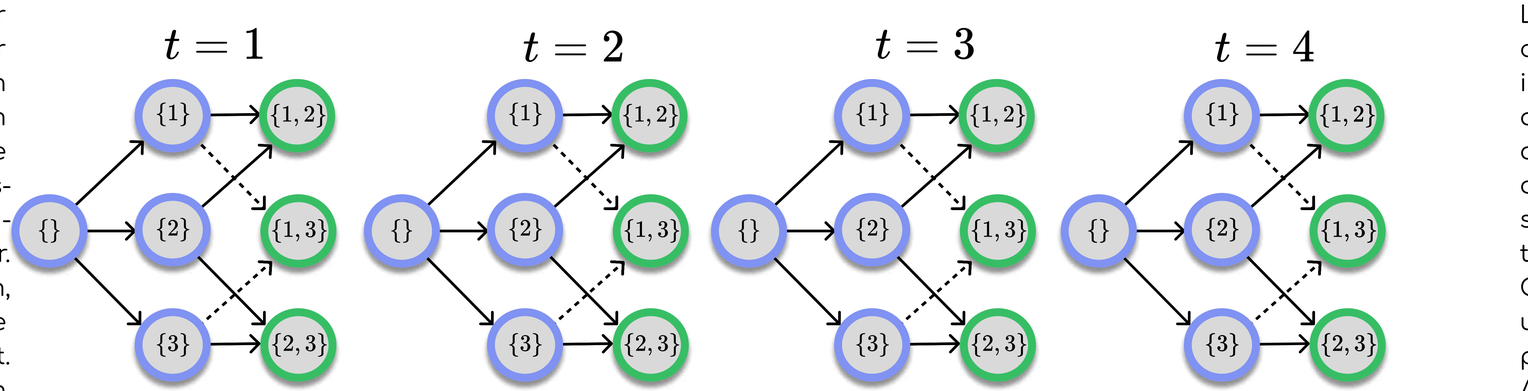

Figure 2: Streaming amortized inference with SB-GFlowNets.

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