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Colourful Simplicial Depth

Inspired by Barany's colourful Carathéodory theorem, we introduce a colourful generalization of Liu's simplicial depth of a point p in R^d relative to a fixed set S of sample points, *i.e.*, the number of simplices generate by points in S that contain p. We prove a parity property and conjecture that the minimum colourful simplicial depth of any core point in any d-dimensional configuration is d^2+1 and that the maximum is $d^{d+1}+1$. We exhibit configurations attaining each of these depths, and apply our results to the problem of bounding monochrome (non-colourful) simplicial depth. Independently found recent quadratic lower bounds by Barany and Matousek and by Stephen and Thomas are also presented.

Joint work with Sui Huang (McMaster), Tamon Stephen (Magdeburg) and Tamas Terlaky (McMaster).