

On the starting point of the constraint generation algorithm for submodular function maximization

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Submodular function maximization (SFM) is a central problem in combinatorial optimization and in many cases it involves graphs on which the maximization is defined. It is a well-studied problem, so there are many proposed algorithms in the literature. The greedy strategy quickly finds a feasible solution guaranteeing a $(1 - 1/e)$ approximation. However, there are many applications that expect an optimal result within a reasonable computational time. One well-known method for finding the global optimum is the constraint generation (CG) algorithm [1]. The CG works on the MIP formulation of the problem which might have exponential many constraints. Traditionally, the initial feasible solution of the CG is given by the greedy algorithm.

In our recent work [2], we created different versions of the CG algorithm using some heuristic steps which are derived from the graph structure or the definition of SFM. The focus of our current research is the starting point of the CG algorithm. It turns out that choosing different starting point than the greedy solution might give more efficient solution in terms of running time. Advantages of using the previous heuristics rules will be demonstrated.

References

- [1] Nemhauser, G.L. and Wolsey, L.A., Maximizing submodular set functions: formulations and analysis of algorithms, *Studies on Graphs and Discrete Programming*, 279–301 (1981)
- [2] Csókás, E. and Vinkó, T., Constraint generation approaches for submodular function maximization leveraging graph properties, *Journal of Global Optimization* (2023)