The Max-Out Min-In Problem: A Tool for Data Analysis in Biomathematics

Jorge Orestes Cerdeira
CMA, FCT-NOVA
jo.cerdeira@fct.unl.pt

Let $N = \{1, 2, \ldots, n\}$ be a set of *entities* and $W = [w_{ij}]$ a non-negative symmetric matrix of weights expressing quantified relations between pairs of elements of N, with $w_{ii} = 0$, for $i = 1, \ldots, n$. For $S \subseteq N$, we define $\phi(S)$ to be the sum of the weights of pairs of elements where an element is in S and the other is in $\bar{S} = N \setminus S$, minus the sum of the weights of pairs of elements in S. We consider the problem of finding $S \subseteq N$ for which $\phi(S)$ is maximized. We call this combinatorial optimization problem the max-out min-in problem (MOMIP). In this talk I will present two alternative formulations of MOMIP, discuss the application of MOMIP in the selection of variables in exploratory data analysis and in the identification of clusters in the context of cluster analysis, and report preliminary results of its applicability in priority area selection for species coping with climate change, an urgent issue in Conservation Biology.

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