Exploring Graph Theory with AutoGraphiX

Gilles Caporossi,GERAD and HEC Montreal
Pierre Hansen, GERAD and HEC Montreal
Rim Kilani, Ecole Polytechnique de Montreal
David Schindl, HEC and Ecole Polytechnique de Montreal.

While mathematical programming has long been used to solve specific problems and applications of graph theory, it is only recently that it was used to advance graph theory per se, i.e., to obtain conjectures, refutations and proofs (or ideas of proofs). The AutoGraphiX system was developed at GERAD since 1997 for such a purpose. It's principle is to view problems of extremal graph theory as parametric mathematical programs, to be solved by a generic heuristic of VNS type. Results are then interpreted by applying to them various data mining techniques. This led to over 1500 new conjectures , more than half of which were proved automatically, about 350 proved by hand, about 250 remain open and just a few dozens were refuted. In this talk we will present and illustrate by examples AutoGraphiX's main features. Ongoing work on properties of induced bipartite graphs will be discussed also.