



# COLLEGE of ENGINEERING AND PHYSICAL SCIENCES

SCHOOL OF COMPUTER SCIENCE

## MSc Seminar

Wednesday June 26, 2019 at 9:30AM in Reynolds, Room 2224

Improving Probabilistic Inference by Combining CSI and  
NAT-ICI Local Structures

**Michael Roher**

**Advisor:** Dr. Yang Xiang

**Advisory Committee:** Dr. Pascal Matsakis

### **ABSTRACT:**

A Bayesian network (BN) concisely represents probabilistic knowledge on a partially observable and stochastic application environment by encoding conditional independencies between variables through a directed acyclic graphical dependency structure. By default, the dependence of each variable on its parent variables is quantified by a conditional probability table (CPT). The space complexity of a variable's CPT is exponential on the number of parents, which also bounds from below the time complexity of probabilistic inference with BNs. Local models, such as Context-Specific Independence (CSI) and Non-Impeding Noisy-AND Tree Models (NAT), may replace the tabular CPT and significantly reduce the complexity. CSI exploits duplicate probabilities to reduce the number of parameters needed. In contrast, NATs encode both reinforcing and undermining causal relationships between the variables in linear space. Existing techniques exploit only CSI or only NAT in a BN to improve efficiency of inference.

In this thesis research, we investigate the opportunity to allow a BN to employ both CSI and NAT local modeling in order to improve inference efficiency and accuracy beyond what is possible by employing only one type of local modeling