UNIVERSITY of GUELPH

COLLEGE of ENGINEERING AND PHYSICAL SCIENCES

SCHOOL OF COMPUTER SCIENCE

MSc Defence

Thursday October 14, 2021 at 3pm via Zoom

Hanwen Zheng

NAT-Modeled Dynamic Discretization for Inference with Sum of Continuous Variables

Chair: Dr. Gary Grewal
Advisor: Dr. Yang Xiang
Advisory: Dr. Fei Song
Non-Advisory: Dr. Mark Wineberg

Abstract:

Bayesian Networks (BNs) are compact representations of probabilistic knowledge for intelligent agents in partially observable and stochastic application environments. To specify a BN, conditional probability tables (CPTs) and the graphical dependency structure completely determine the joint probability distribution. Hybrid BNs (HBNs) extend BNs to both discrete and continuous variables.

For inference with HBNs, we focus on dynamic discretization, which is an approximate inference algorithm that converts HBNs to discrete BNs. However, the CPTs have exponential growth on the number of parent variables. So, the complexity of BN inference is exponential, which extends to dynamic discretization for HBNs. To address the exponential growth of CPTs, local models, such as Non-Impeding Noisy-AND Tree Models (NAT), are developed to reduce the space complexity and improve inference efficiency. We present a novel framework where HBN is transformed into NAT modeled BN for tractable inference.

We focus on the sum of continuous variables in this work, and resolve issues on NAT modeling of conditional sum distribution and NAT model revision for dynamic discretization. We report significant efficiency gain of approximate inference by NAT modeled dynamic discretization over alternative methods.