Towards effective exact methods for the Maximum Balanced Biclique Problem in bipartite graphs

Submitted by Jin-Kao Hao on Wed, 10/09/2019 - 17:50

Titre	Towards effective exact methods for the Maximum Balanced Biclique Problem in bipartite graphs
Type de publication	Article de revue
Auteur	Zhou, Yi [1], Rossi, André [2], Hao, Jin-Kao [3]
Editeur	Elsevier
Type	Article scientifique dans une revue à comité de lecture
Année	2018
Langue	Anglais
Date	16 Sept. 2018
Numéro	3
Pagination	834-843
Volume	269
Titre de la revue	European Journal of Operational Research
ISSN	03772217
Mots-clés	clique [4], combinatorial optimization [5], Exact algorithms [6], Mathematical formulation [7], Techniques for tight bounds [8]
Résumé en français	The Maximum Balanced Biclique Problem (MBBP) is a prominent model with numerous applications. Yet, the problem is NP-hard and thus computationally challenging. We propose novel ideas for designing effective exact algorithms for MBBP in bipartite graphs. First, an Upper Bound Propagation (UBP) procedure to pre-compute an upper bound involving each vertex is introduced. Then we extend a simple Branch-and-Bound (B&B) algorithm by integrating the pre-computed upper bounds. Based on UBP, we also study a new integer linear programming model of MBBP which is more compact than an existing formulation (Dawande, Keskinocak, Swaminathan, & Tayur, 2001). We introduce new valid inequalities induced from the upper bounds to tighten these mathematical formulations for MBBP. Experiments with random bipartite graphs demonstrate the efficiency of the extended B&B algorithm and the valid inequalities generated on demand. Further tests with 30 real-life instances show that, for at least three very large graphs, the new approaches improve the computational time with four orders of magnitude compared to the original B&B.
URL de la notice	http://okina.univ-angers.fr/publications/ua20339 [9]
DOI	10.1016/j.ejor.2018.03.010 [10]
Lien vers le document	https://www.sciencedirect.com/science/article/abs/pii/S0377221718302194?... [11]
Titre abrégé	European Journal of Operational Research

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