

# Dispersion Models for the Point-Feature Cartographic Label Placement Problem

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The point-feature cartographic label placement problem (PFCLP) is a NP-hard problem arising in design of maps and other graphic objects (Mauri, Ribeiro and Lorena, 2010). For the sake of a better map legibility it is important to avoid overlaps in the process of labeling. This paper examines the PFCLP in the legibility context and proposes a dispersion approach for the problem. It is considered that when all points must be labeled and overlaps are inevitable, the map can be more readable if overlapping labels are placed more distant from each other. The discrete dispersion concept is addressed in some combinatorial problems in literature, for instance the Facility Dispersion Problem which is a variation of the Facility Location Problem (Curtin and Church, 2006). The PFCLP is modeled as dispersion and separation (Erkut, ReVelle and Ülküsal, 1996) problems on four mathematical formulations based on binary integer linear programming. Computational results are reported for problems of size up to 5000 points.

## References

- [1] K. M Curtin and R. L Church. A family of location models for multiple-type discrete dispersion. *Geographical Analysis*, 38:248–270, 2006.
- [2] E Erkut, C ReVelle and Y Ülküsal. Integer-friendly formulations for the r-separation problem. *European Journal of Operational Research*, 92:342–351, 1996.
- [3] G. R Mauri, G. M Ribeiro and L. A. N Lorena. A new mathematical model and a lagrangean decomposition for the point-feature cartographic label placement problem. *Computers and Operations Research*, 17(4):2164–2172, 2010.