UNIVERSITY of GUELPH

COLLEGE of ENGINEERING AND PHYSICAL SCIENCES

SCHOOL OF COMPUTER SCIENCE

MSc Seminar

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Dynamic Discretization for Inference in NAT Modeled Bayesian Networks

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ABSTRACT:

Discrete Bayesian Networks (BNs) are compact representations of probabilistic knowledge for intelligent agents in partially observable and stochastic application environments. Hybrid Bayesian Networks (HBNs) extend discrete BNs to continuous variables, and hence are more expressive. However, exact inference with HBNs can only be performed efficiently with limited types of HBNs, such as Gaussian HBNs. Dynamic Discretization (DD) performs approximate inference on general HBNs by converting them into discrete BNs, and offers improved efficiency and accuracy than static discretization.

By encoding conditionally independence relations among variables through directed acyclic graphs, BNs reduces the space complexity of joint probability distributions from being exponential on the number of variables to being linear. However, space of BNs is still exponential on the number n of causes per effect variable. This limitation is inherited when DD is applied to inference with HBNs. Local models for discrete BNs, such as Non-Impeding Noisy-AND Tree (NAT) models, further reduce the space complexity of BNs to being linear on n. When the structure of BNs are sparse, this efficiency extends to time complexity of inference. In this research, we extend local modelling to HBNs by combining NAT modeling with Dynamic Discretization. The expected benefit is significant gain in efficiency of probabilistic inference in sparse HBNs.