Synchronous Hyperedge Replacement Graph Grammars

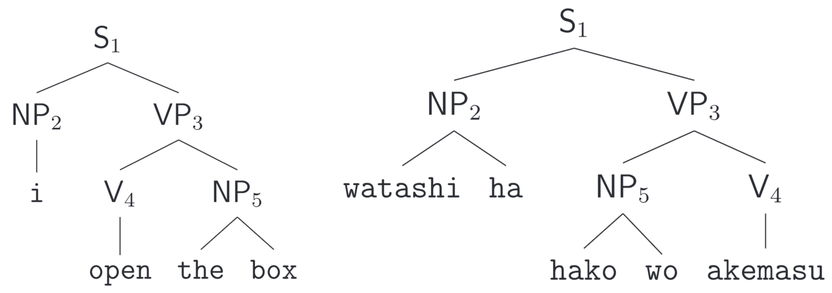
Corey Pennycuff, Satyaki Sikdar, Catalina Vajiac, David Chiang, and Tim Weninger
Department of Computer Science and Engineering
University of Notre Dame
{cpennycu,ssikdar,cvajiac,dchiang,tweninger}@nd.edu

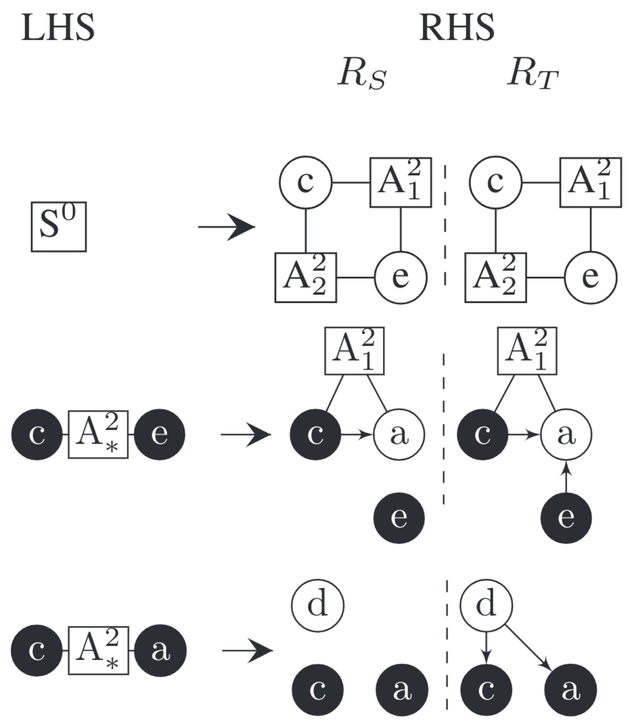
Introduction

Discovering the underlying structures present in real world graphs is a fundamental scientific problem. We describe a method to extract growth rules from the graph. We find that SHRG rules capture growth patterns found in temporal graphs and can be used to predict the future evolution of a temporal graph.

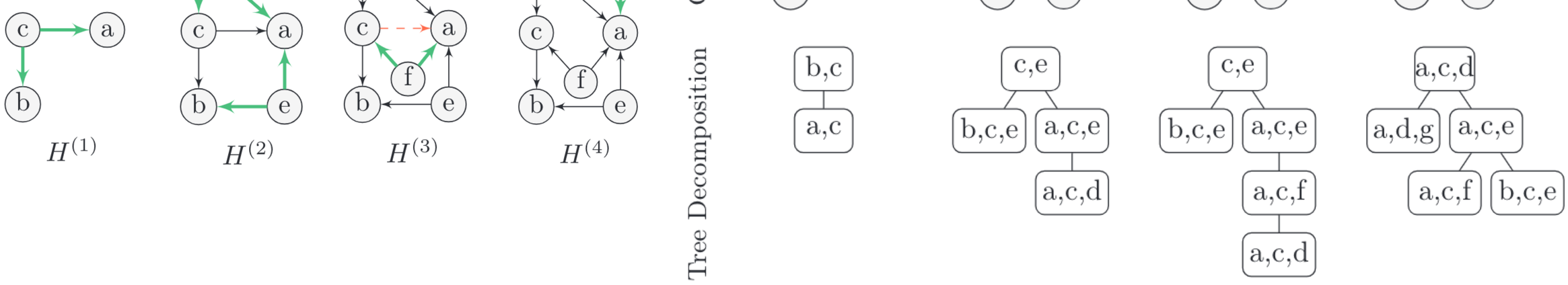
Synchronous Grammars

S	→	NP_1 VP_2	:	NP_1 VP_2
VP	→	V_1 NP_2	:	NP_2 V_1
NP	→	i	:	watashi ha
NP	→	the box	:	hako wo
V	→	open	:	akemasu



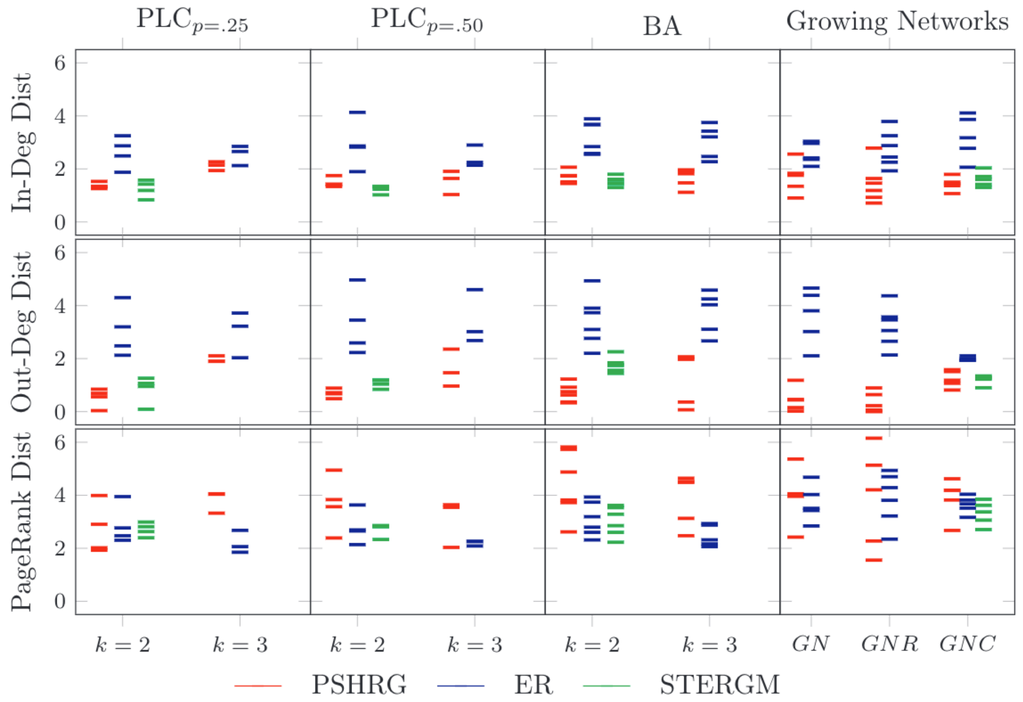


Temporal Dynamics of Networks



Experiments

Results



Conclusion

The present work presents a method to extract synchronous grammar rules from a temporal graph. We find that the synchronous probabilistic hyperedge replacement grammar, with RHSs containing *synchronized* source- and target-PHRGs, is able to clearly and succinctly represent the graph dynamics found in the graph process. This allows for finding a way to predict the future growth of the graph.

Acknowledgement

We thank Chiemi Matsumoto and Peter Bui for their help with this project. This work is sponsored by grant from the US NSF IIS (16-52492).