1112-62-445 **David Haws*** (dchaws@gmail.com), **James Cussens** and **Milan Studeny**. *Score Equivalence and Polyhedral Approaches to Learning Bayesian Networks.*

Bayesian networks (BN) are graphical models represented by directed acyclic graphs (DAGs). Two DAGs may define the same probabilistic model, and are called Markov equivalent. Learning BN structure is the NP-hard task of finding the BN structure that best fits real data, typically via a scoring function such as Schwartz's BIC. Integer linear programming approaches to learning BN structure have recently seen success in finding exact solutions. One IP approach to learning Bayesian network structure models DAGs with zero-one vector encodings where their convex hull is called the family-variable polytope. The other integer linear programming approach to learning BN structure models the Markov equivalence classes with zero-one vector encodings where their convex hull is called the characteristic-imset polytope.

A common form of linear objectives to be maximized leads to the concept of score equivalence, both for linear objectives and faces of the family-variable polytope. We show deep connections between the score-equivalent faces of the family-variable and characteristic-imset polytopes via a one-to-one correspondence in terms of extremality of supermodular functions. As a consequence, many faces of the family-variable polytope can be eliminated. (Received August 10, 2015)