UNIVERSITY of GUELPH

COLLEGE of ENGINEERING AND PHYSICAL SCIENCES

SCHOOL OF COMPUTER SCIENCE

# MSc Defence

**Monday September 26, 2022 at 10am via Zoom**

**Wanrong Sun**

*Learning NAT-Modeled Bayesian Networks from Data with Extended BD Scores*

**Chair:** Dr. Mark Wineberg
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## Abstract:

Bayesian networks (BNs) are widely used for concise knowledge representation and probabilistic inference in uncertain environments. By applying conditional probability tables (CPTs) associated with variables, a BN can encode conditional independence (CI) between variables. However, the complexity of CPTs is exponential on the number of parents per variable. Non-impeding noisy-AND tree (NAT) models are local structures that can be applied to BNs to significantly improve the efficiency. The complexity of NAT-modeled BNs is linear on the number of parents per variable.

To take advantage of representation and inference efficiency by NAT-modeled BNs, this work studies Bayesian approach for learning NAT-modeled BN structures from data. We extend the meta-networks to encode NAT local structures and parameters. By applying the extended meta-networks, we develop a Bayesian Dirichlet (BD) scoring function to evaluate the candidate structures. We present a heuristic search to reduce the search complexity due to huge alternative combinations of global and local structures. An experiment is conducted to evaluate the extended BD score and heuristic search algorithms for learning NAT-modeled BN structures. It demonstrates that the inference with learned NAT-modeled BNs is sufficiently accurate and significantly more efficient than the equivalent tabular BNs.